



Exploring Health-related Uses of Mobile Phones: An Egyptian Case Study

Thesis submitted for the degree of PhD

December 2006

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Abstract

The expansion of mobile phone networks and services to developing countries presents a strategic opportunity for the health sector to maximise the contribution of the technology to meet health objectives. First introduced to Egypt in 1997, the number of mobile phone subscribers has climbed to over eight million people, representing ten percent of the country's population. This PhD Thesis explores changes in health service delivery and domestic health communication related to mobile phones in rural and urban communities in Minia Governorate, Egypt.

First and foremost, the overall increase in telecommunications is improving access to emergency health care services for direct subscribers as well as for the general population. Enhanced access to emergency services has the potential to yield fewer fatalities and more efficient management of emergency transportation and health personnel. It also creates new demands within the health sector increasing the need to ensure that relevant structures and systems are in place and functional. Within general health services, health professionals have enhanced their capacity to monitor patients remotely, mobilize support for facility-based patients in their absence, and consult other physicians for more specialized information in complicated cases (telemedicine). Additional health benefits include enhanced family communication and well-being. Limitations include the high out-of-pocket costs sustained by health professionals for mobile phone calls, cost-recovery for services rendered by phone, and liability for off-site directives provided to facility-based staff.

Qualitative research methods were used to collect and analyse data among health care professionals, including physicians, nurses, administrators, and ambulance workers as well as lay users, including students, business people, and transportation workers. Empirical data was collected in 2002-2003. Study results have been used to provide recommendations for projects, policies, and future research in Egypt aimed at maximising the health benefits of mobile phones within the health sector.

Preface

When I first began my research on the subject in 2002, I received many questions from public health colleagues as to the importance and relevance of studying how mobile phones are influencing health care in developing countries. The connection to me was obvious, having grown up in a household that was predominantly comprised of computer scientists and technocrats mostly developing solutions for the financial industry, second historically to the military for supporting innovation in technology development. Technology has the potential to change both personal as well as professional approaches to daily life. Mobile phones have the potential to enable communication in places where this has not been possible in the past.

Throughout my life I witnessed the transformation of computers from main frame computers which occupied entire floors of office buildings to personal computers to handhelds and tablets. Mine was one of the first households in the United States and perhaps the world to own a personal computer. When I was nine years old my father brought home an IBM XT, which today is considered by some to belong in a museum of technology. The landscape of information and communication technology is continuously changing to provide more efficient and portable access to information and facilitate direct contact between individuals. Mobile phones enable information transfer as well as instantaneous dialogue and communication without dependence on literacy.

Throughout the course of the past few years, I have felt like a keen observer of a revolution within the health sector in developing countries and among multi-national corporations in general. At first, both factions seemed to ignore the potential for integrating the philosophies of the other in their day to day practices and consideration. This is rapidly changing. The traditional focus of public health professionals includes reducing the incidence of disease, managing health systems more efficiently, and improving overall quality of life for target populations. Although communication is an integral part of health care services and public health, many programs and service delivery sites have not systematically explored how best to take advantage of improved

access to telecommunications technologies in their work. Those who have explored the interface between mobile phones and health have focused on health perils at the expense of embracing health benefits. Many are now experiencing the benefits through their own experimental application of mobile phones.

In 2000, after six years working in developing countries mostly in rural communities in East Africa as a teacher and public health professional, I worked for a health care Internet company in New York City's Silicon Alley. It was during this period that I began to seriously consider how information and communication technology (ICT) could benefit the lives of those living in developing countries. I remember contemplating the potential role of ICT in health in developing countries as it applied to a real life situation that happened while I was working with a local community to set up a Primary Health Care Centre in Southern Sudan in 1999. The following is an edited excerpt from the journal that I kept during that time, recounting a personal experience trying to manage an obstetric emergency involving a 16-year-old woman in labour with twins, a two-way radio, and a pick up truck.

It was early on a Friday morning when the health facility watchman came running onto the compound in a panic. Apparently, the nurse mid-wife had spent all night trying to deliver a very petite 16-year-old woman who was having twins. Our general policy was not to use the vehicle as an ambulance because it is not a sustainable input into the local community, but that day I was so overwhelmed by the woman's condition that we decided to put a mattress in the back of the project's pick up truck and transport her to the closest hospital four hours away. In the meantime we had the luxury of a CODAN (two-way) radio to track down the only medical doctor in the district to make sure he would be at the hospital upon our arrival.

We managed to get the woman to the hospital safely, and the doctor was able to deliver the twins safely, and upon leaving the hospital it looked like the prognosis was good. The sense of heroism and accomplishment was significant and provided that bit of hope that made the ongoing challenges and efforts worthwhile. I would like to be able to say that the story ended on such a positive note, but unfortunately it did not. Two days later we were informed that both the mother and the twins died due to the poor quality of the nursing services in the hospital.

In Rumbeck County, Southern Sudan in 1999, there were no paved roads, no fixed-line telephones, no running water, and no electricity apart from the scattered solar panels brought in by international humanitarian aid workers.

This story is not unique or uncommon in many of the world's poorest countries and not even uncommon in parts of so called "developed" countries such as the United Kingdom. It does, however, illustrate that communication technology, such as the CODAN or two-way radio, plays a significant role in addressing public health issues. It also illustrates that there are environmental conditions that must be in place to fully take advantage of its potential impact on health. The same is true for mobile phones.

Acknowledgements

Throughout my career in Public Health and International Development, I have had the privilege to benefit from the guidance of supportive and encouraging mentors. It is my pleasure to express my appreciation and dedicate this PhD Thesis to all of them. First and foremost, I would like to thank Adisa Douglas without whom I would not have considered doing my PhD or pursuing my aspiration to teach.

Next I would like to thank my supervisors and advisors at the London School of Hygiene and Tropical Medicine who have been generous with their time, professional critiques, and encouragement. I especially want to thank Simon Carter, for your direction and targeted feedback, before and during the doctoral program. To Judy Green, I am grateful for assuming supervisory responsibility as well as your uncensored guidance throughout the process. Thanks to my Advisory Committee members, Kelley Lee and Kelly Loughlin, for feedback in the early and later stages. Thanks to colleagues at John Snow International in Cairo for facilitating permissions as well as entry into key health facilities in Minia, especially Dr. Amgad Habib. I also thank my research assistants and translator (Sausan, Howaida, and Marianne) for your dedication towards ensuring data quality. Other academic colleagues that I want to acknowledge who have supported me in this as well as past pursuits include Peter Winch, Ray Langsten, Kathryn Yount, Hoda Rashad, Kristin Kalla, and Moussa Abbo among many others.

Love and gratitude to my friends and family for your support in proofreading (Barbara Pierce and Sarah Chaney) and providing excellent work environments (Emma, Malcolm and Amanda, Sandy and Kent, Kristin, Mom and Dad, Mark and Jamey, and Max). Last but not least, to Jan Slavíček (the catalyst) many thanks for being the stranger+ on the plane and the many mind maps, insightful comments, and encouragement that have contributed to the structure, direction, and completion of this Thesis.

To the others who have studied ICT for Health and Development, mobile phones, and Science and Technology Studies, thanks for providing a place to start.

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Declaration of Own Work

I have read and understood the School's definition of plagiarism and cheating given in the Research Degrees Handbook. I declare that this thesis is my own work, and that I have acknowledged all results and quotations from the published or unpublished work of other people.

Signed: *Patricia N. Mechal* Date: *13 December 2006*

Full name: **PATRICIA N. MECHAE**L (please print clearly)

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List of Acronyms

AIDS	Acquired Immunodeficiency Syndrome
ANT	Actor Network Theory
CSR	Corporate Social Responsibility
DOI	Digital Opportunity Initiative
EFG	Ethnographic Field Guide
GDP	Gross Domestic Product
GNI	Gross National Income
HIV	Human Immunodeficiency Virus
ICT	Information and Communication Technology
ITU	International Telecommunications Union
LE	Egyptian Pound
LSHTM	London School of Hygiene and Tropical Medicine
MCIT	Ministry of Telecommunications and Information Technology
MMR	Maternal Mortality Ratio
MOH	Ministry of Health
NGO	Non-governmental Organization
NHS	National Health Service
PAHO	Pan-American Health Organization
PDA	Personal Digital Assistant
PUS	Public Understanding of Science
STS	Science and Technology Studies
TBA	Traditional Birth Attendant (<i>daya</i>)
TB	Tuberculosis
UNDP	United Nations Development Program
USD	United States Dollar
WHO	World Health Organization

Chapter 1: Introduction: Why Consider Maximizing Health Benefits of Mobile Phones?

“Encouraging the spread of mobile phones is the most sensible and effective response to the digital divide...” The Economist, March 10, 2005

As of September 2004, there were 1.52 billion mobile phone users reported in the world (cellular.co.za 2004). This figure grew to two billion in 2005 and is estimated to reach 3.5 billion by the year 2010 (Cellular-news.com 2006). The technological advances of the twentieth century are increasingly becoming a part of the everyday experience of individuals throughout the world. Information dissemination, communication patterns, business practices, economic development and public health are changing as a result of improved access to mobile phones and other information and communications technology (ICT). The “Digital Divide” has become a mainstay of the dialogue on the differential access between rich and poor countries. It is defined by the United Nations Development Program (UNDP) as, “the gap between those who have access to, and can effectively use, new information and communication tools and those who cannot” (UNDP 2002, p. 5).

Many in the international development field, industry, and the popular media highlight the risk of being left out of the global economy that countries face if they do not maximize opportunities provided by ICT (Digital Opportunity Initiative 2001). In their *Human Development Report* on Egypt, the UNDP extends this alert to the maximized benefits of ICT “whether in education or income, health or politics, the digital divide must be addressed since there is risk of relegating a portion of the world or of a society to an underclass” (UNDP 2002, p. 79). Mobile phones are helping to shrink the gap as networks become cheaper to deploy and subscriptions become more affordable to larger segments of the global public. According to a study by Leonard Waverman, a professor at the London Business School, in some countries mobile phones are contributing to increases in Gross Domestic Product (GDP) on the order of 0.6 percent in populations with ten mobile phones per 100 population (The Economist 2005).

By 2003, mobile phone systems had become available in over 90 percent of all countries, an improvement from 30 percent ten years prior (Sheehan 2003). This spread has also enabled the increased use of the Internet through wireless connections. Mobile phone towers have become cheaper, easier, and faster to install than laying fixed-line copper wiring. Some countries have embraced mobile phones more than others, depending in part on prior access to fixed-line telephone services, telecommunications regulation policies, direct foreign investment in mobile phone services, and cost- benefit to potential individual and corporate subscribers.

Figures 1.1 and 1.2, borrowed from the *World Telecommunication Development Report 2002* published by the International Telecommunications Union (ITU), illustrate the rapid growth in the acquisition of mobile phones (as well as the Internet) throughout the world. As mobile phone access improves so does competition from predominantly government provided fixed-line telephone services in both developing and some developed countries.

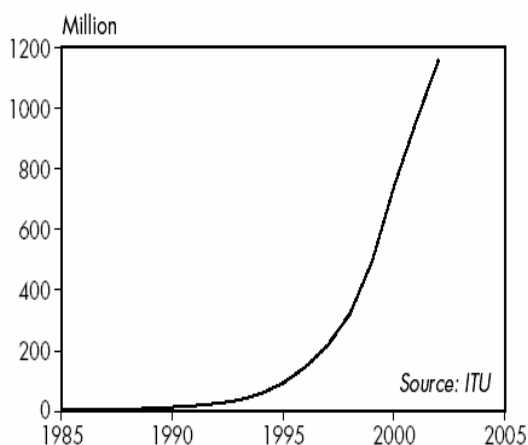


Figure 1.1: Illustration of increase in mobile phone subscribers worldwide 1985-2002 (ITU 2002)

Figure 1.3 from the *World Telecommunication Development Report 2002* shows this progression. In many countries mobile phone use is surpassing that of fixed-line telephones, and in 2002 the number of mobile phone subscribers world-wide exceeded the number of fixed-line telephone subscribers (ITU 2003).

Competition from mobile phone companies has also influenced increases in fixed-line telephone services due to the fear of lost revenues for government provided telecommunication services. The result is a general improvement in access to telecommunications irrespective of modality. The Millennium ICT goals for 2006 are that lower-middle and low income economies have greater than 90 percent mobile population coverage. This includes both fixed-line telephones and the ability within a geographic area to receive mobile cellular signals (ITU 2002).

Cellular Phone Subscribers and Internet Host Computers Worldwide, 1985–2002		
Year	Cellular Phone Subscribers (million)	Internet Host Computers (number)
1985	1	2,308
1986	1	5,089
1987	2	28,174
1988	4	80,000
1989	7	159,000
1990	11	376,000
1991	16	727,000
1992	23	1,313,000
1993	34	2,170,000
1994	56	5,846,000
1995	91	14,352,000
1996	144	21,819,000
1997	215	29,670,000
1998	319	43,230,000
1999	491	72,398,092
2000	741	109,574,429
2001	955	147,344,723
2002	1,155	171,638,297

Source: International Telecommunication Union, Internet Software Consortium, and Network Wizards.

Figure 1.2: Progression of cell phone and Internet use 1985-2002 (ITU 2002)

According to the ITU based on the following figures, the projection set as the Millennium ICT goal is likely to be reached albeit at different times for different countries due to varying growth rates in phone connections (ITU 2002).

With such growth in access to telecommunications, it would likely benefit both the development and public health communities to become more strategic and proactive in terms of how we integrate and use the technology to promote improved livelihoods and health outcomes. So far, the major social impact of mobile phones of interest for poor countries has been economic development through the enhancement of small businesses and micro-credit and enterprise schemes (Bayes 1999; Donner 2005c; The Economist 2005).

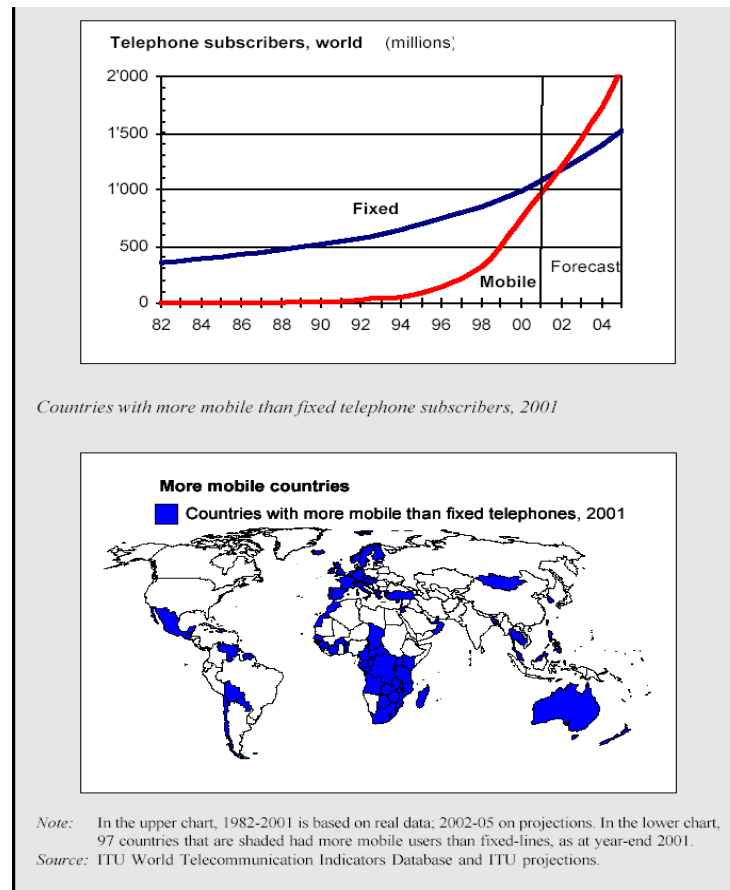


Figure 1.3: Comparison of trends: mobile and fixed-line telephone subscribers world-wide, 1982-2005 (ITU 2002)

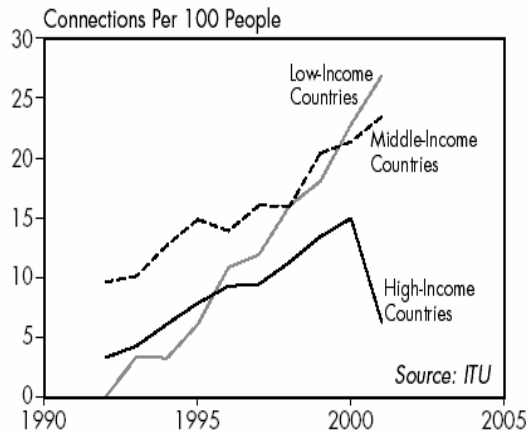


Figure 1.4: Annual growth rate in phone connections by income level of country (ITU 2002)

Poor countries, including Rwanda and India, are replicating The Grameen Bank’s Village Phone Program. This program aims to increase household income through micro-enterprise ventures for women by enabling them to sell mobile phone air time in Bangladesh (Bayes 1999). Similarly, the following illustration is of a Somali trader who uses his mobile phone to coordinate activities for his import and export business between Dubai and East Africa.

On a wooden ship moored in Dubai’s busy creek, a Somali trader dozes in the shade of a tarpaulin sheet. He wakes to the opening bars of Jingle Bells. ‘Hallo? Aiwa..la..aiwa..OK.’ The deal is done. This trader, Mohammed, exports small electrical goods, including mobile phones, to East Africa. ‘It’s my livelihood,’ he says of the mobile phone. ‘No mobile, no business.’ It multiplies his opportunities to make contacts and do deals as he moves between cities and ports, and the short, instantaneous messages and calls to which the mobile lends itself are perfectly suited to the small and immediate transactions in which he is engaged. (Plant 2000, p. 74)

Mobile phones have become a visible part of the lives of millions of people throughout the world. At almost every meeting that I attend in both rural and urban settings in developing countries, at least one person has a mobile phone on hand. Mobile phones can be found in almost any village, and have significant implications particularly for areas which still do not have access to fixed-line telephones. Mobile phone service is provided through a network structure that enables access in places where most other technologies are not available. Until recently, there was very little research done and

nearly no documentation of the potential impact that improved telecommunications or more specifically that mobile phones might have on development or health. In the quote below, Anthony Townsend attributes this to a general preference for the study of the Internet.

[Unfortunately] the advent of inexpensive mass-produced mobile communications in particular, has avoided scholarly attention, perhaps because it seems pedestrian compared to the nebulous depths of cyberspace. Yet the cellular telephone, merely the first wave of an imminent invasion of portable digital communications tools to come, will undoubtedly lead to fundamental transformations in individuals' perceptions of self and the world, and consequently the way they collectively construct that world. (Townsend 2000, p.1)

In response to the digital divide, the initial focus and early investments by a range of governments and international agencies was on improving access to computers and Internet connectivity. In relation to public health in developing countries, this has primarily evolved into improving access to health-related information through free or subsidized access to on-line peer reviewed medical journals and CD-ROMs containing similar information. According to Leslie Haddon at the London School of Economics, two challenges emerge when discussing the digital divide. The first is that the uneven distribution of ICT is complicated. Some individuals have not identified benefits to ownership, while others are impeded by costs and the necessary infrastructure to enable the potential for access (Haddon 2004). The second challenge is that it remains unclear beyond those that are related to economic development cited above what the consequences of the divide might be (Haddon 2004). According to a review done by the Economist, the focus on the Internet has not yielded the positive results originally envisioned (The Economist 2005). The review continues by highlighting that individuals throughout the world are availing themselves of mobile phones without support from the United Nations and other donors because they have identified value in the technology for their own economic and social ambitions (The Economist 2005). Unlike the Internet and personal computers, mobile phones enable individuals to come into direct contact with one another through a variety of information transfer and communication options in a way that enhances their overall work and/or social lives

without being bound to a particular geographic location or influenced by literacy. What remain missing in the public and scholarly research are studies and measures for how to effectively maximize their benefits, particularly in settings that did not have prior access to telecommunications.

Mobile phones and health in developing countries

Interactions with information and communications technology and adaptations in behaviour particularly as they pertain to public health, health service delivery, and the social determinants of health in developing countries have yet to be systematically assessed. It is critical to understand how mobile phone technology enters a society as well as how it defines and informs health behaviours and service delivery in order to maximize its health benefits. In this chapter, I introduce my PhD research which focuses on documenting and exploring the use of mobile phones by health professionals and non-health professionals (lay users) for health benefits in several local settings (one urban, one peri-urban, and three rural sites) in the governorate of Minia in Egypt.

Before I proceed it is important to note that in my research, I broadly define *health benefits* as both *direct* (e.g. improved access to health services, health promotion, lay health communication, and emergency response) and *indirect* (e.g. well-being). This was done in accordance with the World Health Organization definition of health as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.” One example of a direct health benefit is a patient calling a physician to describe their physical ailments in search of guidance on the appropriate treatment in lieu of a clinic visit. Another is a health administrator sending text messages to multiple health personnel to mobilize staff in response to a health-related emergency. Indirect health benefits tend to focus on social determinants of health including familial relationships, economic security, and gender dynamics and as well as other key aspects of people’s living and working circumstances (Wilkinson and Marmot 2003).

Historically, there has been an invisible wall that separates non-health specific information and communication technology developers from health professionals. This

particular sub-set of technology developers is not inherently aware of the ways in which their products can be used within the health sector. Health professionals also tend to be too engaged in health-related activities to become aware of the ways in which technology can be applied as is or modified to support the work that they are doing. More recent studies are indicating, however, that technology developers have grown interested in how their technologies might be modified to reach out to non-user groups in an effort to expand their markets. Such advancements, including the development of technological objects more suitable and affordable for people in poor countries, could also contribute to minimising the digital divide through increased access and uptake of ICT (Haddon 2004).

The study of health benefits becomes particularly complex in situations whereby a technology is introduced into society by a non-technology, non-health corporate entity that maintains its own set of interests. For example, mobile phones have rapidly become a significant segment of the broader telecommunications industry. The goal of mobile phone companies is to increase revenue. The goal of the health sector is to promote health through disease prevention, healthy living, and treatment and management of disease. Until recently (2005-2006), there was very little visible evidence of mobile phone companies publicly announcing partnerships with the health sector that would promote the development of health-specific mobile phone applications and complementary technologies.

Mobile phones are more accessible to individuals than their immediate predecessor, the fixed-line telephone, and their merging with computer technology has the potential to alter how societies approach health care in unprecedented ways. For example, mobile phone, digital camera, and handheld computer hybrids provide the capacity for data and image collection and transmission with the potential to support telemedicine and disease surveillance programs. In this Thesis, I will present some recent trends among mobile phone companies working in partnership with the health sector to create health-specific hardware and software particularly in the area of remote patient monitoring. These efforts to support formal integration of the technology by the health sector aim to reduce the number of visits to a doctor's office and the related costs of caring for individuals that require long-term care as in the case of diabetes.

Mobile phones in society

The study of the integration of mobile phones by society can be examined in a number of ways: institutional vs. individual; by sector (education, health, industry); by gender; and/or according to age groups. With regard to institutions, mobile phones facilitate the coordination of processes and interactions, including staff management, learning and exchange among peers, and an improved sense of connectedness. For individuals they have the potential to increase direct contact, privacy, and for some in both developed and developing countries, social status. In the various sectors, particularly in business transactions, mobile phones can save money and travel time among other benefits. For the health sector, specifically, the appeal of the technology includes emergency response, health service management, health consultations, telemedicine, disease surveillance, and health promotion/education. Individual users, as found by empirical studies of mobile phones conducted in Europe, the United States, and Australia, began primarily with men who initially obtained the technology for business purposes and then proceeded to identify other uses in their social lives (Roos 1993; Ling 1999a; Palen et al. 2000; Bautsch et al. 2001). The profile of users then shifted to increase in female as well as adolescent users (Ling 2004).

With increased mobility from portable communications capacity, the role of women in and outside of the home may be shifting (Geser 2003). For women who have access in developing countries, mobile phones improve their sense of connectedness to social networks and in many settings have enabled them to pursue opportunities that require travel. For young people, they improve communication between peers and for parents help to maintain a sense of awareness of their children's whereabouts (Haddon 2004; Ling 2004). The literature on mobile phones in society likens the technology to "an umbilical cord" within parent- child relations, whereby both parents and children have an increased sense of security when they are apart (Ling 1999b; Geser 2003). As such children have the potential to enjoy more freedom while being reached by parents at any time irrespective of location.

Perceived health risks and paradoxes

In many societies there are perceived negative effects associated with the introduction of the technology into society. There are perceptions in many places that the use of mobile phones while driving is dangerous (Bautsch et al. 2001) and leads to increases in automobile accidents (Harvard Center for Risk Analysis 2002). Many countries have instituted severe penalties for holding a mobile phone while driving. Simultaneously, mobile phones have been shown to expedite access to emergency services (Chapman and Schofield 1998; Horan and Schooley 2002). In one study conducted by Harvard School of Public Health in 2000 key findings initially highlighted how the perceived benefits of having a mobile phone while travelling by automobile outweigh the risk of automobile accidents, however, this was refuted in a follow up study conducted in 2002 (Harvard Center for Risk Analysis 2002).

Although, there are potential health benefits to be attained through the use of mobile phones for health purposes, there is also caution among the general public in many countries regarding potentially harmful radiation being emitted by mobile phones and network masts (Agar 2003; Ellaithy 2004). Case-control and cohort studies on the causal relationship between mobile phones and cancer are still ongoing (Agar 2003). Cancers tend to take many years to develop in individuals who have been exposed to carcinogens and so evidence regarding the linkages may take five to ten more years of ongoing mobile phone use by the general public before conclusive evidence is available. The public, however, is very concerned, particularly those who live in close proximity to masts (Ellaithy 2004). This concern is itself a health issue. Although my research does not focus on this particular aspect of mobile phones and health, it is addressed where relevant to the main aims of the study as a potential limitation to maximized use of mobile phones by the health sector. Studies and policy reviews liken speculation regarding the reluctance of the mobile phone industry to release data on harmful side effects to that of the tobacco industry to fully acknowledge the association between cigarette smoking and lung disease (Agar 2003). In spite of perceived risks acknowledged by users, people continue to use their mobile phones (Agar 2003). Since 2001, the British Medical Association has been reporting on the sociological as well as

the health implications of radiation from mobile phones in an effort to ascertain potential social and health benefits (British Medical Association 2001). This new focus highlights the growing need and interest in ascertaining both positive and negative affects of mobile phones on health for a more balanced perspective on the technology.

There are other social costs as well as benefits associated with this technology. These include improved crime surveillance alongside expanded trading in the international technology black market, petty theft of mobile phones, and improved coordination of criminal activity (Agar 2003). Mobile phones bring people together, while potentially pushing them apart with less frequent physical of face to face meetings, interrupted interactions, as well as increased harassment (Plant 2000; Lasen 2001). As observed through work-related travel in Africa and Asia, in some settings it is considered prestigious to have a mobile phone ring in the middle of a business meeting, while in others the owner is inundated with irritated glances. I have also observed that some individuals are able to increase their income through improved telecommunications, while others are losing money due to their inability to manage the credit and cost structures of owning a mobile phone. These and other seemingly paradoxical aspects of mobile phone use by society will be addressed throughout the Thesis as they relate to health and well-being in Minia, Egypt.

Study design

This study has primarily been situated and informed by case studies in ICT for Health and Development, mobile phone trends in society, and theoretical frameworks in the field of Science and Technology Studies (STS). These resources provide a rich multidisciplinary lens for looking at the complex relationships between individuals and objects through the exploration of context, history, culture, gender, ethnicity, geography, as well as socio-economic factors. For fieldwork I used an ethnographic methodology employing qualitative research methods in the form of in-depth interviews, group discussions, and document review. Among the respondents were health care professionals, including physicians, nurses, administrators, and ambulance workers. In addition, I also interviewed a broad range of what I refer to as “lay users”, including

business people, transportation workers, and students from urban and rural settings. “Lay users” in the context of my research is used to distinguish health professionals from non-health professionals. Ethnographic data collected for this study was supported by other sources of information, such as a recent historical analysis of the movement of the overall improvement in the telecommunications infrastructure and attitudes towards technology in Egypt.

As indicated in the Preface, when I began my research on the subject in 2002 I received many questions from public health colleagues as to the importance and relevance of the subject. In 2000 after six years working in developing countries mostly in rural communities in North and East Africa as a teacher and public health professional, I engaged in work for a health care Internet company in New York City’s Silicon Alley. It was during this period that I began to seriously consider how such technologies could benefit the lives of those living in developing countries. As both the Internet and mobile phones have become increasingly available in the most remote locations of the world, colleagues in technology corporations as well as in public health institutions have grown more and more interested in the changes in the health sector resulting from access to information and communication technologies, including mobile phones. Public health colleagues who initially bought a mobile phone to facilitate social interactions are also experiencing changes in terms of how they use the technology to manage their work. Outside of the health sector, individuals have also encountered situations in which they have derived social and in many cases health benefits.

Study aim and objectives

Why study mobile phones? When I began developing my research proposal, I originally wanted to study the impact of the Internet on health in developing countries mostly due to my professional experience working for a dot.com in New York. At the time there were a number of studies already exploring the health benefits of the Internet with the underlying assumption that improved access to information would improve health practices within and outside of the health sector. It is my observation, that similar and more expanded health benefits are possible through mobile phones because of the greater

number of subscribers with daily access as well as the additional benefit of not having to be literate to use the technology. Much of the research that has been done is based in developed countries and primarily focuses on the domestication of mobile phones for social purposes or potential health risks. Studies in the United States and Australia, have begun to explore the role that mobile phones may be serving in improving access to emergency medical services (Chapman and Schofield 1998; Horan and Schooley 2002). Additionally, other studies in the United Kingdom, have documented the cost and time savings of text message reminders for medical appointments (The Economist 2006). In developing countries, there are only a limited number of case studies on the use of mobile phones for health where the main focus has been on the use of text messaging for drug compliance, particularly for the detection and treatment of tuberculosis (Hedberg 2002) and now for HIV/AIDS in South Africa and other Sub-Saharan African countries (Shields et al. 2005). Parallels have been drawn to other technologies, including two-way radios, however, these devices remain under control of a few individuals and are predominantly stationary (Geser 2003).

By mapping the relationships between mobile phones, society, and health services, the public health community can gain a better understanding of the issues involved in measuring the health impact of the technology with their growing use in developing countries. This research will increase the collective knowledge of the mechanisms by which mobile phones support the achievement of health objectives, including improving access to and utilization of quality emergency and primary health care services.

My primary research question is:

What are the direct and indirect health benefits of mobile phones in Egypt?

The primary study objectives are:

1. Using a local case study, anticipate and identify some of the changes in health services resulting from the overall increased access to telecommunications by health professionals and lay groups

2. Investigate and documenting the use of mobile phones in domestic settings for health purposes
3. Using a local case study, explore some of the potential mechanisms for formal health sector integration of mobile phones
4. Provide preliminary recommendations to key stakeholders for operations research necessary to formally integrate mobile phones within the health sector

The main focus of my research is to document the role of health-related uses of mobile phones in the health services and domestic settings as a basis for more formal integration of mobile phones by the health sector. Changes in health services have been identified based on differences observed (based on previous research in the study location) and through interviews with health professionals in government health facilities and private clinics as well as lay users. Data on the use of mobile phones for health in domestic settings have been collected by identifying male and female lay users in an urban, peri-urban, and three rural locations. Users were primarily male and in the rural locations all identified households with mobile phones were included in the sample due to the limited numbers. Potential mechanisms and preliminary recommendations for formal health sector integration have been identified through the development of case studies based on an analysis of existing practices within the study sample. The core objectives of the study have been met and results from the findings are presented in the chapters to follow. The data collected, in conjunction with available literature, provide the basis of the research and answers to questions of change, uses, and potential areas for formal integration of mobile phones into the health sector.

Limitations of study

There were some key limitations to my study that are worth acknowledging. First, the literature within the broad fields of ICT for Health and Development and mobile phones in society is constantly growing. Much has appeared since I first began my research and conducted my field work. Although it is still evolving, these newly documented and accessible studies would have provided more guidance on potential study design for data comparison as well as a range of additional approaches to data collection. Published

empirical research on mobile phones for development as well as social change has been more recent. Methods were used in studies conducted at the same time as my own that could have been used to enhance study findings, including mobile phone call and voicemail diaries to more closely observe actual calling behaviour (Palen et al. 2000; Donner 2005c). In some cases, review of phone bills would have been possible; however, most respondents were *pay as you go* subscribers, whereby call logs were not available. Second, several challenges presented themselves particularly in establishing a baseline for observing changes in health services and lay health communication. Because of the combined use of telecommunications technologies including wireless systems and fixed-line telephones, the focus of the study expanded from exploring the potential role of mobile phones on changes in the health sector to the role of overall improved telecommunications. Third, the content of such a study is time sensitive. Technology is fluid and constantly changing, new uses are emerging, and as it extends to more users its integration within society evolves. Finally, as with other ethnographic studies findings are linked to a particular geographic setting, population, and time with some aspects that can be generalized to the broader society and other aspects that might only apply to those that are most similar to the types of respondents included in the study. More detailed discussions of the strengths and limitations of the study have been incorporated into the discussion of results. These insights provide guidance for the future of similar research focusing on the role of mobile phones and other ICTs in health in developing countries.

Selection of study sites

When I first considered researching health-related uses of mobile phones in developing countries, I wanted to conduct a multi-country study that would explore the relationship between culture and the adoption of technology for health purposes. The original criteria for country selection was the availability of a widely accessible mobile phone network, limited telecommunications infrastructure prior to the introduction of mobile phones, and a critical mass of users within the health sector and in the general population. Because of financial constraints, I decided to pursue an in depth exploration of one country. Several possibilities were explored, including Bangladesh, Egypt, Peru, and South Africa. After

careful consideration I conducted two brief empirical feasibility studies in Bangladesh and Egypt.

Bangladesh was selected for exploration because it was one of a handful of developing countries with a highly developed mobile phone infrastructure in 2002. Grameen Bank was also proactively using the phones to increase social capital and address livelihoods of women in rural communities living in poverty through the *Village Phone Program* (Bayes 1999). In February 2002, I travelled to Bangladesh to conduct a feasibility study, during which it became clear that although mobile phone services were available, there was limited uptake of the technology by the general public as well as among health care providers. Identifying respondents as well as observing changes would have proven challenging. Upon returning from Bangladesh, I decided to identify an alternative study location with similar infrastructure and coverage, but greater uptake. At the time, key potential research sites included: Costa Rica, Egypt, India, and South Africa. As an Egyptian, the prospect of exploring interactions and changes in Egypt was at first both exciting and anti-climactic. Even though I am familiar with Egyptian culture I was not familiar with the changes in society related to the introduction and penetration of mobile phones.

A preliminary visit to Egypt was carried out in April 2002 to meet with individuals in mobile phone companies, government ministries, international agencies, and research facilities as well as to identify communities that might be included in the study. Egypt was ultimately selected as the study country because the rural and urban mobile phone networks are highly developed. There was a critical mass of individual users that had acquired the phones for personal and business purposes. A new Ministry of Telecommunications and Information Technology (MCIT) had been established in Egypt and has been actively engaged in exploring the potential social impact of ICT on Egyptian society. In September 2002, I returned to Egypt to collect data, which I completed in early 2003. The data presented in this Thesis provide information from within the health sector as well as domestic settings for the application of mobile phones for health as well as potential applications to other sectors.

With the appropriate permissions obtained from the Ministry of Health, I conducted the study in the governorate of Minia. Minia Governorate is located in Upper Egypt (southern part of the country) and contains Minia town and 57 villages. In 1995, it had an estimated population of over 3.3 million (Egypt's Governorates Net 1997), and was chosen because it is an area that would benefit from leveraging improved access to telecommunications infrastructure for health promotion. It also provided an interesting cross section of people of varying socioeconomic status as well as remoteness to health facilities, where members of particular communities have to travel for four to five hours to reach a health facility on boat, foot, and donkey. Minia was also one of the sites for a study that I was involved in from 1997-98 on peri-natal and neonatal health that included a health communications component that explored with whom women spoke about their health during pregnancy and on behalf of their neonates. Women generally leave their maternal homes and go to live with their husbands' families. In 1997 there were very few homes in Minia with access to any type of phone service and many were reluctant to speak with their in-laws about their health during pregnancy. With access to mobile phones and competing fixed-line telephones I was particularly interested to observe how communications patterns are shifting in relation to women's health.

Contextualizing the introduction of mobile phones in Egypt

Recent movements within Egypt to harness the potential of information and communication technology have resulted in strategic developments for the integration of technology in both the education and health sectors (El-Zanaty 2001). Egypt has the health infrastructure to integrate technology to better respond to the health needs of the people. However, the system requires significant changes to make this possible. In this section, I explore the historical and present day context into which mobile phones have been integrated into Egyptian society as well as initial perceptions surrounding mobile phones as represented in the media as well as by respondents.

Known primarily for its rich ancient history, the Arab Republic of Egypt is a predominantly desert country located in northeast Africa [See Appendix A for a map of Egypt]. It spans approximately one million square kilometres and shares borders with

the Mediterranean Sea to the north, Libya to the west, Sudan to the south, and the Red Sea to the east. The population of the country, approximately 66 million in 2002 (World Bank 2002), inhabits only six percent of Egypt's geographic area, mostly in the Nile delta and along the narrow southern part of the Nile River (El-Zanaty 2001).

The country is separated into 26 administrative districts known as governorates. Each governorate, aside from four urban governorates, is comprised of both urban and rural areas. In 1996, 43.0 percent of the population lived in urban areas (El-Zanaty 2001). Urban areas in Egypt tend to have better infrastructure in terms of sanitation, piped water, telecommunications, and health services than rural areas. The movement of the population from rural to urban areas began in the 1800s during French colonization of Egypt. "While the village remained the home of most Egyptians, both the political and economic autonomy of the village community eroded as a result of political centralization and economic commercialization" (Jankowski 2000, p. 104). What is defined as rural in the Egyptian census consists of everything outside the seats of governorates and district towns, that is, the urban is defined in terms of its administrative role, and the rural is residual. "The characteristic setting is ... the village, though this term covers a variety of situations from hamlets of a few hundred people to agro-towns of twenty thousand or more. ... The average 'village' size in Egypt is about seven thousand (in India, for example, it is about two thousand...)" (Hopkins and Westergaard 1998, p. 2).

History

The history of the Egyptian people, particularly in modern times, has played a significant role in how mobile phones have been embraced and integrated into everyday life. Over the past 300 years Egypt has been colonized by three dominant world powers: French, English, and Ottoman. She has also been influenced by socialist philosophies and capitalism through both internal and external revolutions and movements. Attitudes, perceptions, and behaviours are thus shaped and justified by what individuals have experienced in the past along with the environmental conditions of the present.

The influence of Europe through French and British occupation upon Egyptian culture, however unwelcome, has been a critical aspect of societal trends of technology acceptance, adoption, and adaptation (Jankowski 2000). This historical paradox remains to the present. Although there is distrust of the presence of foreign companies in Egypt, many Egyptians embrace Western popular culture and technology, including television (Amin 2000) and mobile phones. Egypt has since existed in a quasi- European, Middle Eastern, and African state (Jankowski 2000). External influence on Egyptian life has not been limited to Europe, but has since expanded to include the Soviet Union and the United States of America.

During the rule of Gamal Abd el-Nasser over Egypt from 1954 - 1970, his leadership was driven by the principles of a socialist republic. The major shift in political ideologies came with the Cold War in the mid-1950s, leading to an era of government subsidies and popular dependence on the government. The influence of the Soviet Union was very different from that of European predecessors. Along with military support, the Soviets asserted their philosophical principles (Jankowski 2000). The residual impact came in the general thinking of the Egyptian people that the government would take care of them. The re-adjustment of the Egyptian people to the progressive termination of this level of government support has been wrought with challenges. For decades the government has been responsible for providing government funded employment, subsidies, and free services to the citizenry.

Many respondents in my study sample expressed their desire to see a government-owned and controlled mobile phone service provider in the hope that it will be much more affordable than the current privately owned alternatives. Galal Amin, an Egyptian economist at the American University in Cairo, in his book Whatever Happened to the Egyptians?, describes historical trends in Egyptian society and how they are influencing modern life. As illustrated by Amin below, the focus of Nasser's government had been for Egypt to become equal to the West through the adoption of key technologies by industry and society.

...however ambitious Nasser may have been, he was not so ambitious as to imagine that the Arabs could develop their own version of 'progress'. His aim was to be equal with the West, but not necessarily different from it.... It was important for the revolution to build new factories, but no serious questions were entertained concerning the justification for producing private motor cars or air-conditioning units, either then or in the future. There was not even any serious debate about the choice of appropriate technology in the new industries that were being established... it was important to wipe out illiteracy, although even in this area there was little improvement, but it was not deemed important to protect the Arabic language from further deterioration and neglect. ... For the goal was 'development,' not creativity or innovation. (Amin 2000, pp. 46-47)

This has been true for the introduction of mobile phones in Egypt. Egypt, like many other countries, remains in large part either a mass producer of existing technologies, including pharmaceuticals, or a consumer, but it does not contribute to the creation and distribution of new products. Egypt now has branded and produces its own household appliances and other technological products. Similar to other socialist and post-socialist societies, Egypt produces goods locally to meet the consumer needs of the population. However, the external market for goods produced in Egypt is limited (Amin 2000). A 31-year-old female university professor, who is from Cairo but teaches in Minia, commented that she would prefer to have locally produced mobile phones, what she referred to as "an Egyptian brand that would replace *Nokia*". To her and others, this is preferable to importing products.

Egypt has imported many ideas and technologies throughout her history with limited success as the fundamental platform necessary to support such change was never established. Free education for the sake of education was initiated in Egypt with limited thinking on why or what to do with the millions of university graduates that are produced each year. *Technology for the sake of technology* is a critical feature within Egyptian culture and stems from a love of all things new and foreign. The fact that a consumer product is new and foreign makes it desirable (Amin 2000). During a seminar hosted by the American University in Cairo that I attended in 2002 on ICTs and Social Development a number of social scientists highlighted the following issues. Limitations to the use of computers and the Internet include the lack of basic computer skills to be

able to use them, training to maximize the use of technology and search for desired information, and critical skills to discern the quality of information obtained from the Internet. Egyptians, especially government ministries, also engage in frequent updates and technology replacements to get the “latest” technology, whereas institutions in the United Kingdom tend to provide training to employees and invest in maintenance infrastructure to use the same systems for many years. There are now computers in all schools, but they have yet to become a part of everyday life.

Mobile phones, on the other hand, in Egypt have become a status symbol (Shahine 1999). As observed throughout my research in Egypt, for those who cannot afford other luxury goods such as automobiles, land, and apartments, the mobile phone provides an increased sense of self worth. During a group interview one doctor mentioned, “The Egyptian is poor, but generous. People buy mobiles for looks, but the majority in Egypt are out of service. They had a peak in use and now are levelling off to a normalized set of users.” Although this assertion made in 2002 was partially accurate it does not fully support what other respondents shared as well as new data generated on a quarterly basis on the rapidly increasing number of new and active subscribers.

Economics, population, and health

Egypt has been categorized as a *lower middle income* country by the World Bank along with countries such as Colombia, Dominican Republic, Jordan, and Thailand. The Gross National Income (GNI) per capita was \$1,490 USD and the Gross Domestic Product was \$98.7 billion USD in 2000 with an annual growth rate 5.1 percent (World Bank 2002). Egypt’s health expenditures as a percent of GDP were 4.6 in 1998 with public sector health expenditure as 30.8 percent of that (Roll Back Malaria 2002). One of the major problems in Egypt as in many countries is an uneven distribution of wealth. Twenty-two point nine percent (22.9%) of Egyptians lived below the poverty line in 1995-96 and 52.7 percent earn less than \$2 USD per day (World Bank 2002).

Life expectancy has risen significantly over the past sixty years. In 1940 it was thirty-one years for males and thirty-six years for females (Gallagher 1990). In 2000 it was 65.4

for males and 69.1 for females (Roll Back Malaria 2002). These figures are slightly lower than other *low middle income* countries (World Bank 2002). Mortality of children under five years declined to 52.2 per 1000 in 2000, but remains higher than other *low middle income countries* (World Bank 2002). In 1999 the infant mortality rate was 41.8 per 1000 (World Bank 2002) and the maternal mortality ratio (MMR) was 170 per 100,000 live births (Roll Back Malaria 2002). The maternal mortality ratio in Egypt is significantly higher than other *low middle income* countries. For example, Jordan and Thailand had MMRs that were 41 and 44 per 100,000 live births respectively in 1995 (World Bank 2002). One area that public health professionals have recommended that mobile phones be integrated into health systems is to address obstetric emergencies. Mortality and morbidity statistics remain particularly high in rural areas in Upper Egypt including Minia where education and access to medical care are lower than the rest of the country (El-Zanaty 2001).

In Egypt, demographic as well as epidemiological transitions are shifting the health priorities to support the increased demand in services for chronic diseases and decreased demand in services for infectious diseases. This is mostly due to successful investments in maternal education as well as public health interventions.

Rapid changes are occurring in the pattern of diseases that affect the population of Egypt, and most other low- and middle-income countries. Chronic and degenerative diseases occurring in adults, such as diabetes, high blood pressure, heart disease, and cancer are sources of morbidity and mortality (Mosley, Jamison and Henderson 1990; Omran 1982). One cause of this shift is improvements in child survival as a result of increasing levels of maternal education and the diffusion of medical and public health interventions, such as immunization, oral rehydration therapy, and antibiotics (Millard 1994; Mosley and Chen 1984).” (Mehanna and Winch 1998, p. 219)

There is also evidence that overall quality of life in rural Egypt has been gradually improving, as measured by consumption as well as by the figures for life expectancy and literacy rates (Hopkins and Westergaard 1998). In Minia in 1996, 80.6 percent of the population was living in rural areas (UNDP 2002). As of 1999 households in Minia Governorate reported having electricity (93%), radios (57.8 %), and televisions (78.6%)

(UNDP 2002). These figures are lower by varying degrees than those for Egypt as a whole. With respect to literacy, in 1960 Minia had a literacy rate of 18.1 percent while as of 1998 this has increased to 41 percent for people over the age of 15 with a female literacy rate of 26.2 percent (UNDP 2002). These and other statistics including education and employment are similarly lower for women as well as people living in rural areas (UNDP 2002). With respect to health services, in 1998 Minia had 4.9 physicians, 11.7 nurses, and 15 beds per 10,000 people with 2.9 health units per 100,000 people; all of which were lower than those reported for Egypt (UNDP 2002). Many of the improvements in social and health indicators for Egypt are due to an improved economy in addition to significant investments in infrastructure development, education, and health. In light of statistical differentials within development indicators between men and women, it is worth noting some key cultural considerations regarding gender in Egypt.

Gender

The gender of an individual defines much of how s/he will be perceived by the people with whom s/he associates with during his/her life. Daughters are traditionally viewed with a sense of ambivalence primarily because of the expectation that she will eventually leave her household to join that of her husband.

[In Egypt] the birth of a female child is reacted to negatively by the family and the culture for a number of social reasons. Even though she will be expected to assist her mother in the household, her labor will eventually belong to her husband's family. There is also fear that a girl can be a source of shame if she breaks existing sexual rules. Given these concerns, mothers react to the birth of a daughter with ambivalence. (Hatem 1987, p. 295)

In Egypt there is a historical transition to nuclear families instead of traditional extended families (Ali 1998; Singerman and Ibrahim 2003). There is also an increased need for a woman to contribute to household income as well as continue in her role as primary caretaker of her husband and children (Ali 1998; Barsoum 2004). For women in rural settings this mostly consists of agriculture or petty commodity jobs. Women in 1996 in

Minia represented 12 percent of the labour force, 24.1 percent of professional and technical staff, and 12.3 percent of legislative and managerial staff (UNDP 2002). The status of most women in Egypt is measured by whether or not they bear children. This was among findings in a study I conducted as part of the Ministry of Health's Healthy Mother/ Healthy Child Program in Minia regarding health practices during pregnancy and on behalf of newborns in 1997. This study showed that newborn boys received generally better care than girls and that for women who had difficulty conceiving, treatment-seeking behaviour during pregnancy was much more intensive than for those who were pregnant with their fourth or higher child (Mechael et. al. 1998). "One informant [in the Harrison study-see below], for example, reported weaning her first child, a baby girl at nine months in order to become pregnant again. She was the second wife of an Upper Egyptian husband who had three girls in the other marriage and wanted a son" (Harrison et al. 1993, p. 1069).

In Egypt there are male entitlements that begin during child development. Boys learn superiority. They are given better food, more play time, and are generally more likely to go to school. Girls learn inferiority with housework duties from a young age as well as responsibilities for other children and are less likely to go to school. Even though women tend to accept the dominant cultural definitions, they identify themselves as "clever, better planners, and more enduring individuals" and reconcile this with connectedness and support from other women (Hatem 1987, p. 300).

There are implications of these relations and support systems for how mobile phones contribute to extending the support structure network for women, particularly as they are increasingly not living within extended family households. In a study of maternal beliefs and perceptions with breastfeeding and weaning in Egypt, Gail Harrison et. al. writes, "the young, inexperienced mother requires a decision assistant; the mother raising her third or fourth child does not need advice, but rather requires physical assistance from an older child" (Harrison et al. 1993, p. 1065). Most women (and men for that matter) prefer to contact their mothers when they require decision-making support related to health and treatment of illness options.

Telecommunications

“Like their European models, [Egypt’s] westernized urban areas featured new amenities such as gas lighting, piped water, and by the 1880s the first telephones” (Jankowski 2000, p. 105). Similar to economics, population and health statistics, “the most important characteristics contributing to the digital divide in Egypt can be summarized under the following four categories: rural/urban, high income/ low income, literate/illiterate, and bilingual/ single language” (UNDP 2002, p.5). According to the World Bank, Egypt progressed from 51.1 fixed-line and mobile telephones per 1000 people in 1996 to 107.7 in 2000 (World Bank 2001). These figures have continued to grow since that time.

At the time of my data collection, a recent study of fixed-line telephones in Egypt looking at teledensity (number of working telephone lines per 100 inhabitants) and teleaccessability (number of home lines per 100 households) had been conducted in Egypt to determine the telecommunications infrastructure needs of the country. The study determined that the overall teledensity of Egypt is 9.82 with teleaccessability at 40.37 (Infocom Technology Inc. 2002). These statistics vary significantly from urban areas to rural. For example, the governorate of Cairo’s teledensity and teleaccessability were 24.38 and 84.15 respectively, while Minia, a predominantly rural governorate, had a teledensity and teleaccessability of 3.21 and 14.41 respectively in 2001 (Infocom Technology Inc. 2002). Poorer, more rural regions have much lower access to working fixed-line telephones (Infocom Technology Inc. 2002). At the time of data collection (2002), the cost of installing a fixed-line telephone into a household was prohibitive for most Egyptian households at \$260 USD, which was nearly half of the yearly income of half of the country’s population. Once the line is installed, the rental per month is \$1.50 USD and local calls cost \$1.80 USD per hour.

Since their introduction in 1997, mobile phones in Egypt have transitioned from an inaccessible luxury item of the elite to a commodity affordable and accessible to poor citizens. The mobile phone networks covered and services were made available to the major inhabited parts of Egypt along the Nile by 1998. The primary service providers in Egypt are MobiNil and Vodafone (mobile phone service), Egypt Telecom (fixed-line

telephone and pay phone service), and MenaTel (pay phone service) each competing for the attention of existing and additional subscribers.

Mobile phones can be purchased in payment installments, as second hand devices, and with pre-paid phone service. At the time of my data collection, the average cost of one hour of mobile phone time is \$8 USD (Africa Connection 2002). Based on reports from the two major mobile phone service providers, MobiNil and Click (Vodafone) in 2002, there were over 3.3 million mobile phone subscribers in Egypt. The increased uptake was largely due to the partial privatization of the telecommunications industry, clever marketing, coordination between mobile phone companies and government ministries, declining cost of building the necessary infrastructure, declining cost of mobile phone acquisition, and the social status they elicit (Khalil 2000). Convenience, efficiency, and social status are heralded by the mass media as motivating factors for the purchase of mobile phones. Business people, doctors, and families can facilitate their work and social networking better with the devices (Shahine 1999). As mobile phone access improves, the government telecommunications provider, Telecom Egypt has become more efficient in providing fixed-line telephone services. The competition within the country has led to an overall improvement in access to telecommunications that is projected to grow significantly over the coming years.

These figures have since continued to increase to 10.3 million fixed-line telephone and 14 million mobile phone subscribers reported at the beginning of 2006 (World IT Report 2006). Although the figures have more than quadrupled since data for this study were collected, the health benefits derived from improved telecommunications would theoretically remain similar or increase as well. This transition closely parallels the experience of the United States and the United Kingdom, as illustrated by Lynn Hamill, as the acquisition and use of a new technology is highly price and income sensitive (Hamill 2000). When fixed-line telephones were first introduced they were expensive to install and maintain. Over time with increased demand the cost decreased. Similarly with mobile phones in Egypt, price sensitivity declined as the technology became more widely accepted and, eventually perceived as a necessity.

The profile of the mobile phone user is quite diverse. In my study sample, there were a range of professionals who felt that the mobile phone would facilitate their work. The major groupings included medical professionals, mostly health administrators, physicians and pharmacists; businesspeople- especially engaged in the buying and selling of goods; truck and automobile drivers; and students. People who travel for work and study are also more likely to invest in buying a mobile phone.

Changes in Egyptian society related to mobile phones

In light of the social impact of mobile phones, many broad changes have occurred in Minia resulting from the introduction of the mobile phone. Almost 50 percent of the respondents through probing and spontaneous mention described how life after mobile phones were introduced into Egyptian society was different. Generally, the sentiments spoken by health professionals and lay users alike were positive. Life is better, easier, and more convenient with mobile phones. Professional interactions particularly as they relate to telemedicine and health service coordination among health care workers are increasingly becoming more efficient as well as networked. Patients have a newly achieved ability to directly contact doctors. Doctors can now contact each other to coordinate the provision of health services, particularly expressed in cases of emergency response. Doctors are also able to contact patients and their families directly to gauge and communicate progress.

Mobile phones save time and money and facilitate family communication. They also provide an increased sense of privacy. Individuals can contact others directly unlike with fixed-line telephones which might be shared and answered by any number of family members or work colleagues. For young people pursuing conversations with members of the opposite sex, they are able to do so with little interference from curious family members. Husband-wife and parent-child communications via mobile phone allow for individuals (especially girls who are able to obtain a mobile phone) to travel more freely and achieve a sense of peace regarding family members.

Before mobile phones, most Egyptians outside of the major cities had to go outside of the home to make phone calls. Their options included not making phone calls (and ‘*leaving things to God*’), telegrams, community-based government sponsored telephone stations known as *centrales* mostly located in urban and peri-urban communities, pay phone booths, and private land-lines owned by wealthier neighbours willing to share their fixed-line in emergency situations. For the teacher, student, and community leader based in rural areas, they described how mobile phones have become an affordable commodity that has made communication “easier.” These perceptions provide a contextual base within which a discussion of health-related uses of mobile phones in Minia can be anchored.

Outline of Thesis

This Thesis will describe the direct and indirect benefits that mobile phones are having with respect to health in Minia, Egypt. Changes in Egyptian health services and domestic settings were observed. The role of health-related uses of mobile phones has been documented and presented using key literature from the fields of ICT for Health and Development, other mobile phones studies, and STS to inform study design, analysis, and discussion of results. This has been done with the practical objective of informing practice and policy. Each chapter described below serves as a building block towards achieving the overall aim and objectives of this study.

Chapter 2: Reviewing the Literature: Mobile Phones and Health

The literature review provides a general framework that has influenced my current understanding of the subject. It has been used to inform the study design and the analysis of data collected in Egypt. Supporting literature related to ICT for Health and Development, mobile phones in society, and Science and Technology Studies has been used to illustrate how various models from sociology, business and health can be combined in order to understand the complexities involved in exploring health-related uses of mobile phones.

Chapter 3: Methodology

The purpose of Chapter 3 is to provide detailed background and justification regarding the methodological approach, study design, and implementation process used to document the role of mobile phones in health service delivery and domestic health-related communication. Included in this chapter is a discussion regarding adjustments to the original study design as well as sampling structures and user profiles.

Chapter 4: Fieldwork Findings: Case Studies in the Role of Mobile Phones for Health in Minia, Egypt

Chapter 4 is divided into four case studies exploring: 1) emergency health care services, 2) general health services, 3) family communication and well-being, and 4) limitations to the domestication of mobile phones for health. In this chapter, I present and explore the complex relationships within the empirical data that was collected from the overall study sample as well as specifically from health professionals. Key topics for exploration include changes in access to and coordination of health services, newly evolving communication patterns, as well as the social determinants of health in relation to mobile phone use.

Chapter 5: Limits to Domestication of Mobile Phones for Health

In relation to many of the benefits described by respondents, there were substantial limitations to their maximized use by the health sector. In Chapter 5, I explore the key perceived barriers to using mobile phones to support health objectives in Minia. These limitations have implications for future programming and research.

Chapter 6: Recommendations: Formal Integration of Mobile Phones by the Health Sector and Future Research Directions

Chapter 6 focuses on the way forward based on the fieldwork findings. It begins by highlighting key areas for formal integration of mobile phones to support access to health services and health service delivery. Many of the recommendations were provided by the respondents themselves and supported by what is known from the literature. The chapter

continues to propose key aspects of health care for which future research may prove beneficial as well as how one might proceed with such research.

Chapter 7: Discussion of Results

In Chapter 7, I take an in-depth look at the how the empirical data and key findings from Minia Egypt relate to the literature reviewed, and can be triangulated to contribute to the overall aim and supporting objectives of the study. Within this exploratory study, there were a number of recurring themes and perspectives that can inform future research and programming in this area. In this chapter, I also document some of the strengths and limitations of the methods and literature used to inform future research in the constantly expanding field of ICT for Health as well as how findings might apply to settings beyond Minia Governorate.

Conclusion

This PhD Thesis attempts to remedy the perception and reality that public health has ignored the potential benefits that mobile phones may offer to achieving health objectives except when addressing risk factors. Rapidly growing access to telecommunications, catalysed by the increase in access to mobile phones, accents the potential role that mobile phones might have in achieving health objectives particularly in developing countries. This potential role of mobile phones has led me to explore how mobile phones can be used to improve access to health information and services, coordination of health services, and well-being. The ideal outcome of such research is an “ethnography of the role of mobile phones for health in Egypt” as well as a proposed integration approach which maximizes health benefits for society at large.

Chapter 2: Reviewing the Literature: Mobile Phones and Health

Mobile phones have widespread appeal as observable in the increasing numbers of subscribers worldwide. They also have great potential as a tool to facilitate health-related communication. Many commentators have characterized society over the last four decades as a post-modern society marked by social change particularly in the areas of “computerization, the emergence of biotechnologies, globalization, and the demise of the nation-state” (Hess 1997, p. 132). *Globalisation*, including trans-national “flows of capital, money, goods, services, people, information, technologies, policies, ideas, images, and regulations” (Lash and Urry 1994, p. 280) and *global health* draws attention to the complexity of the movement of people and artefacts through time and space and the direct and indirect impact that it is having on people’s health (Lee 1999).

There are two dominating voices that are often discussed to project the value of mobile phones in poor countries. The first is naïve enthusiasm expressed by technocrats who believe that technology will miraculously enable poor countries to achieve the levels of economic and social prosperity of rich countries (Avgerou and Walsham 2000; Heeks 2002; Schech 2002). At the other end of the spectrum are sceptics. They view the transfer of technology and the forces that drive capitalism as a thief that imposes foreign values and robs people of culture and jobs, hindering development and fostering a dependency on technology that is not affordable or sustainable (Avgerou and Walsham 2000; Heeks 2002; Schech 2002). It is my observation that mobile phones can have both positive and negative effects, but more importantly, they are a tool with the potential to support the achievement of health objectives in poor countries.

However widespread mobile phones have become globally, there is limited literature or empirical data that directly addresses or documents their uses for health (Kaplan 2006). Generally studies that explore mobile phones and health have focused on their role in supporting a direct healthcare intervention (Kaplan 2006) or as the cause of unsafe driving behaviours and as the emitters of potentially harmful radiation (Agar 2003). More recently, in 2005, a few scattered case studies and anecdotal examples documented

in the grey literature on the use of text messaging for health, mobile telemedicine, and mobile phones in addressing emergencies and chronic illness have emerged. The focus of these studies has largely been cost savings from enhanced communication within the health sector. Within the context of such discussions and activities documentation on the health outcomes related to the direct application of mobile phones to support health objectives has been scarce (Kaplan 2006).

An analysis done in the United States and a related study conducted in Australia, explored the benefits within the health sector that come from improved access to telecommunications within the general population in relation to enhanced medical emergency responses. The analysis conducted in the United States documented the estimated increase in the number of wireless emergency calls from 1985 to 2001 and the reduction in time of fatal crash to Emergency Medical Services notification (Horan and Schooley 2002). In this analysis there was a positive correlation between increased access to wireless communications and time saved. What the analysis also served to highlight was an overall increased demand for Emergency Medical Services (Horan and Schooley 2002). The study conducted in Australia explored similar improvements in the reporting of emergencies. The study showed that although the main focus of discussion around mobile phone use and health is in its negative effects in causing automobile accidents, it is in fact also contributing to improvements in responses to automotive emergencies (Chapman and Schofield 1998).

In developing countries where emergency medical systems are still evolving in both urban and rural areas and technological solutions are considered to mitigate the impact of potential increases in demand for services, a study by Kathy McGrath provides key lessons surrounding the failures of a computer-operated dispatch system by the London Ambulance Services (McGrath 2001). The research highlights the need for technology systems developers to work systematically to ensure that the inputs of potential system users are integrated into the conceptualization, testing, and implementation of systems to ensure its acceptability and utility in the day to day management of life and death situations (McGrath 2001). At a time in which policy makers contemplate the enhanced

use of mobile phones and other technologies within the health sector, this case study provides a key example for how a collaborative working relationship between health professionals and technologists can make the difference between a successful and a failed use of technology for health (McGrath 2001).

A complement to the exploration of the potential role of mobile phones to promote health within the general population, Warren Kaplan from the Center for International Health and Development at the Boston University School of Public Health recently (May 2006) published a paper in *Globalization and Health* that specifically explores the use of mobile phones for the “express purpose of supporting or altering one or more health outcomes” (Kaplan 2006). Through an intensive web-based and library search, the author documented and compiled the results of evaluations of intervention studies of fixed-line and mobile telephone applications to address specific health care issues in developing countries. In response to the question posed by the title, “*Can the ubiquitous power of mobile phones be used to improve health outcomes in developing countries?*,” Kaplan found that the limited studies that were found both show and refute the potential that fixed-line and mobile phones to serve as a support for more effective delivery of healthcare services (Kaplan 2006). He does, however, make the case for what he refers to as the “functional and structural properties of mobile phones [that] make them attractive to use as a healthcare intervention,” (Kaplan 2006, p. 3) namely low start-up cost, text messaging, and flexible payment plans.

There were a number of key challenges to developing a comprehensive review of literature on the use of mobile phones for health in Egypt. The initial challenge was the selection of key bodies of literature that would adequately inform the study design process along with the subsequent discussion of results. The second challenge has been an exponential increase in the literature available on various aspects of the subject that have become publicly available in the past year, between 2005 and 2006, three years after field data was collected in Egypt. This gap in available peer reviewed literature provided an opportunity to familiarize myself with a broad range of literature related to telemedicine in developing countries, the history of mobile phones (and related history of

fixed-line telephones), and empirical studies on the domestication of mobile phones. Having been influenced by earlier research done on the use of information and communication technology (ICT) in poor countries, I also sparingly explored the application of Science and Technology Studies (STS) theoretical frames to inform the study design and illuminate data collected on health-related uses of mobile phones in Egypt.

This review of literature begins with a presentation of mobile phones in the context of health in developing countries. Of necessity, it draws on on-line discussions, conference proceedings, grey literature, and examples provided by public health colleagues working in developing countries due the scarcity of peer reviewed published literature on the topic. This is then followed by a presentation of the history of mobile phones and their domestication by society based on empirical studies conducted mostly in developed countries. It continues with a review of key issues related to mobile phones and health including gender, network interactions, and design and use configurations. The chapter concludes with a discussion of the perceived risk related to mobile phones and health.

Mobile phones within the context of health in poor countries

In the past two years, more significant efforts have been made to document, compile, and identify successful ICT for health interventions to inform policy, replication, and scale-up. When I began my study of health-related uses of mobile phones in Egypt in 2001, the closest surrogate at the time was the existing literature on ICT for development, which mostly focused on the use of computers and the Internet to support economic development objectives. Additional surrogates include evaluations of *NHS Direct* as well as previously cited work on the role of improved telecommunications and other technologies within emergency medical response systems.

eHealth (or electronic health) is broadly defined by the WHO as the “use of information and communication technology for health” (World Health Organization 2005). The main objective of eHealth programs is to use ICT to improve or enable health outcomes and health care service delivery. Through the strategic use of such technologies as

computers, Internet, satellites receivers, mobile phones, and Personal Digital Assistants (PDA), eHealth promotes healthy lifestyles, improves health decisions by health professionals as well as patients, and enhances health care quality by improving access to medical and health information. The increased use of technology can help reduce health care costs by improving efficiencies in the health care system and promoting prevention. eHealth also has the potential to advance clinical care and public health services by facilitating health professional practice and communication and reducing health disparities by applying new approaches to improve the health of isolated populations.

The most visible comprehensive review on the status and potential of eHealth in developing countries was funded in 2005 by the World Bank's *InfoDev Program*. The outputs of this review include a bibliography of ICT for Health documents, a month-long on-line discussion (which I monitored), and a synthesis report of key findings from the on-line discussion. The synthesis report from the on-line consultation, entitled ICT in the Health Sector, emphasized several trends in the existing state of *ICT for Health* as well as provided recommendations for future integration of ICT by the health sector (Shields, Chetley et al. 2005). First, ICT for health must be viewed in the context of broader development sectors, goals, and practices. Second, ICT is not an objective, but a tool that ought be applied in ways to achieve local, national, and regional health objectives. Third, there is insufficient impact data about how ICTs are influencing health outcomes, creating challenges to identify and replicate best practices. Impact evaluation is necessary to move beyond discussions of the potential impact that ICT might have and anecdotal examples of how they are already being used for health. Fourth, ICTs are only as good as the information and communication to which they provide access. And finally, there is a need to move away from pilot programs and case studies to more formal application and learning to set the foundation for national programs and policies (Shields, Chetley et al. 2005).

I would argue that the broad consultation of *ICT for Health* generally was useful in exploring macro-level issues, there were very few examples of the health impact derived from the strategic application of ICT, however, there were few examples of how and

where mobile phones are being used in poor countries to support health objectives. In a parenthetical comment, one participant shared that “the voice and text functions of a mobile phone... can help people (literate or not) share knowledge faster, cheaper, and in far larger volumes than ever before” (Shields, Chetley et al. 2005). There was also a passing reference made to the unrealistic expectation that health professionals who have personally invested in mobile phones should use them for their work without reimbursement (Shields, Chetley et al. 2005). Apart from such limited comments there was a noticeable absence of information that could be directly linked to mobile phones and health.

As policy makers throughout the world contemplate increasing numbers of mobile and fixed-line telephones within the general population and using them to make healthcare delivery more efficient, existing telephone-based health service delivery systems should also be reviewed for applicable lessons. The most comprehensive telephone-based health care system has been implemented as part of the National Health Service (NHS) in the United Kingdom. *NHS Direct*, which has been operating since 1997, is a nurse-led telephone helpline that aims to alleviate some of the burden within the public health care system by providing easier access to advice and information about health as well as referrals to the most appropriate source of care. Studies of *NHS Direct* predominantly highlight some of the opportunities and limitations with telephone-based diagnosis and referral systems that substitute face to face contact between patients and health care professionals (Munro, Nicholl et al. 2000; Grant, Nicholas et al. 2002; Richards, Godfrey et al. 2004). One study indicated that the costs of the system tended to be higher with a lower likelihood to resolve cases than similar general practice phone-based triage systems (Richards, Godfrey et al. 2004). Similarly, another study acknowledged that while findings did not indicate an overall decreased demand for services that the system may be restraining the demand for general practice out-of-hours service (Munro, Nicholl et al. 2000).

With respect to recommendations for future work integrating technology for health in poor countries, according to the report produced by Shields et al., several policy makers

suggested beginning by identifying health care interventions and objectives and then looking at how ICT can be used to achieve them (Shields, Chetley et al. 2005). It was also suggested that a review of interventions and ICT applications that could support them would help facilitate such a process (Shields, Chetley et al. 2005). Caution is advised as illustrated by the McGrath case study of the London Ambulance Service to ensure that potential users are actively involved in formal integration of any technology within the health sector as well as the design of new systems aimed at facilitating their work (McGrath 2001). Existing limitations that need to be overcome include cost, poor access to ICT including language and context-specific health information, and the lack of capacity to use technology (Shields, Chetley et al. 2005; Kaplan 2006). Training was also deemed essential for the full maximization of technology for development purposes (Shields, Chetley et al. 2005).

Potential health-related mobile phone applications

At the start of my study, I compiled the following table in discussion with public health colleagues regarding the potential applications of mobile phones to address health issues in poor countries. Figure 2.1 illustrates the various advantages and disadvantages to health sector usage of mobile phones particularly as they relate to the global burden of disease. This exercise was done prior to data collection to highlight how public health professionals might envision the application of mobile phones to health rather than to document actual applications. The review by Kaplan explored studies, primarily in developed countries, that looked at direct interventions in which mobile and fixed-line telephones were used to address health conditions such as diabetes (patient blood sugar level monitoring), breast cancer (telephone counselling), tuberculosis (adherence to medication), treatment compliance for a variety of conditions, attendance at health facility appointments, depression outcomes, immunization rates, asthma management, and smoking cessation (Kaplan 2006). At the national level applications of mobile phones across the health sector can have positive implications for health care professionals, citizens, and technology development companies.

Application	Advantages	Disadvantages
Telesurgery/ telemedicine	Clinical professionals consult with their counterparts in real-time throughout the world, enabling them to acquire a second opinion to address a broad range of medical conditions.	Many such consultations are between health professionals from developing countries and North America and Europe, resulting in reliance on external assistance that may not be sustainable for the long-term.
Drug compliance through SMS	Automated messaging reminds patients to take their medicines- especially for TB and HIV drug compliance.	Not all patients who might benefit from such a service have the technology.
Health administration	Improved efficiency and monitoring of patients, drug supplies, and staff.	Technology is not yet structured to fully maximise potential for improved health service delivery and information tracking. Greater potential to come with combined mobile phone and PDA.
Disease surveillance using mobile phones, GPS, satellite imaging, and Internet	Monitoring disease spread and related indicators, identifying cases, and responding to specific disease threats.	Systems are not always compatible, limiting networking ability. Capacity and access may also be limited.
Remote access Internet-based medical research	Global access to disease-related information, including prevention, diagnosis, management and treatment, trends, and research on such issues	Much of the information is produced in North America and Europe for global utilisation with material that is irrelevant for other countries. Too much information makes it difficult to discern the quality. Access is not universal. Even those with access are not yet able to take full advantage of the www.

Figure 2.1: Advantages and disadvantages of health-related mobile phone utilisation

In many countries as mobile phone networks develop, the fixed-line telephone structures are by-passed (ITU 2003) which results in decreased potential for Internet access apart from community access points and Internet cafes. In Egypt this has had the opposite effect due to competition with the government supported fixed-line telephone provider that improved its service delivery with the introduction of mobile phones (World IT Report 2006). For the country this means an overall increase in telecommunications infrastructure and therefore potential increases in health benefits. Unlike the creation of electronic medical records, improved access to the latest medical studies and research through on-line journals, and the development of health information systems for

knowledge management and decision-making, telemedicine/ telehealth is the most appropriate sub-set of eHealth to which the study of mobile phones can be discussed.

Telemedicine

Telemedicine/telehealth, has been defined by the World Health Organization as the use of ICT to support or as an alternative to the direct provision of health care, particularly where distance and locally available expertise is a critical factor (World Health Organization 2005). The term *telehealth* is increasingly being used as a replacement for *telemedicine* as it suggests a broader use of telecommunications technologies as well as applications as the focus of programs moves beyond health facilities to the care and monitoring of the elderly at home (*telecare*) (Klecun-Dabrowska and Cornford 2001). In *telehealth* and the more widely understood *telemedicine*, health care professionals use information and communications technologies to exchange information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers. Much of the literature regarding telemedicine focuses on the use of e-mail and the Internet as the instrument of communication for support in diagnostic and treatment decision making. The primary benefits of such programs include cost and time savings, mostly by reducing the number of patient to health facility visits for home based *telecare* and reducing transportation costs and medical fees associated with a physical consultation with a specialist.

At a telemedicine conference that I participated in April 2006, Med-e-Tel, it was apparent that very few existing telemedicine programs had sufficiently managed to assess actual patient outcomes related to interventions (See www.medetel.lu). Significant effort is now being put into place to ensure that appropriate baseline and monitoring and evaluation data collection systems are in place. As health and technology professionals acknowledge the increased availability of mobile phones, more emphasis is now being placed on integrating mobile phones as well as other mobile telemedicine devices, such as PDAs and remote sensors for measuring vital signs, into telemedicine systems (Donner

2004; Med-e-Tel 2006). Apart from a handful of examples, there has been little evidence documented on the impact that telemedicine via mobile phones is having.

Examples regarding telemedicine in Egypt that I found at the time of my study focused mostly on the use of the Internet and satellite connections to establish linkages between health professionals in more Westernized countries such as England and Germany and the Middle East for the treatment of cancer and heart-related diseases. These, however, did not visibly consider the potential for Egyptian health professionals to tap into expertise between rural and urban centres in Egypt. Two of the major concerns in the transfer of health-related or any other information and technology from one country to another are applicability and adaptability (Avgerou and Walsham 2000). Increasingly examples of telemedicine initiatives between urban and rural health care providers and health care providers in facilities and patients at home are emerging from countries such as Pakistan, Russia, and Poland (Med-e-Tel 2006).

One example of decentralised support for diagnosis comes from South Africa, where tuberculosis (TB) prevalence remains high. Health professionals have integrated mobile phones to improve diagnosis and disease surveillance within a particular geographic area. In the example below, provided by Carl Hedberg in a personal communication, mobile phones are being used to support mobile sputum sampling, analysis of sputum in a central laboratory, and communication of results between the central laboratory and satellite facilities. The result has been saved time and improved detection rates for TB in remote settings.

[One] significant undertaking regarding cell phone technology and health delivery I'm familiar with (beyond general cell phone use by managers and staff) is a very successful pilot project in the Libode/ Port St. Johns area in the Eastern Cape, South Africa.

Passive detection of tuberculosis was abysmal in this area because of the extreme turn-around time for lab results (up to 4 weeks, and often no feedback at all). The term "passive" is used because you don't actively seek out patients through home visits, etc. - you just ensure that all patients coming to the facility with TB-like symptoms provides sputum samples

for smear microscopy and/or for culture testing and/or they are X-rayed and/or you analyze the Road-to-Health card for children to detect signs of Primary TB.

They started a pilot project about two years ago using young guys on motorbikes to pick up the sputum samples and bring them to the nearest hospital lab for analysis. Results are sent back to the nurses using SMS messages (some pagers were donated by one of the mobile network providers).

Turn-around times dropped to around 24 hours, and detection rates of TB went up more than 300 percent. Generally regarded as highly successful, despite logistical and financial problems getting fuel for the motorbikes etc. (in that area - droves of doctors have left the last year because they don't get paid). (Hedberg 2002)

Another developing country with increasing examples of health sector applications of ICT is Uganda. The following scenario, implemented in Uganda, uses mobile phones in an HIV/AIDS-related home-based care project. Mobile phones have been distributed to satellite health facilities to enable telemedicine-like decision support consultations between direct care providers and hospital-based staff. Mobile phones are used to produce instantaneous guidance for referrals and treatment to minimize any unnecessary relocation of patients.

In Uganda, one home-based care project working out of a local hospital has provided mobile phones to each of the 20+ outlying mobile sites for better communication with the hospital on HIV and AIDS cases that needed a quick physician consultation for clarification and determination if the client needs to be sent to the hospital or can be taken care of on-site. (Stecker 2002)

Such examples of telemedicine are not unique to the examples provided by colleagues in South Africa and Uganda. The concepts of “remote monitoring” and telemedicine consultations are increasingly being researched to determine what the true potential impact for mobile phones on health is. In Australia, a study was conducted to determine the benefits of photo messaging in the clinical treatment of hand trauma (Lam, Preketes et al. 2004). In Italy, a Wireless Health Outcomes Monitoring System is being used to enable routine communication between patients and doctors for cancer treatment through

the completion of survey forms received and sent by patients on their mobile phones (Bielli, Carminati et al. 2004).

Such technology integration for social impact (including health) can be divided into two general frames: processes and outcomes that lead to development (Heeks 2002). The processes are then divided into processing (transforming data into useful information) and communication (moving data from one location or person to another). Learning and decision-making for action are the two major outcomes (Heeks 2002). These same principles apply when looking at mobile phones for health. In the context of telemedicine and phone consultations, lay users and medical doctors are actively involved in the information transfer and processing paradigm. Through question and answers between parties in combination with other knowledge, advice on a particular situation can be provided and decisions made. In the case of emergency response the same is true, but in reverse: a situation is communicated and then mobile phones are used to collect and disseminate the appropriate information to coordinate the necessary response.

Text messaging for health

The primary feature of mobile phones that has been best documented in the context of health is text messaging. Much of the literature regarding text messaging and health has been made available through the popular media, including news magazines and the Internet. Even though studies are referred to in the popular media, there are very few actual empirical studies that have been published and made publicly available on the subject. In a recent article, aptly entitled, “A text a day...,” published by The Economist in March 2006, text messaging via mobile phones is gaining increasing attention as a means of reminding patients of appointments in the United Kingdom, United States, Norway, and Sweden (The Economist 2006). The result is the lowering of non-attendance to scheduled appointments and is yielding significant savings in health costs for facilities and practitioners. In this case the benefit is cost-related rather than health outcome related. The article continues to highlight the potential of mobile phones to disseminate public health information and mobilize attendance to vaccination programs

particularly in developing countries as well as to manage the treatment of diabetes in Scotland (The Economist 2006). The results of these studies are currently in the process of being published and provide a solid first step towards peer reviewed research on the use of mobile phones for health.

Apart from those shared in The Economist article, I have collected related examples of the use of text messaging via mobile phones from colleagues working in a developing country context. There are some institutions that are using the technology to improve treatment compliance initially for TB, but increasingly for anti-retroviral drugs used in the treatment of people living with HIV/AIDS. One service called “On Cue” provides a platform for sending text messages to remind chronically ill patients at the same time each day to take their medications to ensure that an entire treatment regimen is followed. Results from a study, published in 2002 showed improvements for those with access to mobile phones in TB drug compliance in a particular district where the program was being pilot tested (See www.on-cue.co.za). The potential implication of such drug compliance programs is the prevention of resistant strains of disease vectors. South Africa was one of the first developing countries with widespread mobile phone network access, significant uptake by the general population, and examples of strategic application of the technology to support health objectives (Kaplan 2006).

Measuring the health impact of mobile phones

The impact of mobile phones on health in poor countries depends on whether they are achieved as a by-product of general integration into society or through direct engagement. As compiled from a range of sources, telemedicine (remote consultation, diagnosis, and treatment), collaboration among physicians, medical research, public health messaging, disease surveillance and control using satellite technology, financial and administrative efficiency, and patient data management are all mechanisms for direct engagement of ICT for health (Beard 2000; Digital Opportunity Initiative 2001; Murray and Dopson 2002). Both software development and access to hardware “improve access to timely, accurate and relevant information, which helps health care professionals to

better treat patients, and to enhance individual professional development and the development of improved health care delivery organizations” (Beard 2000, p.1).

Measuring health impact of ICT depends on how they enter society and the specific aspects of health that one is interested in evaluating. One recommendation provided during the *ICT for Health* on-line consultation was that a careful review of existing tools and instruments be conducted to determine the best measure for the health outcome of interest (Shields, Chetley et al. 2005). The first step to evaluating the health impact of mobile phones, in my view, is to map all of the relationships between the various elements in the mobile phone and health network. Once this is done health impact indicators can be used to look at the individual goals, decisions and actions of each member, asking the question “How is this aspect of the integration process related to health and what benefits or losses in health are being observed?”

For areas where formal integration by the health sector has taken place a review of the objectives and the strategy can be evaluated and research undertaken to measure whether the expected outcomes have been achieved. This is a difficulty faced by many ICT health applications as perceived potential outcomes at the start of implementation may differ from actual outcomes due to unanticipated factors and influence (Klecun-Dabrowska and Cornford 2001). In addition, change is generally unable to be measured in any significant manner due to the absence of a baseline in many cases. Indicators for health service management issues as well as individual quality of life assessments should be developed in order to ascertain what is happening. Digital Opportunity Initiative (DOI)¹ and Pan-American Health Organization (PAHO) have both devised mechanisms for evaluating health impact of ICT. The DOI recommends the correlation of health applications of ICTs with pre-existing population-based health indicators, such as maternal mortality, disease incidence, food security and nutrition (Digital Opportunity Initiative 2001).

1. The Digital Opportunity Initiative, collaboration between the United Nations Development Program (UNDP), Accenture, and the Markle Foundation, was established to assess and document the mechanisms by which Information Communication Technology can be used to leverage social and economic objectives in poor countries.

PAHO's approach is to measure health outcomes by creating a series of ICT and health indicators that evaluate ICT integration in relation to quality of health services, access to medical information, and personnel management (Rodrigues 2001). There is limited evidence that they have actually used the proposed methods to evaluate health impact to date in any significant manner.

In a case study exploring evaluation approaches within telehealth programs Ela Klecun-Dabrowska and Tony Cornford (2001) highlight similar challenges to those documented here. First, most evaluation programs have focused on the technological aspects of health information systems. This includes how well the system functions as well as user satisfaction and not necessarily on outcomes or impact (Klecun-Dabrowska and Cornford 2001). Second, it is difficult in many circumstances to directly associate outcomes with technology as many technological innovations are occurring alongside organizational change (Klecun-Dabrowska and Cornford 2001). This will be discussed in more detail in the context of the complex nature of attributing any change directly to the introduction of mobile phones into the daily work of health professionals in Egypt. Third, there is a strong movement to apply a randomized control trial approach to the study of ICT within health systems. There is the perception that such recommendations are geared towards legitimizing investments in such programs rather than genuinely ascertaining outcomes to contribute towards ongoing learning (Klecun-Dabrowska and Cornford 2001).

Interlinked to these various challenges is the need to identify a means that will generate useful information to better understand critical aspects of the use of technology for health. Klecun-Dabrowska and Cornford (2001) explored the use of two frameworks, namely 1) context, process, and content framework and 2) structure, process, and outcome framework, as they applied to the implementation and use of an Intranet system within primary care in the United Kingdom (Klecun-Dabrowska and Cornford 2001). The main observation from the review of evaluation methods was that the first approach provided a means for documenting and understanding the evaluation process, while the second approach provided content on what to evaluate (Klecun-Dabrowska and Cornford

2001). This is a positive movement towards evaluating outcomes. Further work is needed to extend this process to more intensively ascertain health outcomes.

Because the use of mobile phones for health to date has been piecemeal and individualistic, one recommendation for future research is to assemble a framework based on existing frameworks, including those described above, that explores the use of technology outside of a formal program. To assess the impact of mobile phone integration by the health sector one should consider incorporating aspects of technology capabilities, costs, efficiency, organizational culture, as well as health outcomes. To date the integration has been haphazard, making it difficult to measure the actual benefits of mobile phones and other ICTs for health.

History of mobile phones

With the focus of my research to understand the ways in which mobile phones are being used by Egyptian society and health professionals for health, it is important to review the history of the technology as well as the ways in which it has been integrated into the daily lives of people. The comic strip below by Bill Holbrook is a humorous portrayal of the cyclical progression of wireless telecommunication and messaging. In it, Holbrook highlights the movement from the invention of the telegraph and use of signalling patterns developed by Samuel FB Morse in the 1840s to the fixed-line telephone invented by Alexander Graham Bell in the 1870s to the invention of e-mail in the 1970s by Ray Tomlinson (and increased uptake within the general public in the 1980s) to SMS text messaging in the 2000s. Holbrook's prediction that text messaging may be a precursor to the re-visiting of binary communication is a reflection on the continuous need to simplify communication and to make it more efficient. The evolution of old technologies and the development of new technologies is generally aimed towards creating more efficient ways of doing every day tasks (Latour 1999). Once technology is in the public, however, its value and utility is determined by the sorts of users who then use it and promote it, in spite of the original intentions of the scientists/technologists who originally envisaged it (Lie and Sørensen 1996; Latour 1999).



Figure 2.2: Cartoon illustrating movement away from and back to basic forms of communication [printed with permission from the artist] (Holbrook 2004)

In his book, Constant Touch: A Global History of the Mobile Phone, Jon Agar reflects on the progression from the first wireless telecommunications devices developed in the 1840s to car phones to the proliferation of mobile phones to 1.52 billion subscribers globally in 2004 (cellular.co.za 2004) to two billion in 2005 (Cellular-news.com 2006). This transformation from what he calls technology of the home to something carried everywhere is rooted in the evolution of its development in both the United States and Europe (Agar 2003). The movement of mobile phones is not unilateral from rich countries, where they are designed, to poor countries, where I am particularly interested in their use for health. Mobile phone components and even manufactured phones originate in countries such as Chile, the Congo, Russia, Taiwan, Korea and China and then are redeployed to developed and developing countries alike where they are purchased (Agar 2003). Increasingly, through foreign donations and commercial ventures, used mobile phones from developed countries are being refurbished and sent to developing countries. Consumers now reside in households in over 90 percent of the world's nations and are able to reach others and to be contacted irrespective of their geographic location (ITU 2002). Mobile phones reduce the geographic binds that kept people at home in the age of fixed-line telephone systems. For consumers the purpose of acquiring the technology and its use vary across geographic locations, socioeconomic status, cultural norms and practices, profession, and gender. Implications of acquisition and use form the basis of other historical reviews and empirical studies that have

documented broader aspects of mobile phone use and societal trends mostly in developed countries, but more so in developing countries.

In a report prepared at the University of Surrey by a Vodafone-sponsored scholar, Dr. Amparo Lasen uses the historical evolutionary uses of fixed-line telephones as a platform for understanding the history-in-the-making of mobile phones in society today. The purpose of this report was to explore the relationship between the marketing and uptake, the evolution of uses, and the perceived benefits and fears within the general public related to the two technologies (Lasen 2001). This report, prepared for the mobile phone industry, provides useful insight into the domestication of the two technologies. In similar fashion to Jon Agar's historical analysis of mobile phones, Lasen prefaces his documentation of history of the fixed-line telephone with the introduction of the telegraph as the first example of direct communication over electric wire. He argues that when the Electric Speaking Telephone was first introduced by Alexander Graham Bell in 1876 it took an extended period of time to find a common use for the device because it did not have a perceived "clear and agreed purpose" (Lasen 2001, p. 2).

In the original marketing materials for fixed-line telephones in the late 1800s, the target audience was businessmen. The message was that fixed-line telephones were a practical time-saving communication tool. It was not marketed for mass consumption unlike mobile phones in the late 1990s to the present day (Lasen 2001). Business-related outcomes of fixed-line telephone use included the decentralization of the workplace and household management, which Lasen contends ultimately led to the development of corporations and large organizations (Lasen 2001). It also created a new link between work and home. In countries with limited access to telecommunications prior to mobile phones a similar decentralization process would be expected to evolve over a period of time. In the context of my research, it may involve the decentralization of health service administration and delivery as well as household management of health and well-being. Unlike the fixed-line telephone, the mobile phone is not location-bound, enabling direct contact between individuals irrespective of locality.

The business-centric focus of the initial producers of fixed-line telephones limited the perceived uses. When fixed-line telephones were first introduced, Lasen argues that social purposes were viewed as an “inappropriate use” of the technology (Lasen 2001), which he believes was overcome by society’s imposition of its own uses. The extended use of fixed-line telephones to social purposes was largely undertaken by women to overcome isolation and distance, particularly in rural areas in the United States (Lasen 2001). This shift from a business tool to a social device led to the mass consumption of fixed-line telephones. Similarly, the first mobile phone systems were available in the 1940s in the form of car phones (Agar 2003). In 1976, there were 44,000 people with mobile phones in the United States (Lasen 2001). The mass market did not develop for this technology until four decades later in 1983 (Lasen 2001), and even then it was not until the late 1990s that the general public began to escalate its consumption of mobile phones beginning in developed countries among affluent businessmen and then throughout the world among a broader range of users.

Technology developers, as indicated above, are not generally conscious of the ways in which their products can be used and in many cases are already being used by the general public let alone within the health sector. Health professionals and other members of society are often unaware of the ways in which technology can be applied as is or modified to support the work that they do. Many new technologies are simply applied in a contingent and unplanned way as they become available. As part of his concluding remarks Lasen summarizes this point. “[An] important teaching from the history of landline telephones is the power of users to impose their purposes, even in a constraining context, and how neglected and marginal users find successful uses, unknown and dismissed before by the experts” (Lasen 2001, p.27). According to Judy Wajcman, for those familiar with the preceding technology the adoption process is generally faster, however, there is also less inclination to identify alternative uses (Wajcman 1995).

Along the same lines, questions similar to those posed by Massiamano Bucchi throughout Science in Society: An Introduction to Social Studies of Science, ought to be considered: *How much of the utilisation pattern of a new technology is dependent on culture? How*

much is universal? What are the interdependency factors in relation to the past experience of the individual? (Bucchi 2004). In settings where fixed-line telephones were less common, as in the case of Bangladesh, my observation is that individual acquisition of mobile phones has been slower, and utilization began with community phones before shifting towards individual ownership.

Because the two technologies are in use at the present-time, it is important to observe how mobile phones influence the use of fixed-line telephones (Haddon 2004), and in the case of Egypt how rapidly increasing access to fixed-line telephones is influencing the use of mobile phones. In this regard, Leslie Haddon posits the following questions which I have paraphrased: *Are mobile phones a substitute, a complement, or do they serve an additional purpose to fixed-line telephones?* (Haddon 2004, p. 145) Related to this, particularly in the case of developing countries, is the question of the differential experience between those who previously had access to fixed-line telephones and those who did not, keeping in mind that, users often obtain mobile phones for one purpose and then expand their usage to other areas (Geser 2003; Haddon 2004; Ling 2004; Donner 2005c).

Mobile phones in society

Since I began my research on health-related uses of mobile phones a newly emerging body of empirical studies and literature has been compiled, documented, commentated, and presented primarily by European sociologists. Called by some, the *Sociology of Mobile Phones*, the overall framework traces the origins of technology and looks specifically at its impact on social relationships and interactions: familial relationships, professional life, and the newly achieved status and mobility in having a mobile phone (Bautsch et al. 2001; Geser 2003). This collection of literature discerns spatial, temporal, social, professional and other relationships and experiences resulting from increasing access to and use of mobile phones (Geser 2003). Besides empirical studies, a number of literature reviews and review publications have also explored the use of mobile phones within society for a broad range of purposes. These include, but are not limited to, the

research of Hans Geser (2003) and Leslie Haddon (2004), whose respective work will be introduced later in this section.

Within this collection of literature are two key empirical studies that I have found particularly relevant to my research. The first is the work of Rich Ling, a sociologist who has researched mobile phones in Norway and elsewhere for the last decade. Ling's research has its foundation in an empirical study which he conducted that focused on the mobile phone utilization patterns of families. The study conducted in September 1998 generated quantitative data from 1001 telephone interviews with parents of teens that were complemented by qualitative interviews with 12 families in Norway (Ling 1999b). The study focus was to explore the domestication of mobile phones among family members. In a subsequent study to explore the social meaning of mobile phones among teens a complementary phone survey was conducted with 2007 interviews of young people aged 13 to 20 between October and December 1998 (Ling 1999b). From this Ling conducted comparative analyses documenting the role of the mobile phone in relation to changes in parent-child relations, among girls and boys between the ages of 13 and 20, and within society at large (Ling 1999b).

The second and perhaps some of the most relevant work in relation to the use of mobile phones in a developing country context has been that of Jonathan Donner, who recently completed the Postdoctoral Research Fellows Program at The Earth Institute at Columbia University. His research has focused on the use of mobile phones in Rwanda. A survey was initially conducted in Kigali, the capitol of Rwanda, in December 2003 that focused on the use of mobile phone by microentrepreneurs. It included 277 completed interviews that provided call logs detailing information regarding 2700 discrete mobile phone calls that generated data on both business as well as social communication (Donner 2005c). The results of this study focus on the cross-section between the role of improved telecommunications in economic development as well as the role of mobile phones in society.

The most widely documented benefit derivable from mobile phones is the capacity to be in motion and communicate at the same time. According to Rich Ling, in many ways, the mobile phone completed the revolution towards mobility that began with the invention of the automobile (Ling 2004). The automobile has increased mobility over land between geographic locations, while the mobile phone has enabled communication while in motion. “The mobile phone becomes a kind of place where its owner can be found” (Lasen 2001, p. 34). This is of particular relevance to the coordination and organization of activity.

Changes in coordination have mostly been documented in terms of social and family-related activities, but can also be extended to the exploration of professional uses namely among health professionals. Ling refers to this change as a movement towards “micro-coordination” and management. Micro-coordination refers to the instantaneous access and capacity to redirect action and maintain flexible schedules (Ling 2004). In both social and professional settings this capacity can facilitate mid-course adjustments (Haddon 2004). Mobile phones are used to modify activities often-times planned in advance using fixed-line telephones (Ling 2004). This combined use of telecommunications technologies maximizes the cost and benefits of both technologies.

User profiles in mobile phone studies show higher uptake particularly among male entrepreneurs, free-lance workers, and transport workers (Roos 1993). The study by Rich Ling showed similar trends to those presented by Lasen in the context of fixed-line telephones among users, predominantly “established” men with a higher incomes and full-time jobs (Ling 1999a). Such trends in distribution by gender are changing in some contexts. Among 13- to 20-year-olds in Norway, the population of mobile phone users began with a majority of male users in 1997 with the numbers of male and female users growing closer in 1999 followed by a majority of female users in 2001 (Ling 2004). In his analysis, Donner observed that similarly, mobile phone distribution in Rwanda began with businesspeople that acquire the technology for work purposes and then extend uses to social purposes (Donner 2005c). He also observed that later adopters use the technology more for personal purposes than for business (Donner 2005c).

Mobile phones have influenced a change in personal interaction that is independent of physical location and distance between the initiator and receiver of information (Roos 1993). Throughout the supporting literature there is reflection on the positive as well as the negative aspects of this “permanent availability.” Hans Geser provides the following illustrations to reflect some of the societal changes inspired by mobile phones in his review, Towards a Sociological Theory of the Mobile Phone.

Cell phones can be instrumentalized for preserving diffuse, pervasive roles which demand that the incumbent is available almost all the time, because such encompassing availability can be upheld even when individuals are highly mobile and involved in other social or private activities.

Thus, mothers can use mobile phones as “umbilical cords” to their children, so that they are in contact with them the whole day even when they are at work or on travel.

And traditional family doctors can be available to their patients whenever needed, even if he/she is at a dinner party or some other private location.

Similarly, managers can preserve a traditional patriarchal leadership role which demands their availability around the clock. They can thus inhibit processes of organizational differentiation by remaining remain themselves “on duty” all the time instead of delegating responsibility to subordinates. (Geser 2003, p. 14)

On the positive side, there is the utility of mobile phones in facilitating work and social interactions, including those of medical doctors. Although many cite the increased efficiency that comes with mobile phone use, there are no empirical studies which have quantified time saved and/or how saved time is otherwise allocated. That is, apart from the analysis that explored the time to car crash for Emergency Medical Services in the United States (Horan and Schooley 2002). When asked about usages, one study showed that individuals tended to group their uses into “normal” or everyday use; emergencies and “unexpected situations;” and social use (Roos 1993).

In terms of negative effects, mobile phones are considered by many to be disruptive to meetings as well as to others when they are used in public settings (Plant 2000). Other

documented negative sociological effects include increased crime (Agar 2003) as well as harassment (Agar 2003; Ling 2004). There are also emerging restrictions in terms of where and how one can use a mobile phone, including hospitals and classrooms geared towards minimizing such negative effects (Plant 2000; Bautsch et al. 2001). As presented in the introduction ongoing guidance is being provided to minimize potential negative effects of the use of mobile phones while driving.

In his conclusion, Geser lists opportunities achievable with increased access to and use of mobile phones. These can be summarised as follows:

- Enlarging the number of potential communication partners (individuals or organizations) available at any moment irrespective of movement and changing spatial locations
- Distancing oneself from current interaction fields by directing attention to remote partners and reducing reliance on one's inner judgment by asking others for advice
- Expanding the peripheral layers of social relationships by cultivating weak ties to partners one is not ready to meet
- Shielding oneself from new and unpredictable contacts by signalling unavailability
- Combining and switching between divergent roles which would otherwise necessitate one's presence at different places at the same time or demand involvement at any time of day (care-giving, "stand-by," emergencies)
- Living more "spontaneously": without strictly scheduled agendas, because meeting hours can easily be rearranged (Geser 2003, p. 41)

Social and professional networks are changing through the use of mobile phones. In his book, Information and Communication Technologies in Everyday Life: A Concise Introduction and Research Guide, Leslie Haddon argues that wider social change sets the precondition for how mobile phones are domesticated (Haddon 2004). It is my observation that the opposite is also true. Mobile phones often exacerbate or create aspects of social change. Related to the relationship between mobile phones and social change, Lasen differentiates the terms "social role" from "social impact" (Lasen 2001). He recognizes the technological object as a part what he calls the "material culture of a

society” (Lasen 2001, p. 16) or what I interpret as a broader system, network, and context of people, objects, and interactions. The complex nature of how a technological object is integrated into people’s lives makes it difficult to attribute a direct cause and effect to and by social change. This is also true in the study of the “role of the mobile phone in health” as opposed to the study of the “health impact of mobile phones.” Mobile phones as they are used by health professionals and lay users support a broad range of aspects of health, including access to services and coordination. In lieu of identifying their health impact, the role that they play can highlight key strategic areas in which their use can be maximized.

Domestication of mobile phones

The health-related uses of mobile phones vary according to location, method of introduction into the society, and identity of users. The domestication of technology looks at the practical and symbolic meaning derived from technology at the individual level (Lie and Sørensen 1996). *How does domestic culture change as a result of the introduction of a particular technology and how do domestic environments result in a reconfiguring or redesign of technology?* In the case of Lie and Sørensen, the term “domestic” or the act of “domesticating” does not necessarily focus on the home, but how a technology is naturalized into the daily lives of individual and groups of users (Lie and Sørensen 1996). Aspects of this process are influenced by the technology itself while others are influenced by the needs as well as socio-cultural characteristics of users.

Rich Ling through his research on mobile phones describes domestication of technology as a compromise between technical and social determinism (Ling 2004). This theoretical approach to the exploration of technology acknowledges that a technological object defines and is at the same time defined by both creators and users alike (Ling 2004). As such adoption of technology is an on-going process and usage patterns change over time, depending on an individual’s circumstances and needs (Haddon 2004).

“Technology-in-use” as highlighted by Lie and Sørensen addresses the micro-level relations between people, networks, and technology and looks at how a society domesticates an object (Lie and Sørensen 1996). The domestication is a product of all of these factors as they relate to each other. The users make active efforts to shape their lives through creative manipulation of artefacts, symbols and social systems in relation to their practical needs and competencies (Lie and Sørensen 1996). Thus, it is meaningful- even necessary- to study the detailed process of domestication of technology, a process through which artefacts are defined and placed in a way which may imply redefinitions of one’s own routines and practices (Lie and Sørensen 1996). In this process the individual consumer becomes an innovator of sorts as s/he manipulates the technology to serve a specific purpose.

In the case of mobile phones, it is crucial to maintain that users are not simply acted upon by technology, but that they are active participants in the defining of technology. Also it must be acknowledged that these actions are complex and varied and are the product of the system through which technology is consumed (Lie and Sørensen 1996). Domestication applies in the context of my study to individuals that interface with mobile phones for the purpose of health promotion and those who interface with the technology for other purposes, but where health outcomes are apparent. Health facilities and personnel develop a professional culture based on the acquisition of the technology and in response to others who are using mobile phones to interact with them. It is the everyday life integration, the social space that is overseen and managed at the individual level that becomes the unit of observation. By observing individual experiences, patterns and themes can be used to identify collective meaning and understanding. This is in direct contrast to the global, which looks at entire systems at work across national borders.

Ensuring safety and security

Increasingly mobile phones are carried and domesticated as part of an individual’s desire to preserve and maintain safety and security (Agar 2003), becoming a part of the social

image of the technology (Agar 2003; Ling 2004). Safety and security are two aspects of mobile phone use that are gaining increased attention with growing numbers of mobile phone users. They have become a lifeline for many and are carried “just in case” of emergency (Ling 2004). Special studies are currently underway regarding their use in natural disasters such as earthquakes and floods as well as in “extraordinary situations” such as terrorist attacks (Ling 2004).

Based on a broad range of studies mostly conducted in Europe, United States, and Australia mobile phone subscribers have reported the utility of the technology in emergency situations (Chapman and Schofield 1998; Horan and Schooley 2002; Ling 2004). The two aspects of emergency support that are directly related to health are: 1) mobilising ambulances to the scene of motor vehicle accidents and 2) addressing chronic medical conditions particularly among the elderly. In the case of accidents the respondents of empirical studies have reportedly been able to describe an emergency situation for which either they or someone that they knew used a mobile phone to mobilize support (Ling 2004). This was illustrated by the analysis presented earlier in this chapter comparing increased calls to Emergency Medical Services in the United States and the reduced time to scene of a crash of ambulances (Horan and Schooley 2002). With respect to the management of chronic health conditions, mobile phones are used to coordinate routine health care as well as emergency care enabling increased mobility particularly among individuals with disabilities (Ling 2004). As documented by a number of mobile phone researchers, the elderly are more able to communicate instantaneously with their children as well as health care professionals for guidance on their health than they were prior to having a mobile phone (Agar 2003; Haddon 2004; Ling 2004).

Parent-child communications

Another key aspect of the domestication of mobile phones that has been researched and documented is their role in parent-child relations. In this area while Ling has used his empirical study in Norway to explore the micro-level interactions and social change

within a particular society (Ling 2004), Leslie Haddon has focused on the macro level of mobile phone use (Haddon 2004). Using the home context as a point of reference, Haddon describes the potential role of partners and parents as “gatekeepers” to the domestication process, controlling how mobile phones are distributed to family members and how they are to be used (Haddon 2004). This is often done as a result of cost constraints, particularly for middle and lower class households as reported in a study in the United Kingdom (Haddon 2004). The most prominent documentation of social interaction resulting from mobile phone use is in parent-child relations. For my research, this is of particular relevance with respect to the exploration of the domestication of mobile phones for health within domestic settings as household members coordinate their access to health services and information.

Communication patterns are changing particularly with respect to the ways in which young people have integrated the technology into their social lives. Increasingly adolescents are developing with mobile phones as part of their daily social experience (Haddon 2004). They are able to engage in more individualistic communication not having to share a fixed-line telephone with other members of the household. This increases their privacy by decreasing the capacity for parents to monitor their communication. Parents, however, are more able to monitor their children irrespective of geographic location particularly as they are spending more time outside of the home (Ling 2004). In some cases adolescents find the need to evade the constant capacity for parents to be in contact with them (Haddon 2004). The use of mobile phones by family members is two-fold. It focuses on coordination of daily activities as well as the preservation of peace of mind through the monitoring of safety.

The study of how mobile phones are integrated into the daily lives of individuals throughout the world is an ever-growing body of literature. There is a broad range of documentation, from editorials that reflect an individual’s opinion about how mobile phones are influencing social change to empirical studies that explore changes in parent-child relations that is evolving as a result of the domestication of the technology.

Gender and technology

Historically, technology has been viewed as a masculine domain. As presented earlier in this chapter, mobile phones in many studies were initially acquired by men for professional purposes. Men are traditionally responsible for making and manipulating technology (Ling 1999b). Feminist research has evidenced that power and powerlessness are reflected by the design and mastery of technology (Wajcman 1995; Lie and Sørensen 1996). “Technology is associated with *activity* and *mobility* versus the static. It is something in progress, may be pushing or aggressive. Moreover it is *hard* and *vigorous* in contrast to the soft and compliant. Technology also alludes to *knowledge*. The insider’s knowledge leads to *mastery* and *control*” (Lie and Sørensen 1996, p. 216). Along with design and manipulation of technology, wage work is also affiliated more closely with men whereby the likelihood is stronger that they will be engaged in using a range of technologies to more efficiently accomplish work-related tasks (Wajcman 1995).

More recent in its development, feminist theories of technology explore the domestication process as it specifically relates to gender. Judy Wajcman has constructed a framework that explores the influence of male versus female interests in the design of technology (Wajcman 1995). Unfortunately there is very little documentation on the involvement of women in technology development and many of the related fields of engineering remain dominated by men (Wajcman 1995). Of specific relevance in Wajcman’s paper on feminist theories is an example from a study of the American history of the telephone, in which there was an initial disparity between how consumers used the telephone and how the industry of men who developed it thought it should be used. Along similar lines Ling uses the following quotation, attributed to Fischer and Martin, to describe this.

[The traditional] telephone, while originally seen as a technology to be used by men, has become more feminine. As the mystique was removed from the technology, and it became less and less expensive to use, women have incorporated it into their role as the hub of various social networks. [Fischer 1992; Martin 1991 in (Ling 1999b, p. 18)].

Haddon also describes the role of women as the link of households to the social world who are generally reluctant to embrace new technology until they perceive it as a tool for domestic management (Haddon 2004). As working mothers increasingly acquire mobile phones, they can remotely parent when they are at work or can respond to work when they are engaged in parenting activities with their children (Geser 2003).

It is important to acknowledge the masculinities and femininities in the use of technology. In Ling's study, he reported that among youth in Norway, boys tend to view mobile phones as a "visual sign of independence and economic wherewithal", while girls find that "the device is useful and convenient" (Ling 1999b, p. 17). Specific attention in the analysis will be to look at how women in Minia, in light of cultural aspects of gender in Egypt, self identify with mobile phones particularly in light of what Wajcman describes as the contribution of the telephone to make women who are primarily homebound feel less isolated (Wajcman 1995).

The mobile phone for health network

In exploring the health-related uses of mobile phones, it is critical to begin with a basic understanding of potential network elements and interactions. Used throughout studies in ICT for development, actor network theory's (ANT) basic premise is that technology is not developed in a vacuum; rather its success or failure is influenced by a series of actors that attempt to form networks within societies that are either durable or unstable (Law and Hassard 1999). It acknowledges that development and utilization processes are both technical and non-technical, and that they involve humans and objects. Unlike "technological determinism" which only looks at the impact of technology once it is released for utilization and domestication by users (Bucchi 2004), ANT considers the influence that the design process asserts on how users ultimately are able to use a particular technology.

This theory critically addresses the various activity aspects of *technoscience*, which views science and technology as inseparable. An outgrowth of more traditional work in science

and technology studies, *technoscience*, emphasizes the evolution of technology from pre-existing technology in collaboration with knowledge of science and society (Latour 1999; Bucchi 2004). In relation to globalization, *technoscience* is transportable when social and technical aspects go with it making a *technoscience* object such as a mobile phone global (Law and Mol 2001). For example, networks of technology developers took what was known about fixed-line telephones, two-way radios, handheld computers, and other predecessors in conjunction with newly emerging wireless digital networking to eventually create a prototype for mobile phones. These networks lend themselves to a state of greater stability in which a common language is developed among various actors, meaning is derived and individual and collective objectives are achieved (Ryder 1999).

Drawing on the work of Bruno Latour and John Law, much of the literature produced on ANT provides theoretical explanations for the role of society on influencing technology and vice versa. This mutual influence is often referred to as *co-production*. Co-production specifies that the use of technology is determined by the structure of technology in simultaneous combination with individual and collective behaviours in relation to the technology. The resulting outcome or utilization pattern is said to be co-produced. The complex relationships, interactions, and networks of the past provide the foundation for the creation of other networks in the present and future by either, copying and reinforcing them or questioning them and providing alternatives (Law and Singleton 2000).

ANT maps out all of the pertinent actors in light of a particular technology and does not particularly make distinctions between micro and macro, but views all action as local and relevant and then proceeds to summarize the interactions between these actors (Latour 1999; Law and Hassard 1999). Mobile phone developers and users in rural communities in poor countries are two extremes within the mobile phone and global health network that enable a wide variety of health outcomes. Figure 2.3 illustrates some of the key stakeholders involved in the mobile phone and health network. For each member of the various network spheres there are internal and external interactions. Decisions made within one sphere have potential impacts on one or more of the other spheres. Depending

on the technology in question the various actors may change and their roles fluctuate on an active-passive scale, resulting in a series of actions, reactions, and relationships (Michael 2000).

Sphere	Actors
Industry (international, regional, district, local)	Investors, board of directors, management, strategists, researchers, developers, sales, marketing, trainers, distributors, installation specialists
National Government	Ministries of Health, Trade, Communications, Transport, Education, Internal affairs, Foreign affairs
Local communities	Individual technology users in urban and rural communities, health care works, employees of companies using ICTs, Non-governmental Organizations
Hardware and software applications	Mobile phones, Accessories, Computers, Internet, Global Positioning Systems, etc.

Figure 2.3: Actors in the mobile phone and health network

An example of such a mapping is described by Duncombe et. al. using micro-enterprise initiatives in Botswana, where the researchers mapped out the existing communications patterns in order to inform integration of information and communication technologies. They discovered that communications fell into three main categories: social networks (dominant), institutional (governments and private institutions), and business networks based on contracts (limited with strong social component) (Duncombe and Heeks 2002). One of the barriers to integration cited by the authors is the low value that is placed on decision-making related data. This very much supports Michael Callon’s assertion that not only is it critical to understand how networks that produce scientific information function, but how the content contained therein is presented and digested (Callon 1995). Systematic deconstruction of each element in the mobile phone and health network enables a more tangible and practical foundation for evaluating health impact. The value of connecting to a network depends on the number of other people connected to it. The larger the network, the greater the benefit of being associated to it (Hamill 2000).

Industry has played and continues to play a key role in the development and enhancement of mobile phones. It is the vehicle through which mobile phones are presented to the general public with the objective of increasing consumption of objects as well as services. Once industry launches its products and services in a new country, it is subject to national

regulatory systems and government structures. In Egypt, the introduction of the mobile phone industry resulted in the semi-privatization of the telecommunications utility and increased fixed-line telephone installation due to competition. In other countries the effect has been the opposite (ITU 2003). Recommendations have been made to minimize inequalities in inputs to the development of technology and communication about technology through increased collaboration with potential users in poor countries for insight into innovation (Juma et al. 2001). Individual technology users are subject to the information they receive regarding mobile phones through work colleagues, neighbours, family members and the media as well as their own experiences interfacing with the technology.

The concept of the configured user

Objects in this network of relationships are not devoid of influence. The structure of the hardware and software applications also plays an active role in the network and helps to define the parameters of use as well as penetration within segments of society at large. Steve Woolgar's conceptualization of the "configured user" looks specifically at three modes of configuration: 1) configuration by designers, 2) configuration by users, and 3) configuration by environmental factors. The relationships between the various actors, systems and objects are fluid. In this paradigm, members of the designer network may also be part of the user network and vice versa (Woolgar 1990). "[A] user's understanding of how mobile telephony works is not only a matter of learning about its multiple technical components (hardware, software, and network services), but also of understanding service provider policies and integrating information garnered from sales and marketing, and billing communications" (Palen et al. 2000, p. 1). In practice I have found it difficult to distinguish between the various groupings of configuration in relation to mobile phones as what one might consider configuration by design may be considered by another configuration by the user. What the construct does is provide a paradigm with which to attempt to simplify complex interactions that relate to design, construction, and use.

Configuration by designers is dependent on the objectives and characteristics of the designers and the environment in which they are designing. As acknowledged by many science and technology studies, most designs are evolutionary with elements borrowed from previous technologies (Wajcman 1995; Latour 1999; Bucchi 2004). In the case of mobile phones, as discussed earlier, this would include the integration of “caller identification,” similar dialling process, handset design, ring signals, and voicemail from the telephone and address and date book capabilities from PDAs. It is also dependent on how participatory the development process is structured to take into consideration the needs and wants of the “representative user.” The goal is to minimize the need to adapt the product to different user bases to create what Law and Mol call “mutable mobiles,” objects that are the same in two places (Law and Mol 2001).

With respect to mobile phones that cater to the needs of health professionals, the mobile phone industry would need to make the strategic decision that such an adaptation and/or development of relevant software applications would be a profitable investment. Since I began my research in 2001, several mobile phone companies have taken such a decision. One example is Motorola, which in collaboration with Partners Telemedicine has developed mobile phones that use remote sensors affixed to a patch on a patient that transmit blood pressure readings and other diagnostic signs for remote monitoring of patients by physicians. Currently touted as “everyday devices” by technologists, mobile phones are being adapted to health care because they are familiar to patients and have the potential to reduce health care costs (Textually.org 2004).

Configuration by users, I would argue, does not tend to acknowledge the power of the user to manipulate technology insofar as it focuses on the user being subjected to the limitations of a particular design. Both aspects are relevant, particularly in looking at the various types of users. “Designers and promoters of technology cannot completely predict or control its final uses. There are always unintended consequences and unanticipated possibilities” (Wajcman 1995, p. 199). As a result of caller identification and voicemail capabilities, individuals can elect to ignore unwanted incoming calls that they believe intrude on their peace and privacy (Haddon 2004). Two primary departures

from the fixed-line telephone are the SMS text messaging feature and the capacity to use the technology as a signalling device.

The primary departure of mobile phone technology, apart from mobility, from fixed-line telephones is the capacity for limited text transfers. Designers who initially integrated Short Message Service (SMS) for transfer of stock market information have influenced the end use of mobile phones by limiting the transfer of data to 160 characters (Agar 2003). In his historical review Lasen, compares this configuration of uses to modern day utilization of SMS by adolescents (Lasen 2001). The use by adolescents for social purposes is a configuration towards objectives different from those of mobile phone designers as businessmen, not adolescents, were the initial target consumer. Text messaging is also an example of a function that is generally disregarded at first, but then over time as people gain confidence and capacity to receive and send messages becomes more widely utilized (Ling 2004).

The other departure of mobile phones from fixed-line telephones is their capacity to be used as a signaling device. A paper that was written based on a complementary study to the field study conducted by Donner in Rwanda that was described earlier, explores aspects of the technology as a signaling device through the use of “missed calls,” by small business owners and university students. This study component involved in-depth interviews with 15 mobile phone users, primarily microentrepreneurs (13) most of whom were men (10). The findings revealed a trend in configured use comparable to other countries in Africa that enables contact without incurring charges (Donner 2005b), which he terms, “beeping” and others, including myself, refer to as giving a “missed call.” This configured use enables an individual to signal with a mobile phone to another individual to call back, articulate a greeting, or communicate a pre-determined message. Donner provides insight into how Rwandans and others in sub-Saharan Africa make use of this signaling capability particularly in its utility as a free communication method (Donner 2005b).

Environmental factors, including cost structures and pricing plans contribute to configuring user behaviours in direct relation to the technology as well as interactions with other users. In Lynne Hamill's economic analysis of technology adoption at the household and individual level, she explores questions related to choices made in the adoption process, including the speed and patterns in which a new technology will be adopted across a particular society (Hamill 2000). She describes influential factors as design, function, and form but focuses specific attention on how limited money and time are allocated between competing desires and demands (Hamill 2000). How much a household can afford is dependent on its income and the prices of the goods it desires. Given a limited budget, of money or time, it has to make choices. If it buys A, then it can not afford B (Hamill 2000). Not only does cost influence usage, but so do pricing configurations. Related to this configuration of use, Donner describes the influence that "calling party pays" systems have in encouraging short outgoing calls and long incoming call (Donner 2005b).

Individuals ration the number and length of calls as well as adjust their use of the technology to the times in which it is cheapest to make phone calls (Haddon 2004). Increasingly, other regulations including restrictions on the use of mobile phones without a hands-free set while driving and locations that use scrambling devices to create "no service" zones are also serving to configure how users use their mobile phones. Considering the various elements and interactions within the design and domestication process provides a systematic approach to understanding how mobile phones might be applied to health within a particular population.

Risk perceptions of mobile phone use

While exploring the potential health benefits of mobile phones the topic of health risks becomes inevitable. In the broader discussion regarding mobile phones and health the issue of safe utilization and harmful radiation are oftentimes, the only aspects of the relationship between the two that is presented. This is not new. In his review of the period between 1880 and 1920, Lasen documents the following health risk perceptions

that were raised by medical professionals, including those published in the *British Medical Journal*, surrounding the early use of the fixed-line telephone. The key concerns were: aural overpressure, nervous excitability, insanity, addiction, and contagion of infectious diseases (Lasen 2001). He likens these to a current list of health concerns surrounding the use of mobile phones, which are: stress and work overpressure, nervous excitability, insanity, addiction, and cancer (Lasen 2001). The main difference is the substitution of infectious disease concerns for concerns over cancer. Unlike the focus on risk perceptions, there was no historical reflection documented on the health benefits of fixed-line telephones. Lasen likens the historical and current gap in interest by social scientists to the speed at which the technologies have become a part of everyday life and are almost taken for granted (Lasen 2001).

In Egypt, there is an on-going debate within the media and public on the risk perceptions surrounding mobile phones. *Are mobile phones and base stations harmful to people's health? How does interaction with mobile phones change as a result of the media reports that the phones are or are not emitting harmful radiation?* In the midst of this debate are vested interests. Mobile phone companies want to sell their products and so they try to ensure that the general public feels that they are not at risk from the devices. Public relations campaigns work with the media to ensure that negative reports are countered with positive reports.

This follows a similar pattern as expressed in the literature of science and technology in the media, whereby controversial aspects especially risks from public health perspectives are of particular interest to society and therefore receive coverage. This focus on risk has been a central theme throughout public understanding of science texts (Wynne 1994; Irwin 1995; Lewenstein 1995). As such the concerns of potential audiences influence how a scientific topic is approached and presented (Lewenstein 1995). Mobile phones studies are often reported as inconclusive in one direction or another depending on the source of information. There, however, does not seem to have been an effect on uptake or usage based on such evidence or lack thereof. The example below illustrates this

through a critique of a story in the Daily Mail making an association between mobile phone and kidney damage, then deeming the research conducted as inconclusive.

[a] story that could be found in the *Daily Mail*, a British middlebrow, mass-circulation newspaper, in December 1999, was typical. Under the headline ‘Now mobile phones give you kidney damage,’ the reader was told: ‘Scientists say exposure to the phones’ low level radiation causes red blood cells to leak haemoglobin. The build up of haemoglobin, which carries oxygen around the body, can lead to heart disease and kidney stones.’ The reader would already have known of other stories suggesting links between mobile phone use and brain cancer, premature ageing, diseases such as Alzheimer’s and Parkinson’s, multiple sclerosis and chronic headaches. ...

Chilling stuff. And although there was the usual disparity between headlines... ‘More work is needed to investigate some results which seem to indicate that electromagnetic waves in the radio spectrum may interfere with processes within the kidney,’ the economic importance of the mobile industry forced governmental organizations to act. (Agar 2003, pp. 122-124)

The British government in 1999 (after managing the public fallout surrounding BSE) commissioned an independent expert study of mobile phones, which reviewed public understanding of the harmful effects of mobile phones as well as the biological effects of mobile phone. The product of this research, The Stewart Report, provides a “balanced” and non-committal approach to presenting the findings of the research. The same has been done by WHO and other agencies for fear of putting their pronouncement on safety or harm in case future research proves otherwise (Agar 2003). Science and technology information and research then becomes a political and corporate tool, which creates complexities for those attempting to tease out how the public absorbs, understands, and applies scientific information (Wynne 1994; Irwin 1995). Jon Agar, in his review of the history of the mobile phone poses the question: *At what point in time or after how many years, will the public be satisfied that enough exposure to mobile phones has been had to end the debate in one direction or the other?* (Agar 2003, p. 126).

It is worth noting, that mobile phone companies themselves are concerned about the harm caused by radiation from mobile phones as they have been patenting devices to minimize radiation and promoting the use of hands- free devices (Bautsch et al. 2001). In 2003 Vodafone commissioned a study in 14 countries, including Egypt, to research health risk perception from exposure to radiation from mobile phones and masts (Ellaithy 2004). In Egypt, 1,142 face to face interviews were conducted in major cities of which 55 percent were mobile phone users. Unlike in other countries, the issue of mobile phones and masts ranked in the top three prompted health concerns, preceded by air pollution and traffic congestion (Ellaithy 2004). In spite of reportedly high risk perception 68 percent of mobile phone users said that they felt the benefits outweighed the risks (Ellaithy 2004). In 2000 and 2001, the Egyptian government instituted protocols for regulating and monitoring radio frequency fields through collaboration between the Ministry of Communication and Information Technology, Ministry of Environmental Affairs, and the MOH. Such collaboration is a positive precedent for future potential programs which aim to proactively integrate mobile phones within the health sector.

The media and mobile phone service providers are key actors in the broader network of mobile phones in society, shaping socio-cultural understanding and actions beyond the initial creators of the technology (Callon 1995). As a commercial product, mobile phones are the subject of mass marketing research. As a result, multi-national mobile phone companies have become increasingly savvy at pitching their messages to targeted audiences with the goal of increasing their subscribers and the services that they purchase. The public understanding of mobile phones is hence influenced by information collected from the public, which is then used by the media to shape public opinion and discussions regarding mobile phones.

Many systematic studies of science content in the mass media confirm that the public presentation of science rarely is shaped by “objective” scientific issues but instead presents images of science shaped by—and intended to shape—particular cultural contexts. (Lewenstein 1995, pp. 345-346)

This overall bombardment of information and persuasive messaging has had a strong impact on how mobile phones are acquired and utilized and has influenced the opinion of Egyptians which often mirrored what was being presented on television and in local newspapers. Although health as it relates to mobile phones was not strongly featured in the media that I collected and observed during my fieldwork apart from reflections on emergency response and the perceived risks from mobile phone use, much of what was said has implications for cultural aspects within the social determinants of health. Data collected from various media sources have been used throughout my Thesis to validate empirical data provided by interview respondents. This information will be triangulated with data collected in Egypt as well as relevant literature.

Conclusion: Literature Review

The scarcity of empirical studies exploring health-related uses of mobile phones in almost any context has influenced consideration of the literature sources reviewed. Mobile phones are unique among other technologies because they provide individuals with portable voice communication (particularly of value among illiterate individuals), quick and short text transfer, and signalling capabilities. The evaluation of the impact in time and money saved from the use of SMS by health facilities is a positive step towards peer reviewed literature on mobile phones and health. The historical evolution of fixed-line telephones and mobile phones as a business tool that becomes a mass consumption product for social purposes provides a clearer understanding for the rapid progression of this technology to an everyday device. Although, one might expect it to have the opposite effect, this rapid integration partially explains the minimal attention that has been paid by social scientists to their relevant social or health-related roles. As demonstrated through the use of domestication of technology, ANT, and the concept of the configured user, mobile phones do not move out of a central base into a passive society. Their uses are influenced by environmental factors, culture, gender, and the scientific information to which people are exposed. The following chapter presents methods used in Egypt to document changes in health services and domestic settings related to mobile phone use.

Chapter 3: Methodology

Culture, socioeconomic status, and social relationships are critical to understanding how people choose to integrate technology into their lives as well as to understanding how people perceive and approach health and illness. The broad bodies of information within ICT for Health and Development, empirical studies of mobile phones, and Science and Technology Studies (STS) consider the cultural, economic, and historical context that influence individuals and society at large to identify the ways in which people define and are defined by technology. As such relevant literature and theoretical frameworks were presented and discussed in the second chapter of this Thesis. In similar fashion *ethnomedicine* considers and integrates the study of culture with the study of health and illness. The cultural aspects of both technology use as well as health formed the basis for the methodological approach that I chose, namely *ethnography*. This chapter focuses on the methodological approach taken and methods used towards understanding the use of mobile phones for health in Minia, Egypt.

In Egypt, health and approaches to treatment are strongly influenced by socio-economic factors, culture, and whether one lives in an urban or rural setting. Hania Sholkhamy, an Egyptian medical anthropologist, conceptualizes health and ill health in an Upper Egyptian village, emphasizing the importance of ensuring that the study of social constructs and health are not viewed independently (Sholkamy 1998).

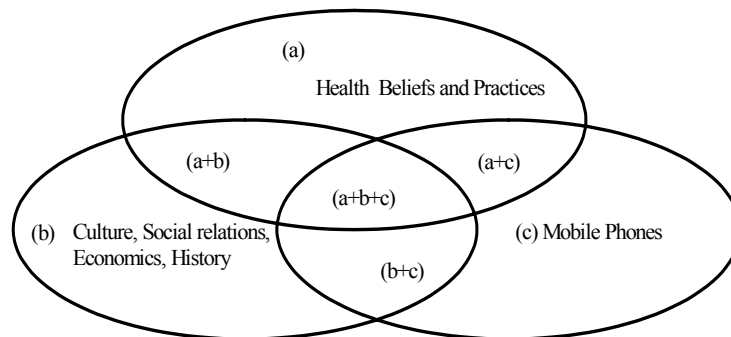


Figure 3.1: Key social constructs as they relate to the study of mobile phones for health

I have broadened this approach, as illustrated by the overlapping rings in Figure 3.1, to integrate health, culture and context, and mobile phones. In relation to ethnomedicine in Egypt, Sholkhamy provides the following arguments for why it is critical to ensure that the study of health takes culture and behaviours into consideration.

1. Health... is a major preoccupation which takes up a significant amount of time in the lives of peasant men and women.
2. Health is a major item of expenditure for many village households...
3. Health, disease, hygiene, and products of medical technologies are idioms in an often fractured but essential discourse between people in villages and the media, the public and private spheres, development agencies and other NGOs, and the state.
4. The conditions that favour health and the services to restore it are human and civil rights of which rural areas are being deprived...
5. The language and social relationships of health, ill-health, and of well-being are an integral, little understood, and rich part of the daily life, culture, and history of Upper Egypt. (Sholkamy 1998, p. 205)

Cultural beliefs, perceptions, and associated behaviours often have a logical flow that is based on the transfer of knowledge through channels that are trusted. Unfortunately, there are many assumptions that are made in the transfer of information about health practices that people should follow that do not take into consideration years and even centuries of tradition. In relation to the uptake of technology in Egypt, much has been contingent upon how the technology has been introduced into society as described in the Thesis introduction.

The issues raised by Sholkhamy, as well as many other medical anthropologists, reflects the sense that how an individual perceives a situation may have stronger influence than the scientific understanding and framework that defines it. The result of this in the context of public health is twofold: 1) a slow progression to the uptake of behaviours that are deemed to be beneficial to an individual's health and/or 2) a rejection of information or practices that could result in positive impact on an individual's health. This question is addressed throughout my Thesis in particular relation to the contextualization of mobile phones in Egypt, the theoretical frames that have evolved in STS, and related health beliefs and practices. The result is an *ethnography of health-related mobile*

phone use in Minia, Egypt based on a narrative description and analysis of perceived direct and indirect health benefits of the use of mobile phones in contrast to barriers to maximised use.

For me, the focus of my research has become increasingly centred on the approach to the study of technological movement and culture. Technology changes and its usages evolve quickly and studies aiming to purely attain population-wide generalizations are problematic. In this chapter, I present and provide relevant justification (strengths and limitations) and examples for approaches and methods used throughout the research process.

Ethnography

In the effort to explain the dynamics of the mobile phone, health professional, and lay person paradigm I used ethnography as a starting point to design a process that would enable me to examine the complex nature of interactions surrounding health-related mobile phone use. The result is a review of the meaning derived by individuals from the use of mobile phones in the context of their everyday lives and in particular relation to health. The introduction of a new technology into an individual's life is a process. People choose to buy them and then proceed to define when and how and why they will use them. Their utilization at first may be quite different than their utilization at one or more years after initial use. A central question then becomes: *What are the processes by which individuals determine their relationships with mobile phones with respect to health professionals and each other for health communication purposes?* The information needed to understand the process begins with identifying what motivates people to buy and use technology as well as what their experiences to date have been with using that technology in particular relation to health.

Ethnography is a study approach that allows an individual to become intimately familiar with a particular social system to understand why and how people think, act, and respond to a particular issue, life in general, or in this case an object. It enables the study of both

technology and health alike. For Martyn Hammersly and Paul Atkinson, as well as in relation to my own research the focus is on identifying cultural patterns.

... the value of ethnography as a social research method is founded upon the existence of such variations in cultural patterns across and within societies, and their significance for understanding social processes. Ethnography is the capacity that any social actor possesses for learning new cultures, and the objectivity to which this process gives rise. Even where he or she is researching a familiar group or setting, the participant observer is required to treat this as ‘anthropologically strange,’ in an effort to make explicit the presuppositions he or she takes for granted as a culture member. In this way it is hoped, the culture is turned into an object available for study. (Hammersley and Atkinson 1995, p. 9)

The methods used in ethnographic research have their roots in anthropology and often involve a researcher living in an unfamiliar environment, learning a new language, and attempting to gain insight into the insider’s or *emic* perspective. When I began my research, I had originally intended to go to Bangladesh which had a relatively sophisticated mobile phone network which covered over 90% of the populated area. I was planning to live there for several years, learn Bangla, and thoroughly become acculturated in the use of mobile phones for health. During a feasibility study I realized that qualitative research requires a high degree of fluency in the language and familiarity with the culture of the research setting (Green and Thorogood 2004). Gaining the *emic* perspective in Bangladesh would have proven incredibly challenging and for the purposes of a more practical public health application lengthy and in many ways untimely. Perhaps, I was not meant to become a *professional stranger* in the most extreme sense of Michael Agar’s book title, The Professional Stranger.

Ethnography was defined by Michael Agar in the 1980s as a social research style that emphasizes making sense of foreign worlds (Agar 1986). Fortunately, much has changed in the study of people and culture since the 1980s to the extent that ethnography is a mainstay of understanding organizational culture, familial relations, and a full range of health beliefs and perceptions by internal as well as external members of particular societies. Newly emerging *reflexive ethnographies* of both technology and health are

conducted and presented by individuals from within the society of study (Hammersley and Atkinson 1995). These include those of Hania Sholkhamy on health in Upper Egypt.

Today, particularly with the current nature of globalization (television, satellite dishes, migration, and foreign travel), exposure to aspects of people and cultures from other countries is becoming a part of everyday life. This along with the development of *autoethnography*, wherein reflexive ethnography is housed and emphasis is no longer on the study of “the other,” but on acknowledging our individual strengths and limitations with observing and investigating aspects of the society which we are studying (Patton 2002). In an autoethnographic study, a researcher must acknowledge his or her relationship to the subject and to the population of study as part of the research process. The study of technology benefits significantly from this shift as a traditional long-term anthropological study would generate information that potentially becomes obsolete with the introduction of a new technology before it is able to be used to inform enhanced health applications to conditions in the current environment.

Researchers who are from a particular group or geographic area of study tend to have improved access to potential study populations and are generally more familiar with the *emic* perspective. Also known as “insiders” such researchers understand how a society functions and the meaning that is derived from improved access to technology as in the case of mobile phones in Egypt. People tend to feel more comfortable sharing the truth, particularly on non-controversial subjects with insiders, and insiders are also more able to phrase questions to elicit the sorts of information they are interested in collecting (Hammersley and Atkinson 1995). One key challenge with being an insider, however, is the potential for insiders to have pre-disposed assumptions regarding what the research outcomes should or should not be. This potentially creates difficulties in maintaining an analytical distance throughout the research process (Green and Thorogood 2004). “Outsiders,” on the other hand, are thought to maintain greater objectivity regarding study results; however, their inability to fully engage as a member of a group could result in limited access to certain types of information.

Particularly with rapid ethnographic methods, the main advantage of being an insider is a condensed period of acclimation relative to the researcher's familiarity with either the subject or the population of interest. As an Egyptian- American I have been considered both an "insider" as well as an "outsider" to Egyptian society. I speak and understand Arabic, but have a foreign accent, which alerts people to the fact that I have lived most of my life outside of Egypt. Also I am originally from the northern part of the country where customs are slightly different, but I had spent one and a half years working in three governorates in Upper Egypt on a mixed methods (qualitative and quantitative) study from 1997-1998.

During data collection, I was perceived to be an insider by some and an outsider by others. As I walked through one of the study villages, many children kept saying "suyyah" (tourist) as they passed me. On the other hand, when I actually conducted the interviews myself most of the respondents were quite pleased at my Arabic in spite of my slightly out of the ordinary appearance. During an interview with one of the physicians in the study sample, the director of the hospital popped into the session and told her to "take care, doctor, Patricia's parents are Egyptians." Her response was: "but you are speaking Arabic fluently, I didn't pay attention to the accent until the doctor told me. If anybody doesn't pay attention to your accent, he wouldn't believe that you are an American."

In addition to acknowledging one's relationship to the study population, the approach used to study the role of mobile phones within health systems begins by familiarizing oneself with potentially influential stakeholders and interests. During my stays in Bangladesh and Egypt, I was able to conduct informal interviews with representatives of mobile phone companies, government ministries, NGOs, health service providers, and lay mobile phone users to gain some initial insights into how to approach my research. To maximize the quality of information collected on health-related uses of mobile phones in Egypt, I developed an Ethnographic Field Guide (EFG). The field guide (Appendix B) was the result of two month-long feasibility studies in Bangladesh and Egypt respectively as well as intensive literature reviews in health and development-related uses of other

information and communication technology and key Science and Technology Studies theories. The EFG on health-related uses of mobile phones served as my written list of open ended questions and topics to be covered in a particular order that guided me as a researcher in achieving my study objectives (Bernard 1995). It was developed and used in this study to establish the basis for interviews, discussions, observations, and document analysis.

Qualitative Research Methods

As indicated in the review of literature, there is limited knowledge of the health-related uses of mobile phones in Egypt and indeed elsewhere. As a result, I primarily relied on qualitative research methods to guide the data collection process and provide descriptive explanations for how the introduction of mobile phones are being used by segments of society in a particular context, namely health professionals and those who access health services through the use of mobile phones in Minia Governorate, Egypt. Models for this approach can be found for other ICTs in STS literature in the forms of ethnographies of technology as well as in grey literature, popular science, and mainstream media in regards to applications for development and health. Examples include research in the use of two way radios, television, Internet, and industrial innovations which have traditionally relied heavily on the use of qualitative approaches particularly in the early stages of their use by society at large and in specific sub-populations.

Qualitative research enabled me to understand the “how and why” of people’s attitudes, beliefs, and preferences in response to questions developed within my ethnographic field guide. A flexible application of qualitative research methods provided a platform from which initial insight into newly evolving issues could be gained. Qualitative research, generally refers to utilizing methods that generate empirical data in the form of “case [studies]; personal experiences; introspection; life [stories]; [interviews]; artefacts; cultural texts and productions; observational, historical, interactional, and visual texts—that describe routine and problematic moments and meanings in individuals’ lives” (Denzin and Lincoln 2000, p. 3).

General non-health related interactions between people and technology and people with each other through the use of technology are critical to the study of health-related uses of mobile phones. Qualitative research provides the means to develop both exploratory systems based on a variety of factors or *typologies* including geography (rural vs. urban vs. peri-urban), profession (health professional vs. non-health professional or lay person), and gender (male vs. female).

The qualitative approach attempts to interpret or describe a state of affairs, attitudes, behaviours or a series of perceptions and perspectives related to a particular subject in search of key common factors and relationships as well as divergent characteristics and factors. This construction process acknowledges the existence of variations in cultural patterns across and within the individuals that comprise a particular group within a broader social context (Green and Thorogood 2004). Qualitative research is often used first to generate hypotheses to new areas of study and second to more explicitly complement and describe the findings derived from quantitative studies or to inform the development of instruments for quantitative social science studies.

During the initial development of my study design, I conducted a feasibility study in Bangladesh which at the time had a well developed mobile phone network in place. However, in highly open-ended in-depth discussions with both lay users and health professionals in both urban and rural settings it became clear that 1) limited access to the technology's predecessor- the land line, 2) limited uptake and use by the general population, and 3) limited uptake and use by health professionals would make it incredibly difficult to even begin to elicit such information from potential respondents.

Mobile phones and service have been available in Egypt since 1997, four years prior to the beginning of my research. At the time of data collection and even to date there has not been enough basic research to generate a testable hypothesis that might contribute to what positive impact mobile phones might have with respect to health. The closest relevant proxies in terms of communications technology were land-lines and pagers

utilized by health professionals in urban settings in Egypt. Due to limitations in fixed-line telephone access, no known studies have been conducted to assess health communications via fixed-line telephones. Mobile phones also have properties significantly different from fixed-line telephones which enable contact between individuals irrespective of the user's physical location.

In light of this and the complex nature of the various relationships between a broad range of individuals, I chose to use a purposively structured qualitative study design with "explicit sampling strategies, systematic analysis of data, and a commitment to examining counter explanations [...in which generalisability was] likely to be conceptual rather than numerical" (Green and Britten 1998, p.1232). Where appropriate numbers of respondents have been categorized by sex, age, and geographic location and tabulated to provide an indication of relative levels of agreement within the sample or among a particular sub-sample. The decisions that I made throughout the design and implementation of my study have contributed to understanding the positive impact that mobile phones are having on health in Egypt. The use of qualitative methods within the broader context of ethnography provided the means to 1) structure my questions, 2) identify the study sample, and 3) engage with information as it was being generated and once it was all collected.

Interviews

According to my original study design, in-depth interviews were to be conducted with men and women, in addition to a series of observations in households and other places of interest (markets, public transport, and medical facilities) of mobile phone users to understand the general nature of conversation and messaging in communities. Key study subjects included health care professionals (physicians, nurses, administrators, and ambulance workers) and lay people, (students, business people, and drivers) with a special focus on mobile phone users, but not to the exclusion of former and never before mobile phone users. A series of case studies have been developed through thorough

observation and discussions with subsets of respondents as relevant to a particular aspect of use. Modifications to the original study design are discussed below.

Additional interviews were also conducted with policy makers as well as mobile phone company leaders and employees. These data have been used to establish a contextual framework into and by which mobile phones have been introduced into Egyptian society and provide a social construction of mobile phones. This construction is both influenced by public perceptions and helps to extend and perpetuate those perceptions to broader segments of the Egyptian population. As with all documents, both formal and in this case informal, the purpose and contexts must be understood along with the potential leanings and biases that might be embedded (Hammersley and Atkinson 1995).

What people say and do is critical to understanding their attitudes and behaviours. Interviews formal and informal are used in primary research to elicit information directly from individuals or groups relevant to study questions (Agar 1996). Observations are primarily used to understand what people actually do. Based on my ethnographic field guide I used *semi-structured in-depth interviews*, *natural group discussions*, and *participant* and *non-participant observations* to assemble a narrative description of the nature of mobile phone use for health in a variety of settings in Minia Governorate.

In-depth interviews

In-depth interviews (non-directive) are a practical, flexible way of gathering research data. They guide participants to talk about specific issues and can be designed in such a way to enable the researcher to ask similar questions of a number of respondents. Depending on the sample, they also have the potential to illuminate the perceptions of the those on the social margins (Hammersley and Atkinson 1995). This was particularly the case for respondents located in villages in Minia who rarely contribute to the greater dialogue on social issues in Egypt. *Semi-structured interviews* usually consist of a series of questions which can be asked to provide overall guidance to the research encounter, but which may lead to the inclusion of new questions or exclusion of irrelevant questions.

They also encourage more free flowing conversations through the building of a rapport and the rigorous use of open-ended questions and probes without requiring answers to all questions by all respondents. Similar observations regarding the beneficial use of semi-structured interviews to evaluate an Intranet deployment primary care were acknowledged by Klecun-Dabrowska and Cornford {Klecun-Dabrowska, 2001 #100}. By contrast *informal ethnographic interviews* do not employ questions, but rely on a series of strategies to gather information in both one-on-one and group settings that are more focused on maintaining the natural flow of discussion (Agar 1996). *Structured interviews*, in which each respondent is posed with the same set of questions, do not allow for the same flow and probing attainable in semi-structured interviews.

Using the Ethnographic Field Guide as a starting point, I developed a series of open-ended questions to be used in a variety of configurations depending on the type and nature of respondents, health professional or otherwise as well as non- and former users. The questions focused on their general and specific thoughts on health when and since mobile phones first became available in Egypt. These were revised during the initial interviews until we had a series of questions for which the overall flow and responses addressed the key objectives of the study (Hammersley and Atkinson 1995). Caution was taken to formulate questions in such a way as not to lead respondents to provide a particular answer. An understanding of the target audience was used to ensure acceptability of how questions were framed as well as their clarity. Questions used in my research focused on the personal experiences of interviewees and included the following (for both health professionals and lay users):

1. *When did you first hear about mobile phones? What did you think of it?*
2. *When did you first buy one? Why?*
3. *Who in your household has a mobile phone?*
4. *What does each member of your household use it for?*
5. *Who do you call? What is each of their relationships to you? Explore the types of conversations that they have using mobile phones. (Last 3 phone calls made)*
6. *Who calls you? (Last 3 phone calls received)*
7. *When do you give a “missed call”?*

8. *When do you use text messaging?(Last 3 texts sent and received)*
9. *How have things changed within your household since you have had the phone?*
10. *When have you or someone in your family used a mobile phone for a health-related purpose? Explore these events in depth. (Who? What? When? Where? and How?)*

Additional questions regarding professional applications of mobile phones and changes in health service provision were included for health professionals. The first few interview questions were used to allow respondents to transition their thoughts to mobile phones. Responses to early questions illustrated that people in Minia with mobile phones hear about and purchase mobile phones for similar reasons, whereas in particular relation to health-related uses there was a broader range of experiences. Unlike structured interviews or survey questionnaires, semi-structured interviews are more labour intensive because the recorded material must then be manually coded and analyzed. In spite of the work involved, they provide greater insight into the thought processes of respondents as well as the exact language used to describe things of interest to the researcher. I used probing techniques to encourage elaboration such as silence, “what else?” and non-judgmental expressions of interest.

Data collection

Data collection was conducted with the assistance of two field researchers. These research assistants had previous training in qualitative research and facilitated the data collection process during interviews. Both were semi-conversant in English, but mostly worked between colloquial Arabic and the written language prior to translation into English. Simultaneous translation could have been done with me writing down the interviews in English as it is taking place in Arabic, but information would have been lost and the nuances of language would have been jeopardized. I conducted each of the interviews myself, but they supported me through note-taking and by clarifying questions regarding the cultural context of data collection and translation. With note-taking the assistants could focus on documenting the conversations word for word as it is challenging to ask questions and take notes at the same time (Agar 1996). This also

enabled me to establish a more conversational atmosphere with respondents and focus on listening actively to probe on areas of particular relevance to my research objectives (Hammersley and Atkinson 1995). They also provided insight into social networks and helped to identify potential respondents.

The tradition of anthropology out of which ethnography grew relies heavily on the written documentation of events. As technology has developed for the recording of interviews, it has become the preferred method for preserving the detail of each encounter with respondents. Some key disadvantages that are often cited are potential loss of detailed information, sense of tone, and sequencing. It is often an exercise in Qualitative Research Methods courses to engage students in both note-taking and tape recording of the same encounter to identify potential loss of information. In the absence or presence of recording devices provisions are made for ensuring that field notes are meticulous and expanded immediately for maximum recall of responses and bodily expressions as it is challenging to capture non-verbal behaviour on recordings (Hammersley and Atkinson 1995; Agar 1996; Green and Thorogood 2004). Egypt tends to be a highly suspicious society where perceptions of conspiracy and government censorship are an everyday part of life. Individuals become highly suspicious of tape recording and this would have had repercussions on the quality of information that was gathered. Historically much of the qualitative data collected in Egypt has been done through writing rather than tape recording.

The dangers of lost information that come from relying on writing rather than recording and transcription were minimized through a collaborative expansion of contemporaneous field notes carried out within two hours of each interview. These recreated the setting, the mood of the discussion, and key sections of the dialogue. I also kept a research journal to document the general day to day research process as well as interview-specific background information and observation (Silverman 2000). There were also cost considerations that make it much more cost effective to work very closely with a research assistant to preserve as much of the information as possible rather than opting for much more expensive transcription. Research colleagues who had used transcription in Egypt

expressed that it varied greatly in quality and had not yet become sophisticated enough to achieve the proper word for word that one is able to attain in the United Kingdom or elsewhere.

As a stranger to all of the respondents, building a good relationship focused on establishing credibility, eagerly listening, and earning trust. The initial interview questions focused on more general thoughts regarding changes in Egypt as a result of the introduction of mobile phones and helped to establish rapport with respondents, setting the tone for the overall direction of the interview. Permission was generally obtained from the head of household or health facility administrator, who served as gatekeepers, prior to interviewing the mobile phone user or non-user selected for inclusion in the study. Many of the respondents (particularly mobile phone users) were open to the subject matter, but there was an element of caution among respondents, particularly in health facilities, at first, wanting to know in what context the information was to be used.

It is common in everyday life for respondents to have ‘public’ and ‘private’ accounts. Public accounts tend to dominate initial responses where more private accounts emerge as respondents become more comfortable during the interview sessions. One view from Agar’s Professional Stranger makes the case for the “stranger handler” as a respondent who tells the researcher what is naturally acceptable in public accounts (Agar 1996). These often were consistent with newspaper editorials tracked in the media review. As rapport is built a shift occurs, and respondents begin to share more about what they “truly” feel about a particular situation. Parallel experiences have been documented by Judith Green and Nicki Thorogood in Qualitative Methods in Health Research as they were experienced by Jocelyn Cornwell (1984) in her research on health beliefs in East London. During my data collection period, it was often the case in which the second half and even post-interview discussions were more informative than the initial interview question responses themselves, which led us to make the questions more conversational to elicit more useful and detailed responses. The questions used became much more focused on general mobile phone usage out of which health-specific uses were more likely to emerge instead of directly asking questions about health-related uses up front.

Criticisms of health services were more likely to come up in these later discussions particularly in light of recommendations to strengthen the use of mobile phones for health. Also more “private” accounts of the negative impact of mobile phones on social relations were often shared by women when conducted in one-on-one sessions without the potential for interruption. During the course of my data collection, there was an incident with a respondent in which specific suspicions were expressed. The first was with a switchboard operator in one of the health facilities. Apparently there had been a governorate-wide review of unpaid telephone bills by the health administration, and so his concern was quite valid. Throughout the interview he kept raising the questions: *Who are you? What is this information going to be used for?* This experience emphasized the need to be sensitive in interviews even if the topic does not appear to be of a sensitive nature.

It is worth highlighting that interview data is a contextual account. It does not indicate how a respondent would reflect on a situation outside of the interview setting. People may also not necessarily do as they say they do. Data collected in individual interviews were triangulated with information through observation, natural group discussions, as well as an analysis of other textual data sources. It was the case that in natural group discussions, participants corrected each others accounts. For example, during one interview an Obstetrician/Gynaecologist spent a segment of his interview complaining about how useless having a mobile phone was in his work. However, later during the interview he received several work-related calls for which he excused himself. If I simply read his transcript, I might conclude that this respondent did not find any work-related benefits. However, having observed work-related utilization, I was able to probe specifically into the situations that this particular respondent found his mobile phone professionally beneficial. Similar examples have been provided when appropriate in the presentation of results. Throughout the life of the study it became incredibly clear that what is known about the culture, history, and other factors has had a significant influence over behaviour.

Group interviews

During the months in which I was collecting data in Minia, I was provided with the opportunity to conduct two natural group interviews. In contrast to the more formal one-on-one interviews conducted in private settings, the group interviews were done in more 'public' health facilities. *Gatekeepers*, primarily directors or administrators from whom permission was obtained to conduct my study in their respective facilities, served in a semi-facilitative role (Hammersley and Atkinson 1995). These interviews provided additional insight into health-related uses of mobile phones and confirmed and/or clarified much of what was shared in individual interview sessions. Each of the gatherings was conducted with health administrators and other health professionals, including a group of nurses.

The first natural group discussion was with a group of four doctors in the office of the hospital director, where I conducted several of the facility-based in-depth interviews in his absence. This discussion with physicians specifically contributed complementary information on the barriers to maximizing mobile phone use for health. The second was with a group of four nurses who share an office in an urban health centre where I was interviewing physicians, paramedics, administrators and nurses. The discussion among nurses provided additional information mostly addressing remote patient care and monitoring as they are often on the receiving side of instruction from physicians working off site. These natural group discussions primarily confirmed data collected during in-depth interviews as well as provided additional information as individuals within the groups built on the responses of their colleagues. They have been incorporated as case studies and integrated into broader presentations on the experience of health professionals with mobile phones. However natural the groups were in their respective gatherings, the sessions were not especially "natural" in that they were guided conversations with specific research questions in mind.

There are a number of key advantages and disadvantages to the use of group discussions in social research. It provides a platform to observe how social knowledge is produced and information is shared. It also provides an environment in which certain types of information are more likely to be disclosed. On the other hand, they are challenging to organize and the generalizability is not guaranteed. Also group dynamics are more difficult to control including peer group pressure, the domination of louder participants, and/or the introduction of tangential subjects. These dynamics are themselves interesting objects of study particularly with regard to peer group pressure for those studying behaviour among health care providers.

The group discussions in my study focused on changes in health service delivery resulting from the availability of mobile phones as they are accessed by lay people and health professionals and led to many of the key focus areas highlighted in the study. It also was a challenge whereby once health professionals started talking about the utility of mobile phones in responding to emergencies, it was difficult to explore additional health related uses. The other key aspect of health and mobile phones of particular concern to health professionals was health hazards. This is primarily due to the abundance of materials currently being produced for and against mobile phone companies in the health and public information domains.

Data collection during Ramadan

The Muslim holy month of Ramadan posed interesting research coordination obstacles as many people are fasting during daylight hours. Work schedules as well as sleep schedules are adjusted during this time, making it challenging to set appointments with respondents for interviews. The recommendation was to do the bulk of all health facility interviews during the day and household interviews in urban and peri-urban households in the evenings. Although we had made advanced arrangements with one respondent, upon arrival at his home, his wife woke him up as during Ramadan his along with many others' sleep schedules become reversed.

Study Sample

Minia town and the surrounding villages are considered to be the northern boundary of Upper Egypt. It is located approximately 275 kilometers south of Cairo along the Nile River. In recent times Minia has experienced some civil unrest due to conflicts between the police force and Islamic militants. However, in spite of the general fear that thoughts of the governorate evokes in people, Minian villages are quite pleasant places to visit and stay. The villages consist of rows of one to three story houses attached to each other by narrow dirt pathways. These residential areas have shops available along the main road of the village, increasingly selling mobile phones and accessories. Each village has stretches of land, used to grow crops for consumption and sale. The people of Minia are extremely hospitable. My sample of key informants in Minia was no different and quite often expressed interest in the subject matter and a willingness to share their experiences and thoughts. Minia maintains a combination of attitudes and behaviours that reflect those of the Northern part of Egypt (Lower Egypt) and the aspects of the Southern part (Upper Egypt), making it an ideal setting for conducting research that would potentially be reflective of the country at large.

Sampling in qualitative research tends to be purposive and strategic as opposed to the random sampling (where everyone in a particular group has the same chance of being selected) more common in quantitative research (Hammersley and Atkinson 1995; Agar 1996). This is done in order to ensure that the right “types” of people, groups, texts, and/or observations are consulted because of their special relationship to a given subject (Patton 2002). For the purposes of this study, I wanted a mixture of male-female, lay people and health professionals, users, non-users and former users, rural and urban dwellers, and a range of occupations and specializations among lay users and health professionals respectively.

The following table illustrates the original breakdown of desired respondents for potential in-depth interviewees. Configuring the composition of the study sample was ongoing throughout the data collection process, whereby future respondents were identified based

on existing interviews for comparison and complementarities as well as accessibility. Factors that influenced the final sample included the lack of female users, the addition of professors due to the focus on students in early interviews, and the diversification of medical specializations. Atypical or “deviant” respondents originally consisted of non-users, but in the final study sample included former users. These respondents, stratified by sex, age, geographic location, and profession, provided a relational frame against which to juxtapose information provided by typical respondents, who were more likely to acknowledge the linkages between their own relationship to technology and health objectives.

	Health System	Mobile Phone Users		Non-users
Setting	Hospitals Clinics Private Doctors’ Offices	Minia city	1 isolated village in Minia Governorate 1 village in an accessible area	Minia city and user villages
Respondents	Doctors, Nurses, Administrators, Traditional birth attendants	Male and female mobile phone users	Male and female mobile phone users	Male and female non-users
Sample size	24 users 6 non-users	10	10 per village (20)	6
Recruitment	Facilities will be identified and randomly selected from a list of private and public health facilities.	Snowball from personal contacts of research assistant and health facility recommendatio ns of people who have used the phones to contact them (emphasis on getting a good cross section of poor-moderate individuals)	Snowball from personal contacts of research assistant and health facility recommendations of people who have used the phones to contact them (emphasis on getting a good cross section of poor- moderate individuals)	Snowball from personal contacts of research assistant (emphasis on getting a good cross section of poor- moderate individuals)

Figure 3.2: Original interview matrix: exploring health-related uses of mobile phones

Within this realm of *theoretical sampling*, categories of respondents were set and expanded upon until responses in interview sessions were not contributing new insights to the analysis, the point of saturation. With each interview additional types of respondents and specific respondents as well as topics were identified. They also

provided guidance for specific media releases and recent events to look for during the media review period. One area for critical comparison was the introduction of the *le silki* or emergency wireless system [limited area- walkie talkies] to identify the relevant areas of impact within emergency response and the role of each technology. Purposive sampling and canvassing the key “types” of people that would be able to contribute to a discussion on health related uses of mobile phones from personal experience provided the basis for conceptual generalizations.

The health system respondents were identified through a purposeful selection of facilities. The user sample was identified using snowballing methods (Atkinson and Flint 2001), whereby health facility staff were asked to identify local health professionals who have used mobile phones to communicate with them. Because of the limited number of such users, I interviewed all staff within a facility who owned a mobile phone. For lay users I primarily utilized snowballing methods beginning with the personal contacts of the research assistants who had been involved in other field research in the governorate. In two of the three rural study sites, where there were no personal contacts, the research assistants went ahead of time to map the villages and obtain lists of mobile phone users. This was done through the local *umdah*, which is comparable to a mayor in the context of the United Kingdom who often served as a gatekeeper to his village, providing the necessary permission to approach potential respondents. Because of the limited number of mobile phone users in the first two rural study sites we added a third village. Non-users in villages were identified in the communities where we interviewed users.

There were a number of critical debates regarding villages to be included in the study. I had originally intended to identify one village with a health facility and an isolated village without one. However, by the time at which the data collection began in Minia all villages had a health facility, unfortunately, many of the health care providers assigned to these health facilities are not physically present to provide services to the local community. In at least two of the villages those that we spoke with in the local community considered themselves to be villages “without health facilities” or “with a

health facility that has a crazy doctor.” They primarily rely on transporting their sick relatives to urban facilities. The urban and peri-urban study sites are distinguished as such. Rural Study Site One was located 30 minutes from the centre of the Minia Town towards the agricultural lands, Rural Study Site 2 was located 30 minutes outside of Minia Town towards the desert, and Rural Study Site 3 (which I reference as “isolated village”) was located three hours from Minia Town and required automotive, animal (donkey drawn cart), and boat transport. The following is an illustration of the isolation of the village from personal experience based on my field notes:

One day when we were trying to leave the third rural study site we missed the last boat to cross the river and had to hire a private boat that took three hours to come pick us up. This will become even more relevant when I discuss access to health services from the perspective of respondents. In many ways the experience enhanced my understanding of the complications of transport.

During my four months in Egypt, I conducted 66 in-depth interviews with a variety of key stakeholders both within the health sector as well as in the local population at large in the governorate of Minia. The following is a summary of the types of respondents that I interviewed. Of the 66 individuals interviewed, 53 were current mobile phone users, ten were non-users, three were former users; 44 were men and 22 were women; and 24 were health professionals and 42 were lay persons. Respondent ages ranged from 19-51 years.

After conducting interviews with three non-lay users, I decided to focus on users as the capacity of non-users to speak about health-related uses of mobile phones was abstract or non-existent. They did not provide the frame of reference I sought at the outset of data collection. Among lay users, the health benefits discussions were generally cased within a broader discussion of social and economic uses and benefits. Actual experiences using mobile phones to communicate with health professionals and other lay users about health as reported by respondents proved more informative than hypothetical questions and probes regarding potential health-related uses of mobile phones that were not necessarily set in reality.

During these interviews as well as during early interviews with lay non-users, it was clear that there was limited value to the overall study from interviews with individuals who had consciously or sub-consciously elected not to use mobile phones. Many of these interviews were short and there was some frustration on the part of the respondents. There seemed to be a clear divide between nurses and doctors, whereby nurses were much less likely to own a mobile phone. Unlike lay non-users, health professional non-users were able to reflect in general terms the changes that they have observed in the health sector in relation to mobile phone use by other health professionals.

Study sample of health professionals

Health professionals were identified in two key locations (1 urban; 1 peri-urban) through purposeful sampling, using snowball methods. With respect to specializations among health professionals, respondents included physicians (general practice, surgeons, emergency specialists, paediatricians, and obstetrician/gynaecologists).

Health Professionals
(N=24)

	Male User	Male Former-user	Male Non-user	Female User	Female Former-user	Female Non-user	Total
Urban	5	1	4	4	0	4	18
Peri-urban	2	0	0	3	0	1	6
Total	7	1	4	7	0	5	24

Figure 3.3: Health Professional Sample by Sex and Geographic Setting

Initial interviews were conducted among health professionals. Most of the physicians interviewed were male mobile phone users or former users. I also included in my sample nurses (all female), health facility switchboard operators, and paramedics who primarily were not mobile phone users due to the low pay received by these professionals. These respondents provided complementary information on the wireless system particularly in relation to coordinating emergency responses.

According to a paper by Soheir Mehanna and Peter Winch entitled, *Health units in rural Egypt: At the forefront of health improvement or anachronisms?*, there are six sources of advice and treatment for illness episodes: the home, pharmacists, the government health unit or clinic, hospitals, private doctors, and sheikhs who practice traditional Arab medicine (Mehanna and Winch 1998). During my data collection, I was able to talk with representatives of each of these sources. To facilitate understanding of the data presented by the health sector, it is important to identify the role of each source of health service in Egyptian society, including traditional healers.

Most people have made use of the government health unit or clinic at some point. The rule is that patients could be examined at the village health unit for a nominal fee of 50 piastres (approximately five British pence) between 9 a.m. and 12 noon. After midday, the physician is free to examine patients privately for a fee of three to four Egyptian Pounds. Despite the higher cost, most people prefer the private examinations, since they feel that the physician gives them more attention and a thorough examination (Mehanna and Winch 1998). Pharmacists are generally consulted if the individual has had the symptoms previously. They either take the prescription from the previous episode to a pharmacy and buy the same medicines, or simply ask the pharmacist for the medicines they took the last time. If they have not had the symptoms before, they describe the symptoms to the pharmacist, and request that the pharmacist provide them an appropriate medicine. Egypt has a fairly comprehensive generic drug manufacturing industry and most medicines are available without a prescription. “Arab practitioners perform *zar* rituals for those possessed by spirits. These practitioners tend to be a last resort for the non-Bedouin; for example if drugs from the pharmacy don’t work” (Mehanna and Winch 1998, p. 226). During my lay user interviews I discovered that one of the respondents performs *zar* rituals using his mobile phone. Although I did not explicitly ask respondents about their health service provider preferences, many shared them in the context of accessing services and addressing general health conditions.

Study sample of lay people

For the most part, mobile phone users apart from doctors were businesspeople, and/or individuals who travel or have transport oriented business in addition to owners of other commodities- truck(s), satellite dishes, as well as fixed landlines at home. They also tend to have relatives outside of Egypt in other Arab countries. It is also worthwhile noting that the distribution of users across gender unevenly favoured male users in all geographic locations, but most especially in rural areas. It was extremely difficult to find a female mobile phone user (owner and/or someone with direct access and regular usage privileges) in the rural study sites where I only found one. In the isolated village, the female mobile phone user shared a mobile phone with her husband, who also was a respondent in my study. Women with mobile phones tended to be physicians and/or women who worked outside of the home, female students studying away from home, and women who travelled for work.

Rural areas in Egypt are generally described in terms of how they are related to urban areas. With population growth and increasing access to education, sewage systems, roads, electricity, and telecommunications infrastructure rural areas resemble more and more their urban counterparts without the high rises. Resources and services do still tend to be concentrated in Cairo and other urban centres. “What is worth noting here is that the condition of being on a periphery, and the deep bitterness engendered as a result of this is something that people experience and express as ‘a village’ rather than a particular class or identity group. Elite and non-elite are largely in the same boat” (Saad 1998, p. 118). The telecommunications gap between rural and urban areas in Upper Egypt is also significant (Infocom Technology Inc. 2002).

One manifestation of this in the context of my research is the fact that “123” is an ambulance number established for and based in Cairo, but automatically programmed in most mobile phones as “ambulance.” During the study period, such a service had yet to be standardized across the country or established in Minia and other parts of the country. When asked how they contact emergency services, respondents provided a wide range of

feedback in terms of their experiences, which highlighted the Cairo-centric nature of public services. For the well-informed mobile phone user to report a medical emergency from Minia one must first contact the police who will then direct the call to the appropriate people. A presentation of responses can be found within the discussion of lay user experiences addressing emergencies.

My experience in each study site was unique. In one village I conducted the first few interviews at the local primary school as the principal had been of significant assistance in terms of identifying mobile phone owners/ users in his village. In another village we were instructed to stay at the *umdah*'s home, and he arranged for the respondents to come to speak with us one by one. Most settings were quiet and the interviews were generally uninterrupted. In some villages due to the lack of penetration in rural areas in Minia, we were only able to find four mobile phone users and conducted interviews with all four.

Lay Persons (N=42)

	Male User	Male Former-user	Male Non-user	Female User	Female Former-user	Female Non-user	Total
Urban	8	1	0	4	0	1	14
Peri-urban	6	0	0	4	0	0	10
Rural 1	5	1	0	0	0	0	6
Rural 2	8	0	0	0	0	0	8
Rural 3	3	0	0	1	0	0	4
Total	30	2	0	9	0	1	42

Figure 3.4: Lay Person Sample by Sex and Geographic Setting

Language

In Egypt there are two language categories, *Foos-ha* or Classical Arabic, and *Aamiya* or Colloquial Arabic. Classical Arabic is a literary language; it is written and read, but rarely spoken. Knowledge of Classical Arabic is highly dependent upon level of education. Uneducated individuals cannot easily understand Classical Arabic. What is spoken is usually some form of Colloquial Arabic. For the purposes of my research, we

have tried to make all questions as easily understood as possible, knowing that the respondents may or may not be educated.

Although Arabic is my first spoken language and I am considered to be a fluent Arabic speaker, I did not learn how to read and write until I took courses in university in the early 1990s. Because of the complex grammar and alphabet structure my ability to read Arabic is much stronger than my ability to write. For this study, I worked with research assistants whose role was primarily to record interviews and provide some assistance in determining the conceptual equivalents in English of Arabic expressions during the translation process (Birbili 2000). Field notes were expanded and typed into Arabic Word and translated by a professional translator into English.

Literal translation (word for word) was used in order to preserve as much of the respondent's meaning as possible in spite of the potential for awkwardness in readability (Birbili 2000). A sub-sample of interviews was translated back into Arabic to ensure the validity of the translation and identify and rectify areas where the meaning of what was said was lost in the translation process. Discussions between the research assistants, translator and me were conducted regularly to address and document any problematic terms where there is no direct English equivalent of Egyptian phraseology as well as reinforce the key objectives of the study (Patton 2002). The texts were then edited for readability in English and words for which there was no English equivalent were transliterated, and an approximate description provided in English.

Based on a review of theoretical considerations when using a translator for research done by Birbili (2000), I integrated methodological consideration regarding translation throughout the study. Specifically attention was given to the following: 1) maximizing the validity of reported material; 2) exploring language, culture, and subject matter background of myself, the translator and the research assistant, and 3) describing choices made regarding translation (Birbili 2000; Patton 2002). The use of translated material inevitably did have some impact on the findings, but measures have been taken to minimize the effect and preserve the meaning of respondents in the study.

Participant observation

Within the literature on methods regarding observation as a means of understanding what people do there is a range of types of observation from *non-participant* to *participant observation*. Observations were used to illuminate interview data. These took the form of living with mobile phone users and observing how phones were being used and watching television programs in which Egyptian households depicted on serial dramas increasingly each had at least one mobile phone user- usually a teenager or a businessperson. In many ways during the data collection period in Minia I became a participant observer to gain insight to “insider” accounts (Hammersley and Atkinson 1995; Agar 1996). I found myself using my mobile phone to coordinate my “health-focused” research as well as to address a number of health-related issues, including following up with sick relatives.

As a young woman in Egypt, having a mobile phone enhanced my ability to travel on my own and spend extensive period of time outside of my home base in Cairo. My relatives, who on behalf of my parents who reside in the United States, checked upon me on a daily basis to make sure that I was safe and that my research was proceeding well. While in Minia, I decided to accept the hospitality of one of my research assistants to stay with her family, which provided increased opportunities to explore mobile phone use by a middle class family in an urban setting that had previously not had access to landline services.

One specific situation in which I used my mobile phone for a health purpose was during the course of an illness episode that my uncle had in which he was hospitalized in Cairo for kidney failure. During his hospitalization I was able to talk to him and my aunt several times each day to make sure that he was doing better. Also during hospital visits family members used their mobile phones to contact his doctor for follow up and other doctors for second opinions from the patient’s bedside. The sense of peace in being able to check up on relatives as well as the time savings in consultations with medical professionals illustrated two key aspects of positive health effects of mobile phones.

There were, however, some annoyances regarding the use of mobile phones in health service settings and beyond. There were interruptions to interviews as mobile phones rang periodically. There was also the expressed risk of interference with medical equipment from mobile phone transmissions in close proximity.

A key challenge in observation, according to Green and Thorogood, is knowing what to look for and how to reflect on what is seen (Green and Thorogood 2004). My experiences and reflections as a participant observer have been incorporated throughout the discussion of results. Although, not included in the study for ethical reasons of non-informed consent, conversations throughout my travels in Egypt have served to confirm and/or encourage me to further explore particular aspects of mobile phone use with respondents in the study sample.

Data analysis

Data analysis in qualitative research is an iterative and on-going process, and is used to inform adjustments in data collected and study samples as well as results and discussion. It is informed by the social science knowledge of the researcher and cased in a broader context of personal experience and interactions with text-based data (Green and Thorogood 2004). My general approach to inductive data analysis began by looking and listening for patterns and inter-relationships and associations between attitudes, behaviours, and experiences generated by the different data sources to generate ideological and conceptual definitions and frameworks (Patton 2002). Earlier interviews provided explanations to be tested and verified/ confirmed in later interviews (Silverman 2000). Within these frameworks I was able to explore the distribution of responses by a variety of typologies to identify consistencies as well as variations within the sample (Agar 1996).

The approaches used were based in part on the principles of *thematic content analysis* (Green and Thorogood 2004), drawing on some of the principles of *constant comparative method* (Silverman 2000) in later stages of data analysis. They helped me to identify

similarities and differences as well as mutual relationships and internal structures within and across texts as well as against theories and context. The progression within *thematic content analysis* from familiarization to identifying themes to indexing based on those themes to charting and rearranging data guided my data analysis process (Green and Thorogood 2004). The sample structure and data generated also enabled an analysis of inter-relationships within and across relevant networks, in this case health professionals, families, and friends resulting in a sort of *network analysis*.

It is out of this sort of content analysis that segments of translated interviews and notes were coded using a coding scheme developed during the course of data collection and analysis to capture the various recurring themes and outliers (See Appendix C). Codes were defined and refined throughout the analysis process based on discoveries made while exploring the data through a variety of lenses. This consistent comparison of codes and text with each other both established the foundation for conceptual frameworks as well as opened the potential for the creation of new ones to be tested against other data sources and theoretical frames, generating new ideas and theories (Green and Thorogood 2004).

The qualitative data analysis process was aided in part by the computer software program, Nudist. I used Nudist primarily to store, code, organize, reorganize, and retrieve data. To begin the formal analysis of qualitative data, I uploaded each individual interview and group discussion transcript into Nudist with a unique identification naming system. The naming system was used to identify the location of the respondent by urban, rural, peri-urban, and isolated village and whether the respondent was a health professional or lay user. I also individually labeled transcripts by using the comment function to assign the age, sex, and profession of the respondent. This was so that I could attribute coded and aggregated responses and direct quotes to the appropriate respondent profile. Once the naming and labeling process was complete and all transcripts entered into Nudist, I began the coding process.

To aid the coding process, I developed several broad categories of codes that were initially based on the questions asked during interviews and group discussions. As supported by the Nudist software, the coding system that I used can be likened to a tree with large branches of major codes and smaller branches of more specific codes within a broader theme. The major branch themes were divided into codes related to aspects of mobile phones and general use as well as health-related uses. For example, this level of codes included information regarding when respondents first heard and purchased mobile phones, perceived advantages and disadvantages, opinions, health professional and other health-related uses, family communication, missed calls, and text messaging. Within each of the major codes, I created a sub-coding system that would enable more micro-level data analysis on specific aspects of interaction and use that emerged from within the data more than three times. The coding process was iterative and proceeded as follows.

I began by coding major codes throughout the first few texts, while documenting potential sub-codes. For potential sub-codes that were repeated more than three times, I created formal sub-nodes within the Nudist program, returning to previously coded texts to recode using the new sub-code(s). For example, many respondents mentioned first hearing about mobile phones 3 years prior to the start of the study, therefore, resulting in the code: *First Heard Time Frame 3 Years*. The coding process for the first ten lay user and health professional transcripts was laborious as it involved the creation of many major and minor codes. However, once the various codes were established, their insertion into Nudist transcripts became much more methodical, using the codebook as a general guide. Text related to each code was highlighted and the code or sub-code was attached to it. In many cases text blocks were coded with multiple codes, contributing to multiple themes within the analysis process.

Once all of the transcripts were coded with the complete set of codes contained in the codebook, the analysis process continued with a detailed exploration of coded texts. To begin all of the sub-coded texts within a major tree-node were extracted and compiled into a single Microsoft Word Document. This process was repeated for each major tree node. These aggregated texts were printed and reviewed to identify themes and sub-

themes. For example, all texts coded with various aspects of *family communication* formed the basis for the case study later developed on the role of mobile phones within families. The codes facilitated the identification of patterns across various types of respondents, the development of narrative descriptions for how families are using mobile phones in their day to day lives, and the identification of illustrative quotes and examples regarding the nature of how mobile phones are used to support husband-wife and parent-child communication. This process was repeated to explore aspects of mobile phone use including when various telecommunications technologies, including mobile phone, fixed-line telephone, pager, and ambulance wireless communication systems, were preferred among lay users and health professionals. It was also used to explore key aspects of access to emergency health care services among lay users and the coordination of those services by health care professionals.

There are some limitations with using software for data analysis, particularly in that depending on the coding structure a researcher may be limited to look at data in one specific way- when there may be other ways to explore them. Other limitations include viewing data in smaller segments which may blur key relationships and detract from the bigger picture (Silverman 2000). One tendency is to over-estimate the output of software packages as analysis (Hammersley and Atkinson 1995). Throughout the analysis I provide references to the codes from which the data was extracted and synthesized as well as a review of interview context and full texts to ensure that loss of potential inter-relationships is minimized.

The coding of data in Nudist, however labour intensive, enabled a much smoother analysis of data within pre-grouped categories based on the conceptual frames that respondents used to express their thoughts and experiences with mobile phones. With respect to the broader sample, the frameworks used to categorize responses included: *communication patterns, accessing health services, quality of health services, and emergency care experiences*. For health professional data on health-related uses, major groupings included *following up on patients, facilitating work in several places, coordination of health services and contacting other health professionals, and emergency*

responses (with a special focus on accidents). Finding doctors was a relevant sub-text and cross-cutting theme to many of the major groupings, and although not discussed in the same terms- telemedicine applications were expressed frequently. For lay users, the information shared beyond the sample-wide data tended to focus on emergency responses and more specifically how to access emergency services through the use of a mobile phone.

The development of each of the case studies presented in the following chapters was an extension of the analysis process as various approaches to data presentation were explored. The first approach divided the presentation of results into lay users and health professionals. The primary challenge with this structure was that it did not provide a coherent picture of how mobile phones were being used as a holistic approach to a particular aspect of health care. Because the analysis generated data that both related to emergency and routine care among lay users and health professionals, these two themes formed the basis for presenting results related to direct health benefits. In exploring access to health services I used the data collected from lay users as the basis of analysis and provided comparisons to health professionals to validate and juxtapose their reported experiences and perceptions. In exploring the coordination of health service delivery, I used the reflections of health professionals as a guide to discussing the direct health benefits derived from mobile phones. To avoid repetition, I integrated lay user specific perceptions and illustrations to validate and juxtapose the sentiments expressed by health professionals. Family communication as a theme applied to both groups of respondents and provided a more accurate illustration for how the entire sample was achieving perceived indirect health benefits through the use of the technology. It was also more comprehensive for me to approach limitations to maximized use and recommendations for programming and research in a similar fashion, detailing notable comparisons between various sub-sets within the sample.

Ethnographic research has some limitations in terms of generalizability. Data generated could potentially apply to all Egyptians, however, the analysis and presentation of results along with examples and counter-examples all pertain specifically to Minia in general

and people interviewed for this study in particular (Agar 1996). The result, again, is an “ethnographic case study of health-related uses of mobile phones in Minia, Egypt.” Reliability within data is linked to consistency and agreement across respondents. Validity, which is much more complicated, strives to align data outputs and outcomes with “truth” or “fact” (Silverman 2000). Often individual perceptions are viewed by the perceiver as the truth. In research like this, one can present perspectives of respondents, strive to explore consistency with the broader population, and acknowledge both the richness of contributions to what is known about a subject and the boundaries of those contributions.

Documentary analysis: History, literature, and media review

Throughout the research life cycle there is a strong need to contextualize information gathered from a variety of sources. Two key means for doing this are observing behaviours and conducting an analysis of documentary sources. For the purposes of this study, I incorporated a review of relevant Egyptian history, a literature review (discourse analysis), and a media review. The historical analysis proved a critical process in that it contextualized and explained a number of recurring responses to key questions posed in the various interviews. The media analysis which was integrated into the next chapter on contextualizing mobile phones in Egypt uncovered some of the strong influences within Egyptian advertising and social commentary regarding how and why people make certain choices or form certain opinions about mobile phones in general and health applications in particular. The literature review helps to locate this study in the broader context of what is known about mobile phones, ICT and health, Sociology of Mobile Phones, STS, and health communication and health service management.

Empirical data and the literature review were complemented by a concurrent analysis of newspapers and television as well as documented observations. During the month of November 2002, my study team and I tracked the three major Egyptian newspapers, El Ahrām (*The Pyramids*), El Akhbar (*The News*), and El Ghomhoreya (*The Nation*), for articles, advertisements, and cartoons that were related to mobile phones and the

telecommunications industry. We also documented television commercials and other television programs to better understand how mobile phones were being presented and represented in various contexts and to ascertain the sorts of information to which study respondents were being exposed. November 2002 also covered a significant part of Ramadan, which is known for having the best television programming, commercials, and other media as the majority of Egyptian families gather together at home to break their fasts.

It is worth noting that the newspaper is a critical part of the daily life of many Egyptians.

... Egypt's early newspapers were established by immigrants from greater Syria who found the atmosphere of the Khedive's Egypt a more liberal one than that of their Ottoman-controlled homeland. One such periodical was *al-Ahram (The Pyramids)*, founded by the Syrian Taqla brothers in 1875 and arguably Egypt's most important newspaper in the twentieth century. ... By the end of Ismai'il's reign in 1879, Egypt's political press was solidly established as the dominant forum of cultural expression and political debate in Egypt. (Jankowski 2000, pp. 86-87)

The review of printed and visual media resulted in a range of materials that I have categorized as marketing and advertising, public interest, news, and social commentary. Beyond marketing, journalists have increasingly picked up on the peaking interest of people in the cultural dimensions and effects of technology. For some this is the evolution of scientific advancements and for others it is the ongoing dialogue on romance via mobile phones. Within public interest also reside many pieces that address the "harmful radiation" fears surrounding mobile phone use. The news media that is included in this analysis specifically focuses on current event stories which involve mobile phones, an example being an article about a bus accident in which passengers used mobile phones to call the police. Comic strip artists, comedians, and editors reflected on the effects of mobile phones on society producing a social commentary that is a reflection of and influencing force in shaping the attitudes towards mobile phones in the general population. Cartoons are an amusing primary source of how either a cartoonist specifically perceives a situation or more often than not how a particular segment of the population thinks. Cartoons and descriptions have been integrated

throughout my Thesis to help illustrate and confirm particular sentiments that were flagged by respondents in my study sample and the general public.

Presentation of results

A synthesis of conceptual themes and trends found within the data is presented as a narrative presentation of results. The data has been organized as a comparison between types of respondents, technology usage, and geographic location as well as a series of case studies. Throughout the synthesis of data, I have used illustrative quotes based on the overall reflection by respondents on a particular aspect of the relationship between mobile phones and health and provided information on the context of the questions asked which prompted such responses. Atypical responses (deviant cases) have also been presented as appropriate in that they illustrate views that exist but do not follow a particular trend. I have also used theoretical frameworks from Science and Technology Studies as well as the documentary analysis to contextualize the study within a broader understanding of the issues raised within the data set in the discussion of results. Case studies have been used to describe trends and changes within individual approaches to health communication with the introduction of a new technology into the context of urban, peri-urban and rural communities in Minia Governorate.

Ethical considerations

As discussed earlier, in the original study design, I had planned to conduct structured and semi-structured observations of public use of mobile phones in the hope that incidents of health applications would arise. This raised concerns over the issue of informed consent by those under observation. Respondents interviewed during the study were required to provide informed verbal consent. They were provided with a project description in Arabic that detailed the purpose of the study, that their names will not be disclosed (confidentiality), and what the information will be used for in the future (PhD Thesis, related publications, and recommendations to inform more strategic use of mobile phones

by the health sector). The acquisition of informed consent from observations was not feasible.

Insights gained through observation and informal discussions have been used to inform study design, but have not been incorporated due to ethical problems with inclusion of “overheard conversations” and “observed actions” when people do not know that they are being watched (Hammersley and Atkinson 1995; Green and Thorogood 2004). Limitations existed with respect to conducting observations, particularly regarding the ethical issues of listening to and recording conversations on mobile phones in public places without permission. As a result, observations were limited to those with whom agreement was made in advance for interviews and who were directly and indirectly involved in the study (research assistants and relatives). This raises questions about the private nature of public discussions that go beyond the scope of this Thesis, but that are worth considering in the broader methodological application of ethnographic methods to public health.

A description of the project and an application was submitted to and approved by the Ethics Committee at the London School of Hygiene and Tropical Medicine and the appropriate letters from the Ministry of Health as well as local administrators and authorities were acquired in Egypt to collect data in health facilities and communities in Minia. Only solicited accounts in which consent was provided have been explicitly incorporated into the data that was analyzed and presented. For all data only basic descriptions of the type of respondent and the type of geographic area where they are from are used in order not to track information back to a particular individual. A copy of this Thesis will be provided to the Ministry of Health as well as all administrators in health facilities involved in the study upon completion.

Conclusion: Methodology

Social and behaviour change as it specifically is linked with technology and health is complex. The study of it is an exercise in the study of complexity. It requires

consideration of the many factors and individuals affected and engaged in relationships at a variety of levels. The application of ethnographic and qualitative research approaches and methods enabled me to establish a framework to describe particular trends and aspects of the cultural context in which mobile phones have become a part of the everyday experience of health professionals and lay people in Minia. Through rigorous application of a range of methods empirical data were grouped and analysed to establish explanatory models for understanding what and why people think what they do (conceptual) and what people actually do (behaviour). In the case of mobile phone uses for health what emerges is a mixed conceptual and behavioural model that links concepts, terms and items together into observable patterns and relationships. The results of this study have highlighted potential future research opportunities and directions which will be elaborated on in the conclusion.

Chapter 4: Fieldwork Findings: Case Studies in the Role of Mobile Phones for Health in Minia, Egypt

Mobile phones are contributing to changes in how individuals access health services and how health care workers approach their professional responsibilities in Minia, Egypt. Due to the complex and dense nature of my research findings, I have organized the presentation of empirical data into three case studies. The first of these case studies explores the role of mobile phones in emergency health care. As the most advanced area within health services and health-related mobile phone uses in domestic settings, this case study illustrates trends and introduces major themes in the use of mobile phones for direct health benefits. The second case study focuses on the role of mobile phones in routine health care. It also contributes to the exploration of the technology to generate health benefits, focusing more closely on the use of mobile phones for access to diagnosis and treatment as well as the coordination and provision of in-patient care. Each of the first two case studies presents data from both the perspective of health professionals and lay users. The third case study entitled, “The role of mobile phones in family communication and well-being,” describes the contribution of mobile phones to the social determinants of health. This case study looks more broadly at the experience of the entire sample as a reflection of how mobile phones are being incorporated into the daily lives of men, women, and youth to generate what respondents perceive to be indirect health benefits through enhanced family communication. The mobile phone is influencing changes in traditional family dynamics.

In each case study, I present empirical results related to health benefits and limitations, noting regularities, differences, and patterns in data generated primarily by in-depth interviews. The trends described in this analysis have been derived from collective utilization patterns observed within the larger study sample in the case of lay user reflections and from the sub-group of health professionals when the focus was on professional and work-related uses. Quotations have been selected based on their capacity to illustrate the trends observed within the sample. Where the perception or

experience is the view of an individual or smaller group, this has been indicated. These case studies include comparisons to what is known about the health services delivery context in Egypt and other empirical data, however scarce, as was deemed appropriate without overshadowing the presentation of the perceptions and experiences as shared by respondents in Minia.

The role of mobile phones for emergency health care

On November 1, 2002 at approximately four o'clock in morning, a bus carrying 35 passengers turned over on the agricultural road in Abu Korkas, Minia Governorate. On November 2, 2002 it was the cover story in the three major Egyptian newspapers I had been tracking during my field work, namely *Al Ahram*, *Al Akhbar*, and *Al Ghomhoreya*. This was two days prior to the start of my data collection. As I read the daily papers I underestimated how significant this bus accident would become to my research on health-related uses of mobile phones.

When I first began my data collection in Minia on November 3, 2002, I was invited to lunch with a Ministry of Health (MOH) representative who became a key informant to me throughout my research. It was during lunch with him that I was introduced to many of the ways that mobile phones were influencing health services in Egypt in the context of that bus accident that had occurred on the agricultural road in Minia Governorate two days prior to the start of my data collection. What many respondents, particularly those working in emergency health services, referred to as the “Abu Korkas Bus Accident” has proven to be an excellent case study for the utility of mobile phones for both access to as well as coordination of health services.

The lunch-time conversation with the health administrator introduced key themes regarding the natural role of mobile phones for health that will be presented throughout this chapter. In this context, I utilize the phrase *natural role of mobile phones for health* to mean health-related usage patterns that have not been formally initiated through a project or policy intervention. In the case of the bus accident, it refers to the ways in

which witnesses, victims, and health professionals used the technology with no directive or special guidance. The perceived objectives and outcomes were to reduce response time and improve efficiency in health service delivery for those affected by the accident.

A close friend of the governor of Minia was on the bus, had a mobile phone, and alerted his colleague who then used his mobile phone to call my key informant. With guidance from the governor, my key informant was tasked with mobilization of support for the bus accident victims. For those surviving the initial impact, the use of mobile phones served a critical role in coordinating emergency health care services. It was reported that during the accident 13 passengers died immediately. This was reported by the ministry representative and confirmed in newspaper articles about the accident. The representative then used his mobile phone to mobilize the necessary support, beginning with 20 ambulances to provide basic life support and transportation for the over 20 passengers who sustained injuries, but did not die instantaneously. He also was able to put on stand-by the three main hospitals in the governorate to receive the patients. This improved preparedness involved the mobilization of appropriate personnel as well as equipment for addressing the needs of each patient. The following account of his role in responding to the accident provided by the MOH representative illustrates how he has integrated mobile phones into his daily work life.

Regarding the bus accident at Abu Korkas I had my mobile then, so they called me. The Governor called me, and we went together to check on the injured people, it was 4:30 a.m., there were 20 injured and 15 deaths. The doctors were ready to receive the injured cases. Also, there is the wireless at every first aid station. But at emergencies, it is easier to call on the doctors using mobile phones. That is why mobiles are very useful.

Most of [the victims] recovered. There were 13 deaths before they reached the hospital and two deaths after arrival because their cases were very serious. Also because the roads are narrow so the conditions of the injured became worse. It can be difficult to reach the hospital.

Ministry of Health representative; age 58; male; urban; user

This health administrator described his approach to the situation beginning with using his mobile phone to mobilize ambulances and health facility response teams. He also

presented the critical interaction between mobile phones and other telecommunications technologies, including emergency wireless systems and fixed-line telephones. The combination of using mobile phones in conjunction with other technologies to facilitate access to and coordination of transportation and services became a recurring theme among respondents. The perceived benefit of these various interactions from his perspective was a decreased response time and improved preparedness resulting in a perceived reduction in deaths. Although none of the articles published in the days immediately following the accident mentioned the use of mobile phones, on November 6, 2002, a short article published in *Al Ghomhoreya* indicated that improved telecommunications in general enabled Abu Korkas Hospital to keep fatalities to a minimum (Al Ghomhoreya 2002).

In this and similar situations, the mobile phone serves as an “individual’s location” to borrow the phrase from Lasen (Lasen 2001, p. 34). The friend of the Governor was able to initiate contact from his location, the scene of the motor vehicle accident, directly to the Governor himself without need of knowing his locality. He is in effect where his mobile phone is. Similarly, the Governor was able to contact my key informant, etc. This chain of communication catalysed a series of potentially lifesaving administrative actions. Before mobile phones either a witness or an able victim would have had to find the nearest fixed-line telephone to alert others to the emergency. In such situations s/he would not be able to necessarily provide observations needed to mobilize the necessary medical support as someone who is reporting directly from the scene. As indicated in the introduction to this Thesis, prior to mobile phones access the telecommunications infrastructure in Minia, a predominantly rural governorate, was very poor (Infocom Technology Inc. 2002). This required individuals in emergencies to spend varying amounts of time looking for government sponsored tele-centres as well as the fixed-line telephones of wealthy neighbours and strangers to acquire assistance.

The MOH representative’s account clearly presents the major element categories in the mobile phone for health network. These categories can be characterized as mobile phone users, telecommunications technologies, and health professionals and facilities. These

grouped network elements generate improved access to health information and services for lay users and health professionals and improved efficiency in health service administration for health professionals.

Mobile phone and health network elements

Within the grouped network elements, as presented in the diagram below, are a broad range of people, places, and technological objects. Elements in the network representing categories of people that were discussed during in-depth interviews and documented in observations included: *patients, family, friends, physicians, nurses, health facility switchboard operators, and ambulance workers*. More object oriented elements were divided into two main groupings: 1) technologies and 2) health service delivery sites. **Technologies** represented in the network were: *mobile phones, pay phones, pagers, fixed-line telephones, and emergency wireless systems*. The **health service delivery outlets** included: *hospitals, health centres, health units, private clinics, ambulances, and pharmacies*. Health-specific outcomes in emergency health care result from a triangulation of the interactions between users and telecommunications technologies, telecommunications technologies and health facilities and care providers, and users and health care services and providers as illustrated by Figure 4.1.

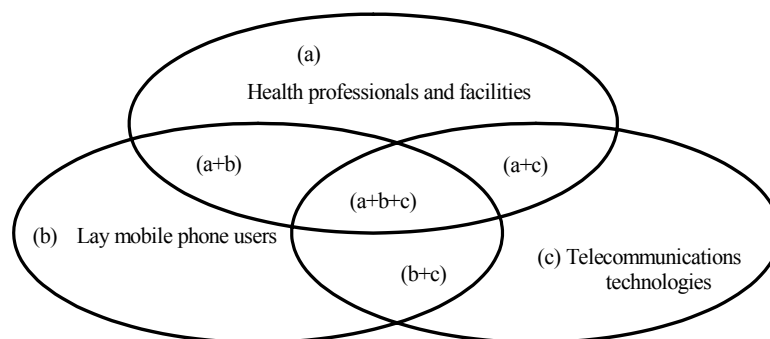


Figure 4.1: Major Element Categories in the Mobile Phone and Health Network

Because of the complex nature of interactions, there was a natural overlap between categories including health professionals who are themselves lay mobile phone users when they are not engaged in work-related activities. Throughout the remainder of this

chapter, I will show through examples provided by respondents how these grouped network elements relate to each other to generate health outcomes.

The subject of emergency health care in relation to mobile phones dominated discussions about potential health-related uses as well as empirical experiences. It was common to find respondents able to recount their own use of mobile phones in such situations, the experience of a relative, or hypothetical situations in which potential health benefits could be gained. In the study sample almost all of the 66 respondents were able to describe a specific personal emergency care experience in which they used their mobile phones to improve access to emergency services. Many of their descriptions focused on the interactions between the grouped elements in categories a, b, and c in Figure 4.1, whereby a lay user personally experienced or witnessed an emergency situation, used his or her mobile phone to contact a family member with a fixed-line telephone who was then able to access emergency transportation to the appropriate health facility. Among respondents emergencies ranged from addressing the needs of aging parents to child birth to reporting accidents that they saw on the road or in the Nile River and tributaries.

Actual and hypothetical emergency health care experiences

Oftentimes when respondents spoke about mobile phones in emergencies there was a duality to their responses. Some spoke of the potential support that could be mobilized by mobile phones in emergency situations and the sense of security that having one on hand provides, while others were able to recount actual emergency situations in which they used a mobile phone to address an emergency. In order to preserve the ability of respondents to recall details of empirical experiences I asked each one to share information regarding their last three phone calls to and from the mobile phone. Several of the calls described were related to mobilizing support in an emergency situation. A 23-year-old football coach answered that his last three calls were all related to helping his sister with a situation involving an injury sustained by her daughter as she tried to disembark from a moving minibus. The sister called from her mobile phone to her brother's mobile phone, and he was able to organize the necessary support.

My sister did not have an experience like that before in her life and when the accident occurred to her daughter and she got injured, my sister did not know what to do, she could not act alone, she called me and I helped her. So the mobile was very useful in that situation, she called me and found me at once.

Football coach; age 23; male; peri-urban; user

Prior to the mobile phone, the respondent's sister would have had to tend to her daughter's injury on her own. In this situation she is able to consult with someone she knows that can provide the information and guidance she needs to manage her daughter's condition.

Of those speaking in generic terms (28 respondents), eighteen were male and ten female and ten were from the urban sample while the majority were from rural and peri-urban areas where other modes of communication are limited. Half of these respondents highlighted that the key benefit of having a mobile phone was to save time or cut in half response time to specifically address *hawadis fil tariq* or road accidents. Their speculation regarding potential areas for mobile phones to be beneficial was in response to very broad lines of questions regarding the "health benefits of mobile phones." Because Minia Governorate is known for having a high number of automobile accidents on both the desert road as well as the agricultural road, respondents mostly focused their attention on this potential area of intervention. Their discussions primarily centred on the desert road where the average speed is upwards of one hundred km/hour, resulting in much more intensive fatalities than those experiencing accidents on the agricultural road. For these respondents, the comfort and security of having the mobile phone *ihdiyati* "just in case" seemed as important as empirical experience.

In general, hypothetical responses were not as informative as when respondents actually shared specific emergency situations in which they used a mobile phone to gain health benefits. They, however, did confirm that motor vehicle accidents are a critical area for potential formal integration of mobile phones by the health sector. They also confirmed the preservation of safety and security as a motivating factor in acquiring the technology.

A dramatic example of buying a mobile phone in “case of emergency” was shared by a respondent who uses his mobile to reassure his children.

There had been an accident on the highway of Samalut, it was a taxi and it turned upside down, that was two years ago, and the news had spread, and on that day I was working, and I returned late, I found my wife in a hysterical condition and when I asked her what was wrong, she told me that she didn't know about me anything, and she heard that there was a taxi accident, and that I was late. So at that moment I felt that the mobile would be useful.

Driver; age 35; male; urban; user

Although not anticipated, the focus on automobile accidents was not surprising. In Egypt at the time of the study, highway crashes accounted for a loss of five to six thousand lives per year (Shahine 2002). Based on an article about another bus accident in Egypt published two weeks after the bus accident in Abu Korkas, “losses caused by traffic accidents are estimated at [one billion Egyptian pounds or approximately \$200 million USD] a year, including damaged vehicles, health care, hospital fees, and lost working hours” (Shahine 2002, p. 2). As presented in the introduction to this Thesis, mobile phones are generally explored as part of the cause of motor vehicle accidents and not as a part of impact mitigation. As such improved telecommunications may be creating new demands on the health sector for the provision of emergency care services, starting with enhanced responsiveness to automobile accidents. This theme of improved access to health services, transportation, and information was a clear focus in both generic and actual reflections of health related uses of mobile phones in emergencies.

Use of intermediaries to access emergency transportation

A second theme, namely the use of *intermediaries* to access health services, transportation, and information, emerged in interviews during which respondents described their engagement or knowledge of the use of mobile phones in actual emergency situations. *Intermediaries* use mobile phones to access services and information on behalf of others. Health professionals often consult other health professionals as intermediaries on behalf of a patient for more specialized information to

determine the most appropriate course of action. In the case of health professionals, this informal decision support consultation process broadly falls within the field of *telemedicine*. Among lay users, individuals use mobile phones to mobilize support on behalf of a relative or stranger (altruism). *Mothers as intermediaries* also use mobile phones and fixed-line telephones to consult with other family members and health professionals on behalf of a sick child. In Minia, there was sufficient access to mobile phones at the time of the study in urban settings, such that respondents provided accounts in which they either borrowed or lent a phone free of charge to address an emergency situation. This extension of improved access to telecommunications beyond mobile phone owners accounts for even broader contributions to health benefits within society. For some respondents it was the witnessing or experiencing of an emergency which motivated them to purchase the technology, especially individuals who own automobiles. These usage patterns are the result of naturally evolving health-related applications at the individual level.

The analysis of lay user responses varied relative to health professionals in terms of how they expressed the health benefits in emergency situations that they have reaped from mobile phones. The key area of variation was in discussions regarding calling patterns and the use of emergency phone numbers and codes to access and coordinate responses. During the early stages of my data collection in Minia, it became clear that there was much confusion in terms of what number ought to be used to contact an ambulance. At the time there was one fixed-line telephone code that was meant to be used for ambulances, “123,” which was known by most respondents. However, all the calls that respondents reported making to this number from a mobile phone were recounted with frustration as they were routed through Cairo and only provided access to information about services in Cairo after a significant waiting period. This service was not particularly beneficial for citizens in Minia living 400 km south of the Egyptian capital.

Health professionals expressed their frustration and confidence with emergency call numbers, including an ambulance worker who described the dysfunctional nature of “123” from a mobile phone and the recommendation to use “122.”

Communication is the basis of my work, I don't move from my place except when someone calls me. And, concerning the subject of using the mobile to call the ambulance it doesn't work, if you call 123 you will get the first aid in Cairo, then they transfer it to us, but if you need us direct, you dial 122 from the mobile, it is the number of the police squad in Minia.

...

People know that if they need to call the first aid, they would dial 123, but in case they are on the highway, they could dial 122 from the mobile, and the last number is the police squad, he informs them about his place in case of an accident, then the police squad could call the ambulance in the east at which there is a big operation room.

Probe: Is the number of the police squad known?

Yes, they always say it on channel seven on the television.

Ambulance worker; age 44; male; urban; non-user

Instead of using “123” many mobile phone users in Minia call their relatives or friends (specifically on a fixed-line telephone) to coordinate assistance or the local police “122,” in emergencies. When asked about emergency call numbers only three respondents did not know a specific number that they could dial to receive assistance in the case of an emergency. These patterns and inability to directly access government services were best expressed by a respondent in the following way whereby a cousin contacted a friend to send for an ambulance.

A discussant interrupts: my cousin had an accident in Assiut and it was so difficult to call from his mobile any governmental service centre, so he called his friend to send him an ambulance.

Two male physicians- natural group discussion; urban; users

Families, friends, as well as police (as illustrated in the quote above) maintain a coordination function as intermediaries mostly because the cost in time and money of trying to coordinate emergency ambulance support from a mobile phone is quite high.

The prominent use of intermediaries means that the lay mobile phone user category can be conceptualized as wider than actual owners. The critical mass of mobile phone users extends benefits to others beyond the owners themselves. In Minia, two such illustrations

of altruism were expressed by key informants. One respondent shared that his brother who frequently travels on the highway as part of his transportation business contacted him to coordinate emergency support for someone who had an accident on the highway. Another example, provided by the MOH representative illustrates how his son contacted his mother to mobilize similar support for a stranger that he had witnessed experiencing an accident.

One day my son saw an accident on the detour route, so he took the mobile of the injured to call his mother and one of his friends, and my son stayed with him until the ambulance came, also his mother and also the friend that he called.

Ministry of Health representative; age 58; male; urban; user

People involved in or witnesses to emergency situations will oftentimes use mobile phones to coordinate responses with people having access to fixed-line telephones particularly family and friends. The diagram below summarizes the various means by which individuals use a combination of mobile phones and fixed-line telephones to access emergency health care services. Due to cost implications, the most common usage is to make short calls with a mobile phone to a family member or friend to mobilize the necessary support on behalf of callers acting in an altruistic capacity or to address their own needs. As presented in the literature review the notion, that the “calling party pays” lends itself to shorter outgoing calls from a mobile phone (Donner 2005b). This combined with the much cheaper calling rates of fixed-line telephones (approximately \$1.80 USD per hour) than mobile phone rates (approximately \$8 USD per hour) (Africa Connection 2002) provides the basis for such calling patterns in Egypt.

In contrast to urban-based respondents most lay users in rural areas reported having never directly or indirectly requested support from ambulance services which have been available for over four years, but rather arrange their own private transport to health facilities. For the isolated village which has a population of 13,000 people, the closest ambulance unit is considered to service only the desert road and not their needs. In speaking with rural vehicle owners, who were also more likely to be mobile phone users, they shared their experiences serving in the role of informal medical transport. One who

also discussed how he is consulted about which health service provider to go to for examination and treatment.

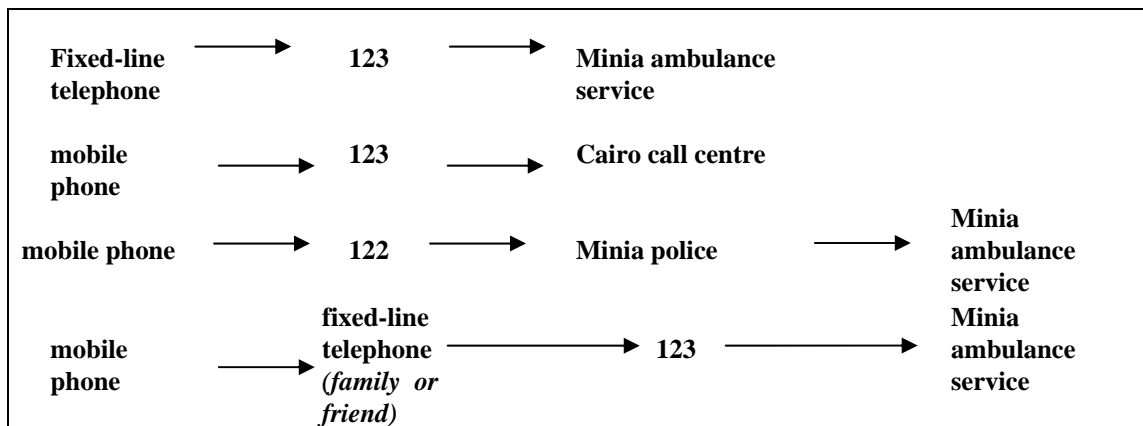


Figure 4.2 Calling patterns to access emergency health services via mobile phones

Ambulance transfers are free of charge, except in the cases of transfer to private facilities mostly for the rich who are more able and expected to pay. Interview respondents tended to express more trust and control accessing transport through neighbours or relatives with cars even though the costs can be higher than what most people can afford. For one village the cost of transport in one direction to the nearest city is ten Egyptian Pounds (approximately \$2 USD), while for another it ranges between 30 and 50 Egyptian Pounds (approximately \$5 to \$10 USD). It is worthwhile keeping in mind that the majority of Egyptians live on income under the equivalent of two USD per day (World Bank 2002). Within the network analysis, access to timely and affordable transport has the potential to enhance the overall role of improved telecommunications. Before mobile phones, access to transportation and to emergency health care services was more time intensive as well as potentially more costly to the physical and financial well-being of victims and their families.

Improving coordination of emergency health care services

Once patients are able to access transportation and entry into health facilities, the use of mobile phones and in the case of ambulances emergency wireless systems for the coordination of service provision begins. On the other side of access to health services is the effective and efficient coordination and provision of those services. As in the example of the bus accident, mobile phones are being used to call medical personnel to emergency rooms. To mobilize several physicians at once, one respondent who presented himself as a technophile shared that he uses text messaging to mobilize staff to come to the hospital emergency room to address the needs of multiple motor vehicle accident victims. This key informant sends an SMS message to several medical colleagues of whom usually about three out of four are able to respond. When enough medical personnel have responded, he sends another message to let the others know that he no longer requires their services. This innovative use of mobile phones can be applied to other aspects of health service delivery.

Emergency wireless systems, as part of the body of telecommunications technologies along with mobile phone, are also used to call into health facilities the types of cases that are being transported. An ambulance worker shared the following benefits which were very similar to those of mobile phones, the emergency wireless system: 1) saves time, 2) facilitates hospital service preparedness, 3) helps identify and coordinate blood bank requests, and 4) enables decision making support during patient transport and ambulatory care. A key challenge with improved communication as indicated by the same respondent is a generally felt increased demand for emergency medical services. This is comparable to the study conducted in the United States that documented the estimated increase in the number of wireless emergency calls from 1985 to 2001 and the reduction in time of fatal crash to Emergency Medical Services (EMS) notification (Horan and Schooley 2002). The analysis showed a positive correlation between increased access to wireless communications and time saved and an overall increased demand in EMS (Horan and Schooley 2002).

Conclusion: Role of mobile phones in emergency health care

It would be expected that in Minia with improved telecommunications, access to and demand for emergency transportation and health care services would increase as was reported in the American EMS study (Horan and Schooley 2002). The ability of health facilities to respond to an increasing demand for services is critical to the overall maximization of mobile phones within emergency health care services. To support the strategic integration of mobile phones by the public health community in Egypt further study is needed to explore mobile phones in the context of emergency services. Such study should aim to ascertain which aspects of mobile phone access and use are contributing to specific improvements in health outcomes as well as to ensure that capacity within facilities is strengthened to address the increased demand for services. For emergency health care services, the role of the mobile phone is focused primarily on improving access to transport and services in order to more effectively care for patients. With respect to general health service delivery, for both health professionals and lay users there was a greater focus on the role of the technology in its capacity to facilitate access to information and enable remote patient monitoring and service coordination.

The role of mobile phones for everyday health care

In general health services mobile phones in Minia enhance immediate contact between and among lay users and health professionals for access to information as well as coordination of health services. When asked about their perceived benefits of mobile phones within the health sector beyond emergency health care, the majority of key informants described the primary benefit as the ability of doctors and patients to initiate contact and be reached at any time and in any location to address health problems. Among health professionals, the domestication of mobile phones into their everyday work life has resulted in increased mobility, facilitated work in several places and increased remote patient monitoring. It has also enabled physicians to consult with one another for guidance on complicated cases (telemedicine). Although less prominent, two respondents described the use of mobile phones in the prevention of both human and

animal-borne disease transmission. Outside of the health sector with respect to lay health communication, mobile phones are reportedly facilitating contact between children travelling or living away from home to consult with their mothers to address minor ailments.

Many doctors in Minia, as is the case in most of Egypt, generally work in multiple locations: hospitals, public and private clinics, in addition to making house calls. In the study sample, six doctors mentioned benefits in this regard, specifically noting that they are able to be in “two places at one time.” Many maintain a private practice alongside teaching as well as government posts, and mobile phones help to make their work in multiple locations more efficient. Related to the theme of facilitating work in multiple locations, the notion of finding doctors was expressed by eight respondents as another benefit of mobile phones by doctors and administrators, particularly when trying to locate specialists. For doctors with fixed schedules, mostly those who do not have mobile phones, they commented that they can be found easily on fixed-line telephones. As such they recounted finding the technology less useful in their own professional activities, but useful when trying to consult or summon doctors with mobile phones and less predictable schedules.

Remote patient care

Contacting other health professionals as described by respondents is usually either consultative or associated with organizing health service delivery. Eight respondents mentioned the use of mobile phones for coordination purposes in response to emergencies and in requesting guidance from physicians with particular specializations. Thirteen respondents discussed contacting other health professionals to access second line staff, obtain consent or permission for action, and to receive and discuss lab test results. Each of these interactions contributed to the mobilization of remote patient care. In many ways this ability of health professionals to instantaneously transfer information or directives off- or on-site in support of treatment and care related decision making is new and unique to the introduction of mobile phones into society.

The following quote introduces the concept of remote in-patient care through the interaction between residents and other second line staff within the health sector who are able to consult with, relay patient status to, and receive guidance or decision support from primary care providers and specialists.

Changes in cases happen every minute and hour. I know patients well and maybe five minutes after I leave a patient his situation changes and the resident has a question for me or information on lab results to save me from making a trip back to the hospital. (Shaking his hands) It is not a substitution for seeing patients, but it does economize efforts. If I know that a result will not be available then I can spend an extra few hours waiting while I am doing something else. Last night, a private hospital resident called to follow-up on a patient.

Emergency Response Specialist from Cairo

Mobile phones have enabled this respondent and others to multi-task. They create free time for physicians to address other professional and personal obligations. The following diagram illustrates such interactions between patients and health professionals, whereby physicians based in health facilities (on-site) can verify patient information and proposed actions to be taken or seek direction from the primary health professional (off-site) responsible for a particular patient in his or her absence.

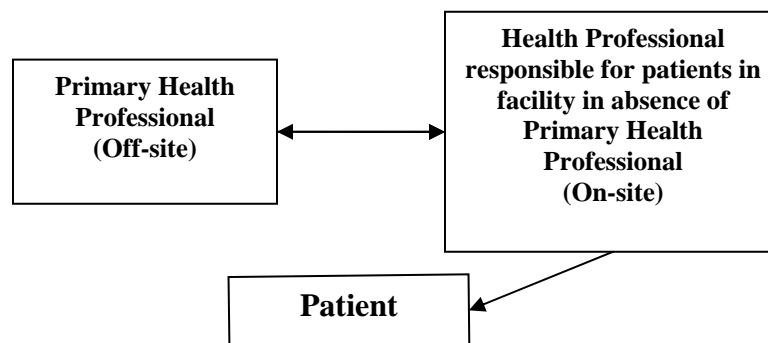


Figure 4.3: In-patient care coordination by junior health professional

This is similar to the decision support system for home-based care for HIV positive patients presented in the literature review (Stecker 2002), where a home-based care provider uses a mobile phone to communicate a patient's condition and receive guidance.

The key benefit derived is the minimization of unnecessary travel for both health professionals as well as patients, potentially resulting in the saving of time and money. The question this raises, however, is *how effective are phone consultations in contrast to a physical encounter and examination?* As acknowledged by the physician above caution must be asserted that improved capacity to receive decision support is not a substitute for seeing patients that need to be seen.

The coordination of remote patient care varies significantly between formal health care providers, such as physicians and nurses, and informal ones. For informal health care providers, such as traditional birth attendants, known as *dayas* in the Egyptian context, newfound connectivity has been approached more cautiously. It has been my experience that in reproductive health research in Egypt that *dayas* are viewed by many Egyptian health professionals, namely physicians, as peripheral, although they remain responsible for the majority of births in Minia Governorate. Medical doctors traditionally look down upon and criticize the work of *dayas*. The two main concerns in relation to the work of *dayas*, according to one Obstetrician/Gynaecologist in my sample, are 1) ability to establish a hygienic delivery environment in the home to minimize infection and 2) ability to address complications in a timely fashion. The antagonism between the two groups of service providers manifests itself in reluctance by *dayas* to contact medical professionals except in the case of extreme complications during child birth. For them consultation with health professionals has always been a sensitive subject as it somehow implies that they do not have things “under control.”

In spite of the antagonism between *dayas* and physicians, a remote consultation pattern was shared by a labour and delivery nurse who often serves as an intermediary between *dayas* and physicians in cases of complicated births. This was confirmed as a regular practice by another Obstetrician/Gynaecologist in the study sample as part of his discussion of communication patterns with *dayas*. Oftentimes *dayas* will not communicate directly with physicians and so nurses become mediators or intermediary communicators. They are also able to contact other health professionals for advice while attending to patients in their homes, where the majority of births in Minia still take place.

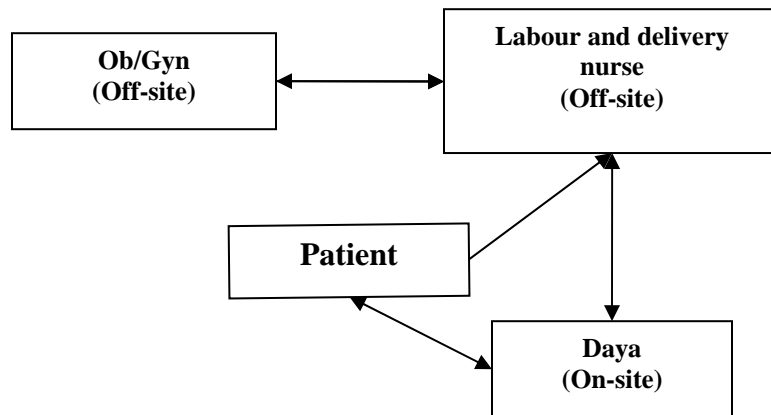


Figure 4.4: Coordination of labour and delivery services for home deliveries

In this scenario, information from a specialist (Ob/Gyn off-site) is accessed on behalf of a patient by a daya (on-site) through a labour and delivery nurse (off-site) or directly, however rare, by the daya herself. When asked the question, “*How do women and the midwives call you from the villages?*” one Ob/Gyn responded:

They do not call us, and we cannot make them leave the villages, they are like creatures that you cannot run away from, the only thing that we can offer is to provide training and we could talk to them to improve their capabilities. (Another doctor interjects) the daya never asks a doctor about anything except if the case becomes critical, and if something wrong occurs, and there is no hope with the case then they call us.

Ob/Gyn; age 59; male; urban; non-user

At the time of data collection, there was talk of a special program under development in Egypt as part of the National Healthy Mother/Healthy Child Initiative to establish communications links through fixed-line telephones and mobile phones between *dayas* and local health professionals, maximizing the rapidly changing telecommunications infrastructure. In the context of such a program, the contribution of improved telecommunications should be evaluated in relation to health outcomes. Although throughout my study, the potential role of mobile phones to address obstetric

emergencies was discussed, there were no actual examples of such occurrences within the empirical data collected.

For patients requiring treatment guidance from health professionals, mobile phones offer quick answers as well as quick reassurance. The following illustration provides an introduction to the nature of remote mobilization of treatment support by patients themselves through the use of mobile phones. The nurse describes two situations in which patients who were uncomfortable with the treatment regimen or desired to be released circumvented health facility staff to directly contact their primary physicians to gain information or catalyse action.

I am working in a hospital, and we were treating a patient by giving her a chemical dose, the problem was that the patient was aware of everything about her condition and the dose she was taking, and she was very worried when someone of us was giving her the dose, and if another doctor gave her the dose other than her doctor she would be very worried. And, once the assistant gave her the dose and he added twelve drops, so she called her doctor and told him that they had increased her dose, so he told her that there was no problem and he assured her, and it would be a big problem if the doctor wouldn't assure her.

Also, once there was a patient who needed to take permission to leave the hospital, and his doctor was very busy, so the patient called him on his mobile, so in his turn the doctor called his assistant and told him to make the necessary arrangements to make him leave, and after that the doctor would take care of him at his clinic.

4 Nurses; age 32-45; female; urban; non-users

Providing reassurance to patients via mobile phones was recounted as an increasingly normal part of their work. As shown in the figure below, patients are more involved in their situations and can access the reassurance they need from their physicians as well as mobilize action as necessary in the absence of their physician.

Mobile phones increase access to information from sources pre-selected and trusted by the patient, increasing the sense of involvement they have in their treatment. Related to this, using the phraseology, *following up on patients*, eight out of the 24 health

professionals interviewed mentioned that mobile phones help them to be reached by patients mostly with questions about prescriptions and by other health professionals on behalf of in-patient ward occupants.

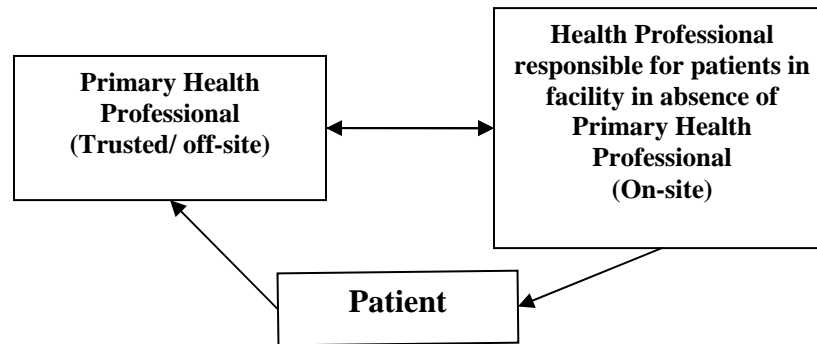


Figure 4.5: Patient coordinating personal health care processes

For many physicians, this increased remote contact with patients was described as a positive movement towards enhanced patient care. However, it raises questions regarding the access of patients to appropriate information as well as their capacity to play an active role in discussing treatment with health care professionals.

Telemedicine

Directly related to coordination of health service delivery, access to advice and insight was readily discussed by most of the health professionals whom I interviewed in informal terms. The mobile phone was described as helpful because a physician can more easily reach a colleague in Minia or outside of Minia to ask about a specific case. This exchange of experience and information is critical to ensure optimal care for patients. For most health professionals the term, *telemedicine*, elicits grandiose notions of hi-tech equipment when it is simply the process of healing (medicine) from a distance (tele). The concept of health-related uses of mobile phones is one aspect of telemedicine that includes other technologies as well as a range of both formal and informal uses.

Formal telemedicine generally refers to pre-established institutional relationships between two or more health facilities. For example, there are hospitals in Cairo with formal agreements with hospitals in the United Kingdom, whereby Egyptian physicians are able to consult with British specialists on specific cases. Informal telemedicine ranges from friends calling each other for social purposes and asking for an opinion on a case or contacting a specialist to ask for guidance without a pre-established institutional arrangement.

While most health professionals interviewed in Minia limited their foray into the realm of information technology to mobile phones, there were three that discussed their professional use in relation to other technologies. Primarily this included the use of digital cameras and the Internet for telemedicine by transmitting images for consultation with physicians in other geographic locations in Cairo and abroad which corresponds to the traditional perspective of telemedicine as a decision support mechanism. Camera phones had not yet appeared in the Egyptian market at the time of my study which provides additional opportunities for future directions for telemedicine via mobile phones. As for more formalized telemedicine, most of the health professionals did not seem ready to embrace this in Minia particularly between *dakatra sagheer* “small” less experienced and *dakatra kubar* “large” expert doctors, but it is happening in informal ways among close colleagues at the same level. Some of this may be a reluctance to acknowledge limitations in ones own skills, experience, and knowledge to someone who is not familiar or trusted.

As presented in the literature review health and technology professionals acknowledge the increased availability of mobile phones and their potential to support mobile telemedicine systems. The newly emerging examples of telemedicine initiatives between urban and rural health care providers and health care providers in facilities and patients at home from countries such as Pakistan, Russia, and Poland (Med-e-Tel 2006) will be of most relevance to a setting like Minia, where most respondents living in rural areas reported seeking treatment in urban areas due to the poor quality of health care services

as well as the lack of specialised care. This aspect of health service delivery will be further discussed in the context of limits to maximized use of mobile phones for health.

Disease prevention and control

Apart from the use of mobile phones for the transfer of information for the treatment of patients, several respondents also discussed in detail health applications related to disease prevention. One example was described by a health service administrator and related to the enforcement of food quality for the prevention of food poisoning.

In general prevention, as in the case of food poisoning that happened once at Minia General Hospital, there were eleven cases of poisoning, and they needed a food inspector, so they called me on the mobile, and we went and took a sample and made the necessary follow up to determine the cause.

Health Centre Director; age 55; male; urban; user

Improved communication along with enforcement in this sort of epidemiological investigation has the potential to reduce the risk of exposure within the general public in similar situations. In such cases a health administrator can use the mobile phones within an investigation team to identify the source of the food poisoning, develop a response plan, mobilize the necessary action to be taken, and ensure enforcement of protective measures. Also, individual physicians receiving such cases can detect patterns and report such occurrences quicker to local administrators. Of more recent public interest due to the global media coverage regarding avian flu, was an interview that I conducted with a “lay” mobile phone user in one of the study villages, who was an animal health worker with a chicken farming and distribution business. He described his work-related use of mobile phones in the identification of disease, treatment, and immunization of chickens.

For example someone can call me to tell me that the chickens have diarrhoea, I can advise him with what to do and which medication to use in the fodder or in the water and he can ask when to give it to them, I can tell him during sunset this is because if chickens were exposed to the sun after they took the medications... So, the mobile is useful for the worker to find me at any time, sometimes I cannot specify the case of the chickens so I have to go to check by myself, to check their abdomens, their livers to see

what is wrong with them and to give them the medication which is suitable for them and I cure them.

Animal health worker; age 34; male; rural; user

Again many of these processes are informal and have not yet been systematically applied with standard protocols within the Egyptian health care system. In other contexts where mobile phones are being used to support the identification of polio cases and to mobilize surveillance for other diseases in developing countries, little has been done to explore the role or contribution that mobile phones have made to their efforts.

Consulting mothers

Beyond the health sector, for minor ailments mobile phones facilitate consultations and access to information by lay users. This often takes the shape of consulting mothers or relatives who are health professionals. For those with health problems that require in-patient health service or out-patient monitoring, mobile phones are used to access information and coordinate activities within and outside of health facilities. Mothers emerged as having a prominent role as intermediaries and sources of health information in addressing the general health needs of their children who reside within the same household as well as those travelling for work or study. For lay health communication related to children living at home, mobile phone communication was primarily used by households that did not have a fixed-line telephone in the home. In urban households, mothers reported using mobile phones when they are off-site to monitor the progress of their children's recovery from illnesses such as colds, flues, and stomach viruses. For female health care professionals, their health-related uses of mobile phones in support of their children's illnesses were both professional as well as personal.

Within the broader theme of addressing general health care needs, the mobile phone provides a connection between travelling children and their mothers with whom they reportedly consult before going to a health facility. For one 19 year old female university student from Sharm el Sheikh studying in Minia, she reported being given a mobile phone so that she could contact her parents in case of an emergency and daily

assurance of her well-being and vice versa. When I asked her about her last illness experience and how she addressed it, she responded that due to fear, she used her mobile phone to consult with her mother before going to the hospital. She then proceeded to describe the guidance that her mother gave to her in caring for a head wound via the phone.

My head was injured, I was in Cairo, so I called my mom to ask her what to do, and how to clean the wound because I didn't want to go to the hospital again, because I went the first time and the doctor did the needful, but I was afraid, so I called mom, and she told me to eat, and she described to me how to clean the wound, and how to change the bandage, so the mobile was very useful in that situation, if I didn't have the mobile I wouldn't be able to call mom.

Student from Sharm el Sheikh; age 19; female; urban; user

In another example, a newly married 25-year-old who moved away from her family with her husband's family as is the custom in Egypt, explained to me that there were very few educated people in her new rural home environment with whom to consult about health-related problems. As a result she primarily consults with her mother, whom she describes as being older, understanding, and experienced, on behalf of her newborn child. Her mother regularly contacts her from a fixed-line telephone on the household mobile phone. This pattern of young married women consulting their mothers for health is common in Egypt as documented by the study on breast-feeding behaviours in Egypt (Harrison et al. 1993). I also had one male respondent who travels for work recount a similar experience to the female student studying abroad. Although these patterns within lay health communication are not uniquely new with the introduction of mobile phones, they are now more convenient and frequent than when individuals primarily relied on telephone call centres outside of the home.

Conclusion: The role of mobile phones for everyday health care

In general health services, mobile phones promote three lines of action 1) remote patient care 2) consultation (with mothers or relatives who are health professionals) or telemedicine (peer to peer), and 3) transfer of information for disease surveillance and

prevention of future infections. Mobile phones have enhanced the capability of health professionals to remotely coordinate patient care and access specialised information. They enable health administrators to mobilize prevention efforts to minimize the effects of human and animal borne diseases and children to consult with their mothers to address health problems. Many of these communication patterns are new with the introduction of mobile phones. The formal integration of the technology by the health sector has the potential to generate new opportunities as well as challenges.

Newly experienced “immediate contact” among health care professionals raises many questions. Do physicians want other physicians and patients to have direct access to them? Which types of health care professionals should be more readily accessible? With the increased volume of communication, is centralized moderated contact needed? To what extent can clinical advice be provided by phone? These questions relate to the provision of both emergency and general health services address the need to overcome perceived limitations to the maximized use of mobile phones within the health sector and will be addressed in the last two case studies, namely the limits to the domestication of mobile phones for health and recommendations for formal integration.

The role of mobile phones in family communication and well-being

As mobile phones become part and parcel of daily life in Egypt, their benefits to the health of society extend to well-being, not just improving access to and coordination of emergency and general health services. This observation is in direct support of maintaining a state of “physical, mental, and social well-being” as described in the WHO definition of health presented in the Thesis introduction. Similar to the rest of the Arab Region, the family in Egypt is the “foremost social institution.” As such, Zeinab Khadr and Laila El-Zeini (2003) in their paper entitled, “Families and Households: Headship and Co-residence” describe it as the focal point for both reproduction and decision making (Khadr and El-Zeini 2003). It is not surprising that in the case studies exploring the role of mobile phones in emergency and routine health care that the families and family members play critical roles in the coordination and mobilization of support and

serve as key sources of advice on health issues. This correlates with the family's role in assuring and preserving the well-being of its members. As such, the prominent theme that emerged in the empirical experience of respondents was the role of mobile phones in producing an increased perception of security of contact between family members to maintain "peace of mind" and collectively manage difficult situations.

In the Minia study sample, the most common reasons that people indicated in terms of why they bought mobile phones were for work (12), to be reachable (10), travel (10), social pressure (6), and emergencies (5). These purposes are more supportive of social aspects of life and their prominent influence on health is likely to be interlinked with social and economic advancement and the assurance of well-being. Although as a public health professional I was more interested in the direct health benefits, the empirical data that was generated enabled reflection on the perceived importance of the mobile phone within the family as a source of assuring and maintaining well-being. Hania Sholkhamy, an Egyptian medical anthropologist, argues that the traditional separation of health research from exploring the natural context of the daily experience of people's lives is artificial. The preservation of well-being should also be recognized as a form of disease prevention and impact mitigation for health conditions (Sholkamy 1998). As such it is important to consider the holistic context in which mobile phones are used to gain a more complete picture of potential interactions for health benefits and not just when they are used to address a specific health problem.

Social determinants of health and mobile phones

A family's access to improved economic security, educational opportunities, and enhanced social relations as enabled by mobile phones contributes to the broader ***social determinants of health***. Such indirect health benefits tend to focus on economic security, gender dynamics, familial relationships, and social interactions as well as other key aspects of people's living and working circumstances (Wilkinson and Marmot 2003). The direct role of the mobile phone with respect to the social determinants of health was difficult to ascertain, although respondents spoke frequently of its role in social change in Egypt. Given the nature of such relationships within the public health literature one

could speculate that individuals earning more money, attaining higher levels of education, or being able to join the labour force are likely achieving some indirect impact on the health of their families.

A first consideration for exploring the potential role of mobile phones in the broader determinates of health is their utility for fostering communication within families. In Minia, Egypt, as in other contexts, mobile phones are purchased with the aim of enhancing family communication. Jon Agar describes this dynamic in his modern historical review of mobile phones, aptly entitled Constant Touch: A History of the Mobile Phone.

Mobile phones are carried as part of the complex strategies that we all develop for dealing with the risks and dangers of modern life. So a phone is bought by parents for a son or daughter who is leaving home as a student, or for a teenager who is starting to stay out late at night, as an act of reassurance. Should they ever be in trouble, they will not lack the means of contact. The diminishing guardianship of family is replaced by the constant touch of the mobile phone. (Agar 2003, p. 139)

Throughout my data collection in Minia, many respondents talked about the relationship between mobile phones and health and well-being in broad terms, including having a sense of peace knowing that their family members could phone in an emergency and be contacted directly wherever they were. Within the mobile phone and health network, family members as a user group emerged including husbands, wives, sons, daughters, sisters, brothers, mothers, and fathers. In general, mobile phones were described by respondents as enabling 1) mobility, 2) the transfer of information regarding personal conditions (status), and 3) coordination of solutions to problems at a distance. This reportedly produced an increased sense of security that within an instant contact can be made with family members who can provide guidance, information, comfort, or mobile support. In the context of the role of the mobile phone in emergency health care, this was illustrated by the respondent whose sister was able to contact him for guidance on her daughter's injury immediately.

Three major types of well-being discussed by respondents in relationship to mobile phones emerged from the empirical data. The first of these is a perceived sense of *psychological or mental well-being*. Phrases such as “*ana be sta’mil el mobile alashan a tammin ala...*” (I used my mobile to check up on and be at peace about...) were frequently used by respondents in the context of family members running errands, going to work, or living away from home. The second type of perceived well-being was that of assuring the *physical well-being* of family members. This has been discussed in the previous two case studies as part of the family’s strategy to minimize the negative health impact of emergencies such as automobile accidents and routine illness. In this case study, I will explore the use of the mobile phone as tool to be carried “just in case” to mitigate the impact of physical harm particularly while travelling as described by twenty-four respondents. The third type was the use of mobile phones as a source of *economic well-being*. In relation to their discussions regarding business and other work-related uses, twenty-eight respondents described how they use their mobile phones for work with a sub-set detailing how they have increased their revenues and income as a result.

In the context of this case study, I will focus mostly on the two main themes within family communication and the assurance of well-being that cover many aspects of the social determinants of health listed. The first theme that emerged was changing dynamics within husband-wife relations as they directly related to mobile phones as well as to the social change affecting Egyptian families to varying degrees. The second theme addressed changes in the dynamics of parent-child communication. This theme encompasses the day to day care for children as well as for the growing cohort of aging parents. As such an individual may find him or herself in the role of contributing to the well-being of his or her parents and children at once as observed in several discussions among mobile phone users in Minia. Key social changes occurring in Egypt are potentially intensified by the integration of mobile phones in the daily lives of men and women, creating platforms for the enforcement of tradition as well as the establishment of new territory and social identities.

The common thread between the two themes is gender. Adolescent boys and girls and recent university graduates are increasingly attaining greater levels of freedom with the facilitation of their travel for education as well as work with fewer responsibilities. Married women are also attaining greater levels of freedom; however theirs is much more controlled by the traditional focus on their roles as wives, mothers, and increasingly members of the labour force. Apart from daily assurance or addressing household errands, solving problems was the primary focus of phone conversations among family members.

Social change and the Egyptian family

Before presenting the data related to mobile phones and all three types of family well-being, it is important to introduce critical aspects of social change being experienced in Egypt. Egyptians are increasingly mobile. Extended families are becoming exceptional and nuclear households living in separate geographic locations the norm. Young people are travelling more for education as well as employment opportunities. Husbands are continuing a trend towards migration for work to other Arab countries. Along with an aging population, such movements are creating changes in both husband and wife as well as parent and child communication. Mobile phones entered Egypt at a time in which these dynamic changes within society were being experienced by more and more families. Although some observers might attribute aspects of social change to mobile phones, my observation based on comparisons of the empirical data with demographic and other ethnographic and sociological studies of Egyptian society is that mobile phones are a catalyst or support mechanism for pre-existing trends within society. In addition social change, Leslie Haddon argues, has the potential to set the precondition for how mobile phones are in turn domesticated (Haddon 2004).

Some of the key changes in Egyptian families that are now being intensified by mobile phones include:

- Movements away from extended family households to nuclear family structures (Ali 1998; Singerman and Ibrahim 2003)

- Increased need for women to join the labour force (Ali 1998; Barsoum 2004)
- Increased dependence on money income and consumerism (Bach 1998)
- Migration of men for work and increasing number of female heads of household (Ali 1998)
- Shifts towards an aging population (Mehanna and Winch 1998; Khadr and El-Zeini 2003)
- Changes in parent-child relations (Al-Tawila et al. 2003)

These trends are contributing to dramatic changes for Egyptian households particularly with respect to the dynamics of husband-wife, parent-child, and male-female relationships. These changes are both trans- and inter-generational as family members cope with increasing distance between their nuclear family unit and the traditional support as well as control over decision-making from the extended family. Within nuclear families, travel for education and work is also more frequent for men, women, as well as youth. This is extending distances between members as well as supporting a trend towards a more individualist society (Ali 1998). One father who travels for work as a driver described calling his children: “If I am on duty at a distant place ... and I am late, it is very difficult to find a phone, so I call my children to assure them that I am doing fine. Also they could call me at anytime to know where I am.” One can legitimately speculate that mobile phones and overall improvements in access to telecommunications are easing some of these trends by enabling contact when needed to support the psychological well-being of family members.

Increased costs of living and focus on a money-driven economy are having two broad effects within Egyptian families: more frequent migration of men for work within Egypt and abroad as well as increases in women joining the labour force. “Women are forced to seek employment outside their homes to help pay for the increasing costs of educating and rearing children” (Ali 1998, p. 172). The result of both dynamics is an increased need for income and involvement of women as heads of households well as decision-makers over the allocation of household resources and other social aspects of daily life. Mobile phones in such situations enable families to increase their household income as

well as maintain contact with migrated wage earners. They also enable women to maintain three roles within the household simultaneously as wives, mothers, and wage-earners. Many of the familial mobile phone trends identified in the study are either exacerbating existing trends in gender relations or forging new territory for future exploration in the broader context of social change in Egypt, particularly in support of maintaining economic well-being of the household.

The two other trends within Egyptian society that emerged within the analysis of empirical mobile phone for health data are the on-going shifts towards an aging population as well as changes within adolescent and parent-child dynamics. With increased distances between nuclear and extended families, the burden of caring for aging parents, particularly for the treatment of chronic diseases, is increasingly being managed and coordinated among multiple nuclear households from a distance. With respect to adolescents increased access to education for girls as well as their exposure to the world beyond the household is influencing their involvement in household discussions as well as interactions with boys. The focus of most parent-adolescent interactions is marriage as it is a major economic project that extends over long periods of time (Singerman and Ibrahim 2003). As a result of the increased autonomy of children, the progression towards marriage, and other changes between the current generation of parents and their children, there are stronger movements towards marriage by choice over traditional arranged marriages. As observed in my study, mobile phone use among youth is reportedly contributing to increased direct interactions between adolescent boys and girls that some view as positively and others as negatively impacting their own and the future marriage prospects of their children. Such interactions via mobile phone cut across all aspects of well-being.

For most households in the study sample in Minia at the time of data collection, there was only one mobile phone. Households that reported having multiple mobile phones (11) generally consisted of two parents working outside of the home or a child who travelled for education or work. The progression of family members with mobile phones began primarily with men, mostly those who purchased the technology for business purposes.

It has since transitioned to increases in adolescent and female users as well older users. This is similar to trends observed by other mobile phone empirical studies (Ling 2004; Donner 2005c).

The primary benefit of having a mobile phone within a household is that whoever is travelling outside of the house can take the mobile phone to communicate with a fixed-line telephone at home or that of a nearby neighbour or a government operated tele-centre in case of emergency. In such situations, it is important to consider who maintains control over the distribution of the device. As such, this individual family member manages the potential well-being of the family and serves as a “gatekeeper”. Apart from the assurance of the physical well-being of family members who are absent from the home, the hope of increasing household income was strongly expressed by those who purchased the mobile phone for business purposes or to enable a new family member join the labour force.

Husband-wife relations

As social change in Egypt dramatically impacts on the lives of families, the most documented aspect is related to married couples as well as marriage prospects. Eight female and seven male respondents mentioned that they use mobile phones to facilitate contact with their spouses. In the study sample in Minia, there were examples of households in which the husband worked in another part of Egypt, leaving a mobile phone with his wife. I also found a woman whose family lives in Cairo, but was given a mobile phone by her husband so that she could make, what she described as, a positive career move to Minia. These examples help to illustrate how mobile phones serve as enablers in the pre-existing stream of social change. The range of communication topics as experienced by husbands and wives primarily focused on one of three major themes: 1) communicating delays in return home to let a spouse know that s/he will be late; 2) confirming location when travelling; and 3) requesting items to be brought home.

In Minia, male entrepreneurs and small business owners in their primary role to provide for their families as in the example below have reportedly maximised savings by using their mobile phones for shopping around to identify better pricing on goods for sale as well as minimizing purchase and transportation costs by eliminating unnecessary travel.

It facilitates work, instead of going to a place I could make a call to the customer, but if the customer doesn't have a mobile I would be obliged to go. The mobile has shortened the distances; it is easy to use it at any time because I am dealing with people in Damietta, Alexandria, and in Cairo in furniture, and crops' merchandise. I call them to make the request, and the things I need, so the mobile made it easier instead of travelling, also it helps to know the information I need concerning tenders of the crops, and my trading in general. The mobile has saved me time and effort, and it made my work easier about 90 percent, that is why I spend money on it and buy the charging card with L.E. 110.00, because the mobile is very beneficial and it covers its costs, if not I wouldn't have bought it, I spend L.E. 110.00 every four months and at the same time it saves about L.E. 400.00 or L.E. 500.00 to go to Cairo or Alexandria, it saves money, you spend L.E. 110.00 and in return you earn L.E. 400.00.

Carpenter; age 24; male; peri-urban; user

For a 40-year-old male part-time taxi driver and teacher living in a rural village described the work benefits of mobile phones as follows. “It saves a lot...for example someone needs to be transferred if he doesn't find me I will lose money, the mobile phone has helped in increasing my income.” When asked what percentage his income increased he responded, “35 percent or one third of my family income.” Mobile phones are also increasing the ability for men to travel further from home for gainful employment as well as women to seek more formal employment outside of the home, while fulfilling their household obligations. This for many households is resulting in increased household income and enhanced economic well-being. Although the link between mobile phones and economic security in relation to the data from Minia is anecdotal, much of the literature on mobile phones in developing countries tends to focus on the economic benefits they generate (Bayes 1999; Donner 2005c). The future study of the relationship of such economic benefits to health potentially could provide a necessary bridge for the full understanding of how mobile phones are having an impact on the overall health experience of families.

For one husband/wife pair with whom I conducted separate interviews, dynamics were described in confirmation of traditionally Egyptian patriarchal norms. For example, the husband is the household wage earner who travels for work, leaving the mobile phone at home so that he can contact his family. According to his wife, he has taught her only how to answer calls, but not how to use the phone to initiate calls so that she will not waste minutes on frivolous conversations.

From husband's transcript:

They (my family) can call me anytime if they need something. Also, I go to Cairo a lot, and I am home every now and then. Sometimes I leave the mobile to my wife here because we do not have a phone at home, so I can make sure she is fine, and if they need anything from Cairo, it is easy for me to call them from work.

Manufacturer; age 28; male; isolated village; user

From wife's transcript:

I only receive calls, sometimes my husband leaves it to know how we are doing, and he taught me how to receive calls, and he doesn't want to show me how to use it, he is afraid to lose the card balance. And, I am afraid to play with it in order not damage it, but when my husband leaves it with me, I only receive calls.

Housewife; age 25; female; isolated village; user

In this case the mobile phone provides peace of mind to the wife, while the husband's control over knowledge of the use of the technology reinforces key cultural gender norms. The technology also enables him to seek economic opportunities outside of his village, contributing to the overall improvement of the quality of life for his family. This example highlights some of the aspects of engendered technological control described by Judy Wajcman and will be further discussed in the following chapter (Wajcman 1995).

For women specifically, they mostly reported conversations that followed up on household requests as well as "knowing where her husband is located." This is primarily an issue of preserving "peace of mind" to check to make sure that the other is all right in support of psychological well-being. For maintaining their authority in the marriage relationship, men require that their wives seek permission for specific outings as well as

to inform them of potential delays. Such dynamics reaffirm a man's position within the marriage relationship, while resulting in increased mobility for the woman in general and enabling her to work and study outside of the home and even in some cases outside of the home city or village. For most married female respondents, the mobile phone is used specifically to communicate with their husbands and to a lesser degree with their children.

With increased mobility for women, the respondent whose family lives in Cairo described how she is now able to work in Minia, although her husband, children, and aging father are in Cairo. This arrangement has been facilitated due to the mobile phone provided to her by her husband. For the sub-group of working mothers it is a way to ensure that household duties are addressed and maintained in spite of their physical absence from the home. It was also deemed useful for their work as well. Prior to mobile phones much business was conducted in person, however, now businessmen and women as illustrated above are waiving travel costs and saving time. The increased mobility for women also avails them of additional opportunities for employment outside of the home contributing to increases in household income and enhanced economic well-being for the family. The changes for mothers as care providers are being facilitated by their own use of mobile phones as well as that of children who are outside of the home. This parallels the notion of the role of the mobile phone in enabling both remote mothering and remote work described by Hans Geser (Geser 2003).

Additionally, in relation to husband-wife communications, there were a number of respondents who shared observations that the trends in spying on spouses by checking their mobile phone logs, improved coordination of extra-martial relations, and requests for divorce via mobile phones was on the increase in Egypt. The social dynamics have reportedly had positive and negative effects on psychological well-being in the realm of male-female relationships. As such the mobile phone has the potential to alleviate as well as to breed suspicion among couples. An unmarried 31-year-old university professor focused her remarks on the changes occurring within male-female relationships beginning with lovers and then shifting to married couples.

... the lovers who call each other on the mobile and their parents do not know, and sometimes there are married men and women, and this could cause many problems, a man could call and know many women at the same time, and many wives have noticed that their husbands delete the missed calls and the messages that they receive, and this not a good example for the youths, and it has caused many problem between husbands and their wives. And, my friends have told me about their husbands, and the women get jealous easy, and there are many problems between the husbands and their wives, there is no wisdom in dealing with the mobile.

Professor; age 31; female; urban; user

The anxiety expressed mostly by female respondents was often discussed in theoretical terms, but illustrated growing concern over the future of marital relations. There was enough concern, particularly among Muslims in the Arab region, over divorce via mobile phone that in 2004, an official announcement that one could not divorce via SMS was made out of the most prominent Islamic academic institution in Egypt, *Al Azhar*. This came as the result of many couples questioning the use of mobile phones to divorce their husbands and wives. In Islam a couple can divorce by saying, "I divorce you," five times. Apparently, some people were sending texts to such an effect. The *fatwa* (religious edict) from *Al Azhar* was that divorce using mobile phones would not be acknowledged within Islam as anybody could take the mobile phone of another person and send such messages to their spouse. These debates on the use of mobile phones within social relations have the potential to both ease and strain psychological well-being, primarily among married couples. Their function as a material symbol of changing social relations is also present in accounts of how mobile phones have impacted parent-child relations.

Parent-child relations

For parents and children alike in my study sample mobile phones provide a sense of increased security and mental health in terms of knowing at all times where each member of a household is located as well as their condition. Within the study sample, 16 respondents mentioned that they either call from or to mobile phones to speak with their

parents and/or children. Apart from addressing emergencies and ascertaining physical well-being, an additional purpose of mobile phones as recounted by parents and children in the study sample were calls made to mobilize financial resources to address the needs of aging parents and children.

For several respondents, they described how the mobile phone enables them to check up on the health of their aging parents. In relation to the use of mobile phones by aging parents, one of my respondents was an elderly fruit-seller in a rural outdoor market, who, although he could not read or write, bought a mobile phone so that he and his wife could communicate with their children in case of emergencies. Globally, the market has increasingly been targeting older consumers (as the young and business oriented have already been reached) “presenting the mobile phone as a safety technology of last resort” (Agar 2003, p. 141). For those caring for aging parents calls were primarily related to the coordination of access to medical treatment and the financial resources needed to pay for it. The increasing trends towards nuclear families and children living and working in other parts of the country and abroad also contributed to the psychological well-being for aging parents expressing their sense of peace knowing that at any time, they could easily reach their children.

Parents described their distribution patterns for household mobile phones according to travel requirements, giving priority to children who are going on long journeys over local errands. As described within the context of emergency related mobile phone use, travel and most specifically motor vehicle accidents are key concerns among Egyptians that mobile phones provide much needed support and security to maintain physical and psychological well-being. A female student in Minia described a situation relating to her brother as well as another friend that involved the minimisation of worry of their respective mothers:

My brother Ahmed was travelling and he was late, so I called him on the mobile and I assured my mother. And, I had a colleague who was travelling at the time of the train fire accident, so she gave her mother the mobile number of another colleague who was with her, and her mother

was calling every five minutes to be assured that her daughter was doing fine, and if there was no mobile, I could bet that something might have happened to her mother from being worried.

Student; age 18; female; urban; user

In addition, as discussed in the context of general health seeking behaviour, children who are living away from each other often consult mothers for advice regarding health problems due to the greater trust of mothers than local health care providers. Parents with children living abroad particularly expressed their sense of peace knowing that at any time, their child could easily reach them and vice versa.

In 1998, a research program entitled, “Adolescence and Social Change in Egypt” was launched. A national survey was conducted with a total of 7,256 households with at least one member between the ages of ten and 19 years of age. As part of this program 9,128 adolescents were interviewed. According to a paper entitled, “Social Change and Adolescent-Parent Dynamics in Egypt,” parent-child communications are shifting in varying degrees towards more egalitarianism (Al-Tawila et al. 2003). Much of this is linked to the education levels of parents as well as the physical mobility of sons and daughters for higher education. The first noteworthy trend was that of boys towards embracing traditions in their best interest as males, whereby girls are much more willing to accept and advocate for social change. Another noteworthy trend is that daughters of mothers with higher education are more likely to pursue education and work away from home (Al-Tawila et al. 2003). It is in scenarios such as this that mobile phones are both catalyzing and easing pre-existing social change.

More prominent than addressing the needs of parents was the mobilization of financial support for the education of younger children and the preparation for marriage for adolescents and university age students. For one respondent this meant “keeping control” of his four adolescent daughters. For parents who talk about communicating with their children, the patterns primarily relied on parents (mostly mothers) calling to check on them for their own reassurance and peace of mind. For working mothers, they recounted how mobile phones enabled them to maintain contact with work while they are at home

and home while they are at work. In relation to parent-child relations and mobile phones the interactions reportedly contribute to all three types of well-being.

Parents as well as teachers often discussed their observations of social change among young people as influenced by mobile phones that is both perceived as a positive and negative aspect of the social development of adolescents in Egypt. This was not something that I intentionally pursued in my data collection at first although it did come out in a number of early interviews. As a result, I expanded my lay user sample to include university students as well as professors to better understand the unique dynamics of the health-seeking behaviours via mobile phones of adolescents. At one of the universities, I primarily found boys from Minia and girls from other governorates with mobile phones. The discussions about health and well-being, particularly with female students and their female professors generated specific information regarding relationships between male and female adolescents.

Parents, students, and teachers all recounted that there is a great deal of peer pressure among university-aged girls as well as boys to have a mobile phone. Thirty respondents focused some part of their discussions on the changes in youth dynamics as a major social change in Minia resulting from mobile phones. An 18 year old female student estimated that at her university approximately 85 percent of female students and 60 percent of male students had mobile phones at the time of the study. This was observed as it was not difficult to find student users, particularly female, to interview for my study. She recounted that this is generally, “because the girls are more spoiled, and most of them are migrants so they need it to call their parents, but the boys who are migrants their parents could not afford the mobile, but they have to buy it for the girls even if they could not afford it.” This is related to control and coordination as described by another female respondent:

My brother bought a used one from someone who wanted to sell it and gave it to me in order to check on me and in order to call me any time and at any place.

Probe: What is the difference before and after you got the mobile?

There is a big difference, first when they used to call me in the students' dormitory and I was not available, I wouldn't be able to know anything about them for example if one of my brother was coming to Cairo they used to call me to let me know if I needed anything, and when I was in the institute they were hardly reaching me, but now they could reach me anywhere and at any time, and they can send me money if I need with my brother, or if I need clothes, anything similar, I could tell them directly.

Student; age 18; female; peri-urban; user

When parents discuss mobile phones among girls versus boys, they reported that girls are much more responsible in their uses and use the phone to provide them with the desired reassurance, whereas boys are much more likely to use the phones to send jokes and harass girls having a negative impact on the psychological well-being of girls.

Although disparities in education for boys and girls remain high in Minia (as described in the introduction), there was an acknowledgement among male and female respondents that mobile phones for girls were more important than those for boys who in the general population were more likely to have them. This need for connectedness to girls is related to maintaining control from a distance particularly to avoid grey areas in the future marriage prospects of young women. As described by one mother below, it is due to the increasing caution regarding direct social interactions across the sexes.

When a girl between 17 and 18 years old goes to the college and she has a mobile, she will need some control, because the mobile facilitates many things, that is why there must be some way of control. It is not a good thing that boys and girls in that age have mobiles, unless there is some control.

Receptionist at a health unit; age 44; female; peri-urban; user

The idea that young people, especially girls, must be controlled was apparent and stems from the broadening physical distance that is emerging between them and their respective families as they seek educational and economic opportunities away from the home.

Twenty respondents described the risk of harassment and concerns over the perceived dishonouring of girls. This was also recounted by respondents and young people in particular, as a negative use of mobile phones. The following is one example of the fears that surround young women with their mobile phone ownership, specifically focusing on problems caused by friends sharing numbers and receiving harassing phone calls from boys creating strains in formal engagement and marriage relations. In response to a probe about the sorts of harassments that young women experience, a 19-year-old university student living away from home, described:

Boys could call, or send a message, and the students call a number and know that the number belongs to a girl, and he could tell her that her friend gave it to him. And, the girl might be engaged, and he gave her a ring while she is with her fiancée, and problems might occur in that situation. Also if someone is married and that happens, she could be divorced, or her fiancé might leave her. The mobile is a very big problem concerning harassments.

Student from Sharm el Sheikh; age 19; female; urban; user

The risk for young girls of such problems with fiancés and husbands has negative side effects on their own psychological well-being in addition to that of their parents whose goals often are to ensure a socially acceptable marriage for their daughters. For the adolescent girls such harassments have potentially adverse effects on her future marriage prospects and psychological well-being. By contrast there was little talk during my research, however, of the potential effect of such interactions for boys. When I asked one male respondent if he had ever experienced harassment on his mobile phone, he emphatically replied, “*I am a man, who could harass me?!*”

For men in my study sample the focus of their well-being transcripts centred on marriage, but was more linked to monetary needs and self-esteem meaning economic and psychological well-being. As presented earlier, marriage is a significant part of the lives of young people for which the groom was found by a demographic study generally to bear approximately 75 percent of the financial burden (Singerman and Ibrahim 2003). These sentiments were clearly articulated by a 26-year-old male from a rural village when he said, “as a young man, I need to build a house, and to buy its furniture, and

when I need to recharge my mobile I have to postpone everything.” In Egypt, men are expected to provide the dwelling at the time of marriage. Because of the devaluation of the Egyptian pound as well as the increased cost of living many men are delaying marriage. These delays often create strain on the psychological well-being of young men and their parents as they strive to ensure optimal marriage conditions for their sons. During that delay, many adolescent males find their confidence and self esteem in mobile phone ownership as described by the respondent below.

Some people buy it to be showy, if someone would not use it for business, if he has no car, for example the students (boys and girls). Their parents buy them mobiles in order to know that they are fine, they didn't think how they are going to pay the cards, they are still students and taking their pocket money from their parents, so it is useless.

Driver; age 44; male; rural; user

It becomes in many ways a status statement that they can afford to buy modern technology, perhaps not an automobile or an apartment, but something that warrants respect. Thirty respondents mentioned the use of mobile phones by adolescents especially among boys for “show” in front of girls as well as their peers.

Brother-sister relations

Although 20 out of 66 respondents mentioned speaking with brothers and/or sisters, the content of the dialogues was specifically focused on the passing on of greetings and/or making announcements at critical times. For example a brother called his sister to congratulate her on the birth of her child and to check on sick siblings, while others called to give condolences in the case of parent deaths. In the analysis, I tried to determine with minimal success if there were any patterns within sister to sister, brother to brother, and sister to brother conversations. One pattern among young siblings is the contacting of each other on behalf of parents, who want to minimize their interference in their children’s lives. Brothers also reported getting mobile phones for themselves or their adolescent sisters to “keep control” over them. Another pattern was greater mention

of contact with siblings living outside of Egypt, particularly in Jordan and the United Arab Emirates.

Conclusion: Family communication and well-being

“Family and community spheres of social identification and cultural outlooks are complemented by new social encounters and new social networks. Education and work abroad, as well as television and radio, provide new flows of information and cultural norms” (Bach 1998, p. 184). I would also include mobile phones in the list. The improvements in telecommunications (mobile phones and fixed-line telephones) are strengthening family-focused support systems for psychological, physical, and economic well-being. For husbands, wives, children, aging parents, and siblings mobile phones enable direct contact to attain reassurance and mobilize collective responses to problems as they occur. This included coordinating access to health services and health-related information as needed. For young people, mobile phones grant them freedom, respect, and esteem among their family members, peers, and future mates. Mobile phones are also creating new norms for women and female adolescents through their movement away from the physical household as well as enforcing gender norms for women who are not able to fully access the benefits of mobile phones. Increased household income through the use of mobile phones can play a strong role in changing the health outcomes for some families. The social determinants of mobile phones in relation to health provides a critical link between empirical data collected on health-specific uses in Minia and key societal trends within the country.

Conclusion: Fieldwork Findings

Each of the case studies presented provides a descriptive account of the ways in which mobile phones are contributing to change within the health sector, facilitating contact and efficiency in service delivery. They also illustrate the prominent role played by families in mobilizing health care support as well as preserving well-being. The following chapter explores perceived limitations to the full appreciation of benefits that mobile phones could potentially support in relation to health.

Chapter 5: Limits to Domestication of Mobile Phones for Health

In order to fully explore and understand how best to maximize the use of mobile phones for health in a country such as Egypt, it is not only important to document the role of mobile phones to support direct and indirect health-related benefits, but also to review the limitations or barriers that hinder such maximisation. In this chapter, I will present empirical data from my research in Minia that illustrate six key barriers to maximizing mobile phone use for health as expressed by respondents during in-depth interviews, documented in observations, and identified during the media review.

The primary barrier to maximizing mobile phone use for health, as expressed by both health professionals and lay users was cost. This is a major area of concern when considering integration of any new technology within an already overstretched health care system. The second barrier, which was described in greater detail by health professionals and the media than by lay users, was the risk perception of the “harmful radiation” emitted by mobile phones. Such risk perceptions influence both direct and indirect uses of mobile phones for health. The third barrier, which primarily links to direct health benefits, was the perceived reliability or lack thereof of mobile phone and fixed-line telephone systems in health facilities. Because of the cost-related preference for fixed-line telephones, health professionals expressed their dissatisfaction with the current state of telecommunications capacity within the health facilities where they work. Fourth, there were concerns described by health professionals about being directly reachable by patients with respect to both privacy and the risks involved with respect to liability and cost recovery for service delivery by phone. This issue highlights the need for a balanced view, acknowledging the advantages and disadvantages, of the use of mobile phones in health service delivery. The fifth barrier was the lack of understanding of users of the range of functions available within the mobile phone, including text messaging. And finally, a key barrier to maximizing mobile phone use for health was the poor quality of health services and an inability on the part of health facilities and emergency care personnel to respond to the increased demand from improved access to transportation, information, and health services.

As with any integration program, one must have a clear understanding of the potential hindrances that may be faced while trying to develop special programs to maximize the health-related use of mobile phones. These barriers may be societal perceptions of how mobile phones should or should not be used or structural problems with telecommunications and/or health care systems.

Cost

As discussed in various sections throughout my Thesis, the major barrier as expressed by all respondents during field work as well as in the popular media is cost. Despite costs, health care professionals have devised systems of contact and communication to minimize costs, including the use of text messaging, missed calls, and fixed-line telephones in conjunction with brief mobile phone calls. At times when an actual discussion between health professionals might be useful, several respondents recounted how they opted to use signalling with a *missed call* or not to call at all due to the high out-of-pocket cost.

Regarding the use of mobile phones in both emergencies and general health services, there was a noteworthy preference for coordination of activities and brief consultations via mobile phones. For long calls, however, several health professionals expressed preference for fixed-line telephones. Many also shared that they have a general tendency to receive calls which are free of charge and to only initiate calls from a mobile phone in cases of emergency or to address urgent matters. Such calling patterns, where preference is given to short out-going calls and longer in-coming calls, have been attributed by Jonathan Donner in his research in Rwanda to the “calling party pays” system (Donner 2005b). The general time limit mentioned for mobile phone calls was one to two minutes.

For calls that would take longer than two minutes doctors preferred to give a *missed call*, what Donner calls “beeping” (Donner 2005b), signalling to a colleague to call him or her

back on a fixed-line telephone or to use a fixed-line telephone to initiate the call. *Missed calls* refer to calls in which the initiator allows one ring and cuts off the call before the receiver answers the call and charges are incurred by either the caller or the receiver. In most cases, there is a pre-determined understanding between the two parties.

In general, mobile phone use was generally focused for making arrangements and for brief consultations. Coordination and “micro-coordination” via mobile phone, as presented in the literature review (Ling 2004), enable users to make and adjust plans irrespective of location. Such calls, unlike consultations, tend to be short. The main motivation for limiting mobile phone use was that one minute of call time cost approximately one Egyptian Pound and seventy-five piastres (approximately \$0.30 USD) in the *Pay as You Go* system used by most health professionals at the time of this study. There was consensus among health professionals to have mobile phone call costs subsidized or establish special “business line” type plans for health professionals with the purchase of unlimited service for a fixed monthly cost. In health facilities that do not have direct lines, the mobile phone has become the only means of direct communication among health professionals and between health professionals and their patients.

One respondent summarized the sentiments expressed by most health professionals highlighting the use of mobile phone calls for emergencies and general health service coordination and the use of missed calls as well as the general preference for fixed-line telephones for consultations.

If it is an emergency they (other doctors) call me. Also, if a colleague needs me to help him with a surgery, he calls me. They can reach me anywhere with the presence of the mobile. It has facilitated the way of communications and shortened distances between my colleagues, my patients, and my students. They can reach me any time and anywhere. It is quite enough to say that I prefer to use the telephone in case of long calls, if I am going to discuss something with a colleague in a medical case. But if I don't find him, I have to use the mobile to tell him to call me where I am, meaning that the call from the mobile doesn't exceed a minute. In one day I can use the mobile to receive calls and make calls for 5 to 6 minutes in total.

Paediatric Surgeon; professor with a private clinic; Age 38; male; peri-urban

Such calling preferences and patterns are critical to the movement from exploring the natural role of mobile phones within the health sector to maximizing health benefits through formal integration of the technology.

Among health service personnel, there are a number of employees whose work would benefit from having a mobile phone, however, due to the low pay provided and no programs to subsidize access, their inputs into my study were mostly theoretical and based on their experience receiving mobile phone calls from other health service providers. In one of my key informant interviews, a 44-year-old female anaesthetist provided a classification of specializations that *mahtaag* “need” the mobile phone. Among them were emergency care workers, anaesthetists, and gynaecologists. She mentioned internists as a group that do not require mobile phones, which is likely related to the notion that professionals with fixed schedules and work locations can be more easily reached in general via fixed-line telephones. In a group discussion with nurses in an urban area in Minia, the sentiment that health service delivery would improve if they as nurses had mobile phones was expressed by one of the nurses with resounding agreement from the others. The specific potential benefits derived by nurses as described included preparing operating and emergency rooms and supporting first aid teams.

The doctors and the nurse managers in general have mobiles. The mobile makes work easier for the nurses especially those who are working in the operation rooms either in private or public hospitals, or even with a private doctor, because the operations can be done at any time and any place in private clinics or the emergency room. That is why they should have mobiles with them. ...Sometimes the nurses working with the first aid should have mobiles because in case of any accident on the highway, they would be reachable, they would be available in case of any accident or emergency.

But not all the nurses have mobiles because it is expensive, one call is fifty piastres and that is too expensive for the nurses.

4 Nurses; age 32-45; female; urban; non-users

The calls at the time actually cost more than the sum described by the nurse. However, there was a general consensus among nurses in the sample that they ought to be given mobile phones to enhance their efforts. All health professionals interviewed that have mobile phones bought them personally and pay for the services out of their own pockets. They all see the benefits derived from access. The chronic low pay, however, of health professionals in Egypt does not encourage increased usage of mobile phones even when it can be used to assist a patient.

As such, the costs per minute and the phone calling system have resulted in a complex series of patterns of signalling and information transfer for remote patient monitoring and telemedicine. The desire to keep mobile phone calls short impedes the complete explanations needed to fully address a case or to ensure that full instructions for patient care are understood by attending staff in health facilities. A more intensive review of impact of cost on use of mobile phones by health professionals is recommended. In addition, when exploring the potential for integration of mobile phones, a review of key health personnel within the system must be undertaken to fully appreciate which professional functions would most benefit by increasing their access to the technology. From this a cost-benefit analysis should be conducted to assess improvements derived from direct access to mobile phones for particular health personnel along with relevant training to maximize its benefits.

Risk perceptions

Although the focus of my research has primarily been on role of mobile phones to support health promotion, a number of respondents (18 out of 66, half of whom were health professionals) spontaneously mentioned negative aspects of mobile phones in relation to the perceived risk from radiation generated by the devices. Most of the references were to cancer, headaches, and loss of hearing. Several respondents expressed awareness and interest in ongoing studies and the inconclusive nature of research on the harmful effects of mobile phones. Reviewing public interest stories in the Egyptian media provided significant insight into the public understanding of science and

technology and highlighted how Egyptians perceive telecommunications in general and mobile phones in particular. Most of the stories and editorials I found focused on risk perceptions and social change.

In similar fashion to the stories presented in popular newspapers in Egypt, respondents complained about masts being set up too close to their homes and the way in which their computers and television screens become blurry and shaky when their mobile phone rings or when they receive a text message. In spite of such complaints respondents described how the benefits derived outweigh the health risks. The following quotation from a paediatric surgeon in Minia typifies the ambivalence surrounding the harmful effects at the conclusion of a presentation of the range of benefits he had experienced in his work.

But in the opposite side, the mobile has its bad effects concerning the electromagnetic waves. I cannot say that it is dangerous because in some research they said that there is no harm using the mobile, in other research they said that it is harmful; till now there is nothing specific to tell us if the mobile is harmful or not.

Paediatric surgeon and professor with a private clinic; age 38; male; peri-urban; user

Similarly, the public understanding of health risks related to mobile phone use also serves as a barrier to maximized use of the technology for health. The experience between the public health community and tobacco companies is quite similar to that of mobile phone companies. It is in the main interest of the mobile phone companies to ensure that radiation studies do not jeopardize their sales. Even so, people who know that smoking is harmful continue to smoke and mobile phone users who perceive that phones may be harmful to their health continue to use the technology.

There are many complex factors that result in particular perceptions and behaviours even when there is evidence and experience that one would think would result in a modification of behaviour. The cartoon below from the popular Egyptian newspaper, *El-Akhbar*, found at the time of the study, presented this paradox as a medical school

professor was shown giving a lecture on the harmful radiation that emanates from mobile phones, and excused himself to answer a call on his mobile phone.



Figure 5.1: Cartoon from el-Akhbar depicts a medical school professor giving a lecture on the harmful effects of mobile phones, while excusing himself to answer his mobile phone (Al Akhbar 2002).

The cartoon of the physician giving a lecture on the harmful side effects of mobile phones and excusing himself to answer his mobile phone (Al Akhbar 2002) is not uncommon in relation to other accounts of science in the media. “For example, even a technically literate person may reject or ignore scientific information as useless in the absence of the necessary social opportunity, power, or resources to use it” (Wynne 1994, p. 363). It is assumed that the message of the cartoonist is similar, the professor like many of the respondents in my study who expressed concerns about the harmful effects as well as the one conducted by Vodafone in Egypt (Ellaithy 2004), have found that social and other benefits outweigh the perceived risks. The question then arises, “why does the concern have so little effect over behaviour?” (Agar 2003, p. 127).

The lay understanding of mobile phone technologies in the context of health related uses of mobile phones was mostly expressed in terms of 1) a mutual validation process between popular media and what respondents shared during individual interviews

regarding their understanding of how the technology is structured and its potential uses and 2) risk perceptions among health care workers and lay users. Risk perception played an important role in terms of how study participants initially expressed ambivalence about health in relation to mobile phones and affected the way that people use the technology. Individuals interpret, internalize, and “renegotiate” scientific information in terms of what they want to hear as well as on how such information is presented in addition to the social context (Wynne 1994). In public health, the public understanding of science is critical to the development and dissemination of communication messages geared towards behaviour change.

Direct contact with health professionals

At the time of this study, health professionals questioned the overdependence on mobile phones and the increased capacity for direct contact. The newfound reliance on telephone consultations is creating challenges in privacy, accountability within health service delivery, and obtaining payment for services rendered. Another related concern with respect to direct contact to health professionals was personal safety, particularly for female health professionals who make house calls. Improved direct access can be positive as discussed earlier. It can also be invasive especially if numbers are being provided by someone other than the mobile phone owner. Patients now have more involvement in their personal health care and treatment with direct access to health professionals 24 hours per day seven days per week, making it easier for them to intrude on the personal time of health care providers. A major concern as expressed by a group of nurses is that patients can circumvent in-patient care givers and contact doctors directly. This can result in frustration on the part of the doctor as well as the in patient care giver.

... and sometimes, we face problems with the doctors for example the doctor could be at home, or at the hospital, or the clinic, and other places that he could be at, so in order to assure the patient, he could give him his mobile number, in order to enable the patient to reach the doctor easier and at any time, sometimes the patient calls the doctor and before we inform the doctor about his case, he would know first because the patient

had called him first, and sometimes he would tell us what are the medications that we should give to the patient.

4 Nurses; age 32-45; female; urban; non-users

Physicians have a false security that patients and other in patient staff are able to contact them regardless of their location. This had reportedly led to doctors who were meant to stay in the hospital feeling free to leave because they had a mobile phone, resulting in a perceived increase in absenteeism.

A related limitation to increased absenteeism of doctors from health facilities and off-site coordination was liability. With increased remote patient care and the provision of directives by phone, the paper trail within health service delivery was described by physicians as being lost. Doctors are not signing off on key orders in person, but remotely. Responsibility for decisions made and services rendered was becoming blurred. This also impacts the advice provided directly to patients by phone and some of the implications this may have for the practice of medicine in a society that does not maintain the same series of checks and balances as other health systems. For in-house staff working on behalf of an off-site physician, this dynamic creates potential ethical problems when a problem is encountered. In such situations, who is accountable? Protocols for engagement with off-site health care staff must be put in place to minimize confusion and build accountability within the health system.

A potential impediment to maximized mobile phone use for health was the increasing inclination of patients to call for advice rather than go for a visit to the doctor's office. In such situations, a physician is not able to check vital signs or identify any other potential signs obtainable through a physical examination and other measurements. As such, physicians are not able to determine or confirm a patient's description of his or her ailment. This also had reported implications for payment for services and a physician's ability to generate income. There was an existing precedent with this sort of practice which was generally referred to in colloquial Arabic as *keshf bil bouk* or "examination by mouth" through question and answer which was very common between male doctors and female patients in Egypt. With mobile phones women can now describe their symptoms

or those of their children to a doctor and receive advice over the phone. Most drugs, for which a prescription is needed in the United States and the United Kingdom, can be purchased over the counter or ordered by phone without a prescription in Egypt. This contributes to a potential decrease in income for doctors practicing in the public sector which is already low in Egypt (average \$100 USD/ month). As discussions regarding mobile telemedicine systems increases, it is critical to identify which aspects of health service delivery (diagnosis and treatment recommendations) can and cannot be provided by phone, either between two physicians or directly between a physician and a patient.

A final example of increased risk of improved direct access to health professionals was shared by a nurse, who found herself in a dangerous situation when she was responding to a house call for assistance in a complicated child birth.

I used to do that (give out my number) with my relatives, but I have a neighbour who advised me not to do that with anyone whom I do not know.

Once I had a delivery case in a house, and when I got there they were all men in the apartment, and they were going to hit me. That is why if I don't know the case I will not go in order not to put myself in a bad situation. It happened that a man came by and asked me to go with him, so I asked him to let me see his ID, so he refused, and I also refused to go with him.

Nurse mid-wife; age 56; female; urban; user

Although in my analysis of the social determinants of health I focused on women's empowerment and increased mobility, this was one example indicating a situation in which a woman recounted being more vulnerable as a result of her interaction via a mobile phone. To date, there are no known guidelines in any context that have been developed on the appropriate use of remote consultation as well a gatekeeper system to mediate direct access to health care providers. Accountability, liability, and an ability to recoup lost costs are three major barriers to consider when planning health interventions using mobile phones.

Reliability of telecommunications systems

Access to health services and information is improving; however barriers remain when trying to come into contact with facility-based staff, due to problems with telecommunications systems in health facilities. Availability and reliability of fixed-line telephones in households as well as in health facilities is a critical component of the mobile phone and health paradigm. These concerns were primarily expressed by health facility staff regarding non-existent or unreliable fixed-line telephone services in health facilities and other difficulties accessing health-related information and emergency services. Improved communication influences both the ability of the health facility to mobilize appropriate staff and equipment as well as paramedics' ability to provide well-informed support to reduce complications during transport. Mobile phone use for health purposes is impeded, however, when mobile and fixed-line telephone services in rural settings are minimal and those in health facilities are unreliable, nonexistent, or slow.

When asked how communications are coordinated between patients encountering health problems, one nurse provided the following guidance specifically related to childbirth, which is to use the phone of the local mayor to alert health facilities of an incoming case to improve service preparedness.

[The patient] could use the mayor of the village's phone to call us, then we could send her the ambulance. There is a wireless between the ambulance and the reception, so they could issue the ticket [needed to enter the health facility], and any other comments could be revised before she enters the hospital. We are here for emergencies at all times, and when we receive delivery cases, we are ready in every minute. They call us from the wireless.

Nurse mid-wife; age 56; female; urban; user

In speaking with a switchboard operator in a hospital in an urban setting, he shared that the primary purposes for calls coming in on the four external and 40 internal lines include: 1) patient follow-up by doctors, and 2) administrative calls from the managers to follow-up on work procedures and to ask about gate passes and the necessary papers

for administration. When asked how long it takes for calls to be addressed, the operator replied, “only seconds.” This is contrary to concerns expressed by other hospital personnel.

During interviews with health facility staff in Minia, they described calls into the hospital that took over 15 minutes to get to the right place. There was no direct dialling into the various wards. This was the unfortunate result of a recent Minia government scandal that generated four million Egyptian pounds in unpaid telephone bills. Articles in the various newspapers that I tracked confirmed that all government agencies in Minia owed the Telecommunications Ministry four million Egyptian pounds for services provided from 1997 through 2001. The mayor of Minia urged each of the agencies to pay back their bills and educate employees on appropriate use of phones. In the health sector, delays in telephone transfers could result in complications as well as death in critical cases.

In health centres in both urban and peri-urban areas, there were complaints from health personnel about the reliability of fixed-line telephones. In the peri-urban facility, the line was routed as an extension from the local government building and was not working from the time it was installed. As a result the health facility staff pooled their personal funds to buy a phone and requested that fixed-line service be installed, which at the time of data collection for this study had not been done even though the request had been submitted months prior. In the study villages, lay users expressed that although they tried to call ambulances, fire trucks, or health facilities those lines were frequently busy and/or required long waiting periods. Preferences are generally to go to the facility or doctor’s office directly without calling.

Key recommendations provided by health professionals to improve health service communication was to shift to a direct line system and/or install a reliable pager and coin operated phone system for easier access to each other and to patients. In many health facilities mobile phone use was restricted due to potential interference with medical equipment, making it more important to ensure that fixed-line telephone services are effectively structured. Another recommendation to address the overall problems with

telecommunications services in the health sector was to conduct regular reviews and testing of health facility communications systems in order to ensure that when a patient needs to contact a health care worker, he or she is able to do so in a timely fashion with minimal difficulty.

Quality of health services

As with my own experience in Southern Sudan which motivated me to conduct this research, as shared in the preface to this Thesis, it requires more to improve health outcomes than simply improving communication capabilities. To further reduce risk of death and complications from disease, injuries, and other medical conditions, quality health services must be available once a patient has been successfully transported to a health facility. Several respondents recounted experiences in which they used their mobile phones to contact health information centres that were unable to direct them to the appropriate facilities in a timely fashion. This was compounded in situations by poor and delayed mobilization of care in health facilities. Health service delivery systems are a significant network component to be explored further within the specific context of mobile phone use for health.

The following example was described by a former mobile phone user from the peri-urban village. She acknowledged the benefits of improved communications, but then proceeded to highlight several key areas within the Egyptian health care system that require attention based on her experience as an intermediary mobilizing support for her sick brother. The first problem she encountered was misinformation from the call centre when she contacted it for guidance on where to take her brother. The second was the absence of physicians at the hospital. Third was the general apathy among health care workers who did not acknowledge the urgency of the respondent's brother's condition.

I called the information office a few months ago to ask about the doctor's number because my brother was sick. It was three o'clock in the morning, and the lady who answered me -her voice seemed sleepy, and I was furious at her, and I didn't get the number I needed. The telecommunication

system here is not a problem, but first the employees have to answer the people with all the information they need, all the services are available here but the employees have to answer.

You know, when my brother passed away, we stayed for two hours calling the ambulance and nobody was answering, and when they answered they came after two hours. All that was at dawn, meaning that there was no rush during that time to prevent them from coming. My brother was very well known to them because he was working at the first aid. Then we took him to the hospital, and we stayed there for more than two hours and a half because there were no doctors, they were all sleeping. Then the doctor came and after an hour my brother passed away. This all happened because of neglecting their duties of answering the phone during the initial contact.

Housewife; age 39; female; peri-urban; former user

From inaccurate and low quality phone service to unresponsive and unaccountable health service provision, there were many gaps described that remain to be addressed within Egypt's health system to ensure quality of service for its citizens in spite of improved telecommunications. Low wages and conditions for health professionals in government health facilities were recounted as major contributors to poor quality of service and lack of care that result in such outcomes for patients.

Technology alone will not solve these problems. Although most respondents expressed that improvements have been made in health services over the past four to five years, they remain concerned about the quality of service as well as availability of equipment and supplies. This was particularly true for the facilities in the rural and peri-urban villages. One health facility staff person from the peri-urban village told me that she would advise people to seek treatment in the neighbouring city due to lack of appropriate specialized personnel, equipment, and supplies. Another respondent echoed the recommendation, highlighting that the facilities in the city were more "civilized" than those in his village. The specializations that were required in the villages, however, were not available and so they relied on physicians in the cities anyway. A review of resource allocation in health services in Minia could help determine the most appropriate investments to improve quality of care, which would also maximize benefits from newfound connectedness.

Familiarity and use of functions on mobile phones

With respect to health benefits, data assembled from in-depth interviews helped to provide insight into the range of potential applications that were known by users. Key aspects of the understanding of the mechanics of mobile phones included text messaging, placing phone calls, receiving calls, and maintaining a telephone directory. Limitations that were expressed during my field research in Minia primarily focused on challenges with text messaging and maintaining a telephone directory for faster contact. This was directly linked to issues of literacy as well as the departure from the standard functions of the precedent technology, the fixed-line telephone.

Several questions posed in the literature review find their answers in this aspect of mobile phone barriers. First was the question of how prior experience with fixed-line telephones influences uses of mobile phones. Second was the question of how the structure of the technology influences or “configures” use. Although, most respondents did not have fixed-line telephones at home, all of them had prior experience using a telephone, mostly at government-sponsored tele-centres and the home of the mayor for rural respondents. As such the direct two-way dialogue of both technologies was a familiar usage.

In similar fashion to other studies, SMS text messaging is a feature that people learn to use over time mostly for social purposes (Ling 2004), in spite of its creation for the transfer of financial information (Agar 2003). During in-depth interviews in Minia, 20 out of 66 people mentioned that they do not use the text messaging function on their mobile phones. The majority of these were from rural study sites (10) followed by urban (7) [two former users and five physicians] and peri-urban (3). Respondents cited that youth are the primary users of this function (6), they do not have time to type in messages (5), and illiteracy (4) as primary reasons. Those who mentioned illiteracy were all from rural study sites. When asked if he used text messaging one respondent, a 40-year-old male truck driver, replied, “No. (Probe: Why?) Because I can't write or read. (Probe: Is your mobile Arabic or English?) English, making the message matter more difficult,

even so I don't know how to read or write the Arabic.” Because of the limited text display and predictive text capabilities, new abbreviations are becoming a part of everyday language. For countries that do not use Latin characters, including Egypt, individuals are improvising by transliterating their words when using mobile phones that do not have their specific alphabet, in this case Arabic. Although beyond the scope of my research, I have observed a growing concern that the preservation of the Arabic language (and quite possibly other languages) is being effected by the use of abbreviations and other alphabets to communicate.

The potential implication of such expressions of challenge was that the technology's application for health purposes was impeded. For example, an individual may want to use text messaging to provide information to multiple relatives or health care providers through a single message regarding an emergency. Unfortunately, illiteracy in both Arabic and English and a lack of knowledge regarding the functionality of that particular feature of the mobile phone hinder his/her attempt to maximize connectivity. What was most notable was that more information and possibly training is needed within society at large as well as the health sector to provide guidance on the range of possibilities available to enhance their work practices through mobile phones.

A humorous example of the public understanding of how mobile phones work was illustrated below in another cartoon from *el-Akhbar* newspaper. A husband talking to his half dressed wife with a mobile phone with a camera in her hand says to her, “Please put on your robe on before you answer the phone.” He doesn't quite understand how the technology works but if it takes pictures then surely whoever is on the other end of the call will see her. Unfortunately this is the case with most technologies. People make assumptions about how a technology functions or are often unaware of the full range of what the mobile phone can do for them. The full range of mobile phone applications and functions must be considered to overcome this particular barrier to maximization of mobile phone uses for health.

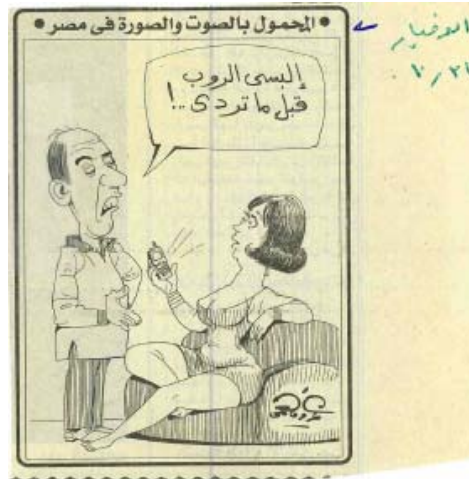


Figure 5.2: A man pleads with his wife to put her robe on while talking on her “mobile phone with sound and picture.” (Al Akhbar 2002)

Conclusion: Limits to domestication of mobile phones for health

As indicated by the overview of the mobile phone for health network groupings in the previous chapter, each category of elements within the network must be functioning well in order to maximize the benefits of mobile phone for health. In planning for health interventions with mobile phones a similar analysis of potential improvements in health outcomes as well as impediments must be considered. The following chapter considers recommendations for interventions as well as future research based on insights from respondents, the media review, as well as the literature reviewed.

Chapter 6: Recommendations: Formal Integration of Mobile Phones by the Health Sector and Future Research Directions

The empirical case studies, particularly those on emergency and general health care along with corresponding limitations to domestication, provide content to inform strategic decision making towards maximising health-related uses of mobile phones. Within this paradigm key communication patterns that are identified as potentially desirable for positive health outcomes that contribute to health objectives will be suggested for implementation and scale up beyond current informal uses. In support of study objective three related to the potential mechanisms for formal health sector integration of mobile phones, the first half of this chapter will focus on recommendations provided by respondents as well as those that emerged from the empirical data. When asked for specific recommendations that could maximize the utility of mobile phones in the health sector, respondents shared simple and in many cases low cost solutions.

The second half of this chapter will focus on the final study objective, which is to provide recommendations for operations research. Operations research in its broadest definition is the use of analytical models to inform policy and program development decisions to achieve specific objectives. It is an approach that has existed as a scientific research approach for over 60 years and applied to healthcare for over 40 years (Brailsford 2005). Although in my study objective this was stated as operations research, I will also consider the use of other approaches to obtain appropriate and practical data. In the case of mobile phones for health, it is the strategic application of both quantitative and qualitative research methods to study aspects of mobile phone integration by the health sector that will likely generate the data needed for strategic decision making.

Recommendations for maximizing the role of mobile phones for health

Many respondents began their responses to recommendations for formal integration of mobile phones for health with, “Tell the mobile phone companies that they should...” or “Let the Ministry of Health know that...” Many of these suggestions posed by respondents could easily be worked into the efforts of mobile phone, phone booth, and

fixed-line telephone service providers and handset makers to support social programs as well as the MOH. In the conclusion I will make the case for improved coordination between Ministries of Health (MOH) and mobile phone companies to explore how best to maximize access to mobile phones and develop formal integration programs that have the potential to improve health service delivery in Egypt as well as in other developing countries. Inherent in recommendations for ways in which mobile phone use for health can be maximised was a focus on such collaboration between public and private sector institutions.

Creating an enabling environment for access to emergency health services

As discussed earlier, mobile phones are improving access to emergency health services as well as the coordination of those services. In Minia, the improvements primarily related to automobile accidents. Through many discussions with health professionals there was also a perceived need for improved applications of mobile phones to address obstetric emergencies. With respect to key entry points for formal integration to improve access to emergency services, the focus ought to be on creating an enabling environment for lay users to access emergency transportation. In relation to this two major considerations emerged within the empirical data. The first is the reported inability of Egyptians to directly access emergency health care either because of long waits to have their calls connected or emergency call numbers that are routed through Cairo. This has resulted in more circuitous modes of accessing such services through intermediaries such as family members and police departments. Ineffective emergency calling systems not only add an unnecessary layer of communication but waste critical time that could potentially result in increased complication of health conditions. The second is the reluctance of respondents from rural areas to utilize ambulance services. Additional limitations to this aspect of formal integration include cost of mobile phone calls, knowledge of the range of functions available through a mobile phone, and poor past experience with emergency health services. To begin to maximise the benefits of this aspect of mobile phone integration by the health sector, each perceived limitation must be systematically minimised.

Many of the recommendations made by respondents regarding ways in which mobile phones could be used to improve health services were related to accessing emergency health care by decreasing perceived barriers. These recommendations mostly related to improving health benefits for individuals travelling on the desert road and those living in rural areas, including:

- Installing more phone booths in rural areas as well as on the desert road with free calls to emergency call numbers
- Distributing mobile phones to key households in rural areas for use in case of emergencies
- Improving access in villages to ambulances

Improving telecommunications and transportation in rural areas

Increasing the number of mobile phones (in lieu of more expensive fixed-line telephone systems) in rural areas as well as installation of specially designated booths for emergency calls only would improve access to emergency health-related transportation. This sort of service already exists on the highways in Egypt and could be adapted to serve rural areas if the support services are in place to respond to emergency call requests.

The best means is the highway phones, there must be a health phone with no coins or cards, and it has to be related to health directly, and there must be the sign of the red crescent on it, the sign of health, as you pick up the phone they answer you immediately, and this service would be respected from the people because the Egyptians are not ignorant people as in the past and these phones must be on the high way.

Engineer; age 30; male; rural; former user

Directly linked to the more general desire for government sponsored mobile phone services, 18 respondents shared that one recommendation to improve communication with the health sector and access to emergency services is to reduce the cost of health-specific phone calls and improve access to the technology for the poor. This would include expanding mobile phone network coverage to isolated villages. Again, given Egypt's socialist history, the desire for government intervention remains strong

particularly among older respondents. For 14 respondents, many of whom had tried to call “123” with no success from their mobile phones, the need to establish a standardized number and call centre for Egypt similar to “911” in America was expressed. Having one emergency call number where anyone can call from anywhere would minimize some of the roundabout ways individuals have devised to mobilize support. Because the infrastructure for decentralised emergency call centres exists for fixed-line telephones, its expansion to include mobile phones would require a mobile phone network routing to the closest health emergency call centre. Such a system would provide a cost-effective means for individuals to acquire direct access to emergency health services wherever they may be. The focus of such interventions should be on scale up in order to expand direct access to emergency health services particularly for rural areas, through free emergency focused phones as well as citizens living outside of Cairo, though a direct emergency health care call number.

Developing standard protocols for health service administration and delivery

In terms of health service coordination, standard protocols for the use of mobile phones for administration to mobilize emergency care personnel ought to be considered and developed. Many of the innovations in mobile phone use for health are individual and uncoordinated. One example is the use of text messaging to mobilize physicians and other emergency care personnel for treatment and minimizing the impact of injuries. At the time of the study two out of 24 health professionals mentioned such uses. In order to formalize this innovative use one must further explore the broader capacity of other health professionals to use text messaging as well as the need for more of a certain type of health professional to have a mobile phone. Considerations of cost-effectiveness must also be taken into account. The potential impact would be heightened by increased awareness of mobile phone capabilities in relation to health promotion in the general public and among health professionals as well as support for enhancing the structures that would be connected through a more formalized system of communication in the health sector.

Facilitating access and referral to health service providers and facilities

Health professionals in Egypt described the desire to embrace the use of mobile phones in their daily practice of medicine. The most common recommendations to maximise the use of mobile phones within general health services, focus on improved access to health-related information and services, including

1. Creating health service directories and quick reference guides and establishing 24 hour health hotline consultation and referral systems
2. Establishing either free (government sponsored) or lower cost phone calls to and from health service providers and facilities
3. Improving overall quality of health services particularly in rural areas

In order to facilitate access to general health services, twelve respondents recommended the development of health service directories and quick reference guides. Specific information that people shared that they wanted regarding the health service provider directories organized by specialization included addresses and maps, mobile phone and fixed-line telephone numbers, and schedules and hours of operation. Some respondents went further to recommend that these directories be placed in all health facilities and public phone kiosks as well as that the numbers be indexed and codes developed per specialization for easier dialling.

Mobile numbers of key health care providers must be known, for example in a directory in order to be able to give it to anyone who asks for it, especially people in key positions to facilitate knowing the citizens' problems. There are means of communications, but they cannot transfer you to the Ministry directly for example but they can help to reach the closest person who can help to find the proper solution for your problem.

Ministry of Health representative; age 58; male; urban; user

The development of health professional directories is a prominently recommended tool in the WHO's eHealth strategy (World Health Organization 2005) to help developing countries facilitate access to health professionals and services in a time of improved telecommunications as well as transportation. Movements in this direction have already

been made in Cairo with the creation of a CD-ROM directory of health professionals, however, the nurses who shared this information felt that it was too technical and that a paper-based version was needed for Minia.

Another related recommendation was to set up a similar system to what has been done by the Ministry of Law's e-Governance efforts, which allows people to call a central number 24 hours per day for twenty piastres and then redirects their calls to the appropriate law offices. Similar hotlines have been established for specific health issues including breastfeeding and HIV/AIDS. Apart from private fee-based services, a general health care referral system does not exist. During my data collection I found advertisements in the newspapers that I was tracking for such fee-based systems. Similarly, the National Health Service (NHS) in the United Kingdom provides a health call centre service called *NHS Direct*, whereby individuals can place free calls to determine how a patient might address a physical complaint through referrals to the appropriate service providers or health facilities. This sort of referral centre could also serve as a gateway to minimize the potential bombardment of physicians with phone calls resulting from improved telecommunications.

A private service on offer by MobiNil, one of two mobile phone service providers in Egypt, is a health insurance scheme that utilizes a calling centre to guide participants to appropriate health service providers. It provides the sort of service recommended by study participants. I used an advertisement for this service to ascertain the attitudes of ten respondents towards such a service. Their reflections and responses to a series of questions regarding their general perceptions of and whether or not they would consider using the service ranged from comments on the cost as well as the circumstances in which some Egyptians might find such a service of value. Five respondents commented that the cost of 60 Egyptian Pounds (approximately \$10 USD), which is the approximate equivalent of seven Pound Sterling, was too high for insurance service.

Like in other situations respondents complained of the exclusivity of such a service that only certain people could access and/or afford to participate in this sort of "Cairo-centric"

insurance scheme. Some also mentioned that the unreliability of mobile phone signals in the mountains and highways where someone would most want to access such a service would discourage subscribers. The philosophy behind free or subsidized services is that there is nothing to lose, whereas in paying for such a service there is risk in not receiving value for one's investment. It was also recommended by a number of respondents that this service would benefit individuals who are currently sick or have a chronic illness that could maximize their utilization, while others expressed that an insurance scheme as a concept is not accepted by many in Egypt and is something that only "spoiled" Egyptians would use. Insurance is viewed as a western construct; for many in Egypt the view is "why pay for a service that you may never have need to access?" It is also perceived that these systems are less personal than referrals made by relatives or neighbours.

Ibn Sina 1495 is another private service which stores and tracks all doctors and health data related to a particular family, including the closest pharmacies, hospitals, and service schedules of health professionals. This information can be obtained from a mobile phone by dialling 1495. Another health-related service posting adverts in the major newspapers and on television include the Medical Emergency Call Center (See www.mcit.gov.eg), a service provided by the Ministry of Communication and Information Technology as part of an overarching program to address social and health needs of the general public.

During in-depth interviews I used several of the health-related advertisements to engage respondents in discussion regarding the sorts of services they would or would not want to access through their mobile phones. Many respondents found the services to be too expensive, irrelevant to their local circumstances, and impersonal. Most Egyptians consult their relatives and household members for advice in addressing personal health-related issues. They tend to use physicians that have been used and recommended by other family members and consult with family members for in-home treatment options. The increased availability of specialised health-related hot-lines in Egypt has not to date generated the demand that was initially thought would happen upon creating the supply. Only among young people has this phenomenon begun to spread. With increased migration for work and study, it may be worthwhile to pilot such government sponsored

referral systems with students who are studying away from home and may not be familiar with health care providers in their new locations.

Recommendations for future research

The nature of qualitative research is to generate hypotheses. Two key inter-related hypotheses generated by this study are 1) mobile phones are playing an important role in responding to motor vehicle accidents and 2) mobile phones are enabling more access to health-related transportation, information, and services especially for people living in rural areas. Based on the study findings two opportunities for intensive study became apparent. The first is to measure the health impact of the use of mobile phones to address motor vehicle accidents. This includes the use of mobile phones by accident victims and bystanders to mobilize emergency transportation as well as the use by health professionals to coordinate and organize treatment and care. The second is to measure the health impact of establishing telemedicine sites in rural areas with formal relationships to facilities and specialized staff in urban areas. Additional areas for which the potential study would be beneficial, but for which I will not provide proposals in detail include measuring the impact of mobile phones 1) to address obstetric emergencies in Safe Motherhood programs, 2) to facilitate disease surveillance, prevention, and control, and 3) to increase household income and the relationship this has to health. Each study design proposed considers how mobile phones have been used in the health sector and by families and how existing barriers to maximised use might be overcome. Future research ought to be approached systematically by first analysing the problem, evaluating the situation, developing a solution, testing and modifying the solution, and integrating successes into the system.

Mobile phones and motor vehicle accidents

As presented in the case study on emergency health care with the specific example of the Abu Korkas Buss Accident, the primary area in which respondents expressed eliciting benefits was in relation to automobile accidents particularly on the desert road which connects Cairo to major cities in Upper Egypt including Minia Town. In the context of

health systems the result is a potential reduction in complications from injuries endured due to improved emergency service preparedness. Highest on the list of the key benefits garnered by health professionals regarding the availability of mobile phones in Egypt is the decreased response time in emergencies and the ability to mobilize services more efficiently. Based on the study design that I utilized, I was unable to directly observe the causal relationship between access to mobile phones and reduced motor vehicle fatalities. Although physicians anecdotally mentioned that health outcomes are improving in emergency services, they also indicated that potential confounders apart from mobile phones include seat belt and hands free legislation and improved access to ambulance services.

In this respect what the study can contribute to this field is an initial indication that mobile phones are reducing response times to emergencies, resulting in improved transportation mobilization as well as early warning of types of injuries for enhanced case management. The potential health outcome achievable is fewer fatalities and complications. There was an overarching perception that the elements within the health sector necessary to support formal integration of mobile phones or maximize benefits require review and enhancement. This includes a review of the reliability of emergency call numbers, staff presence in existing health facilities, and poor communications infrastructure in the facilities themselves. A key point for consideration by health service coordinators will be to evaluate the increased demands placed on emergency services resulting from improved telecommunications and access to transportation.

Operations research, particularly simulation of analytical models, is an approach most commonly used to assess process efficiency within health facilities and most especially with respect to emergency departments (Brailsford 2005). A pre- and post- intervention evaluation or a case-control study with a sample large enough to generate mobile phone uses and non-use events, should be considered. This will enable researchers to compare deaths and complications minimized or averted due to time saved and health service preparedness and their relationship to the following parameters:

1. Method of accessing emergency services- use of local call numbers
2. Time of emergency transportation to the site of a motor vehicle accident
3. Condition of patients at the time of arrival
4. Mobile care provided – look at quality and capacity of ambulance workers
5. Early warning to health care facilities of condition of patients
6. Service provider mobilization (time of contact to arrival at facility)
7. Facility preparedness
8. Increased demand for emergency services

The design of a study to evaluate these parameters should begin by calling together key stakeholders and managers of all systems and sub-systems that are related to providing emergency health care. The special focus on motor vehicle accidents should also provide consideration for involving potential beneficiaries, including truck and bus drivers as well as other transportation workers such as dispatchers. Data collection methods would likely include forms to be completed at the site of motor vehicle accidents to register and report the condition of patients and surveys and interviews with patients, bystanders, and health administrators and professionals involved in collectively addressing the needs of patients.

The development of an intervention to support increased access to mobile phones in addressing motor vehicle accidents must include the following: 1) establishment of a localised emergency health call number, 2) development of protocols for health professionals in mobilising emergency transportation and facility staff, 3) implementation of training programs for health professionals to learn standard protocols for communication and action as well as documentation, 4) implementation of awareness programs for transportation workers to increase efficiency in initial contact, and 5) continuous assessment to refine interventions as appropriate. Standard protocols for communication over mobile phones enable health personnel to maximize the benefits derived from mobile phones while economizing on time needed to relay messages. This builds on successes with emergency wireless systems described by ambulance workers. Resources needed to implement such study include health care management and staff

commitment and time; training materials and programs; and an information system that facilitates data management, compilation, and analysis.

Associated with changes in both emergency as well as routine health care, the notion that mobile phones are reducing costs for health care system in Minia emerged, but not as prominently as one might suspect. It was my observation that this was largely due to the limited thought given to and the absence of systematic explorations of the potential cost benefits of mobile phone use within the health sector. In the broader literature on mobile phones for business people and family members, one key consideration was savings attained through the elimination of unnecessary travel (Geser 2003). The same applies to health services. Physical journeys from place to place can be minimised through telephone consultation systems that eliminate unnecessary travel when possible. The other consideration of a more health-specific nature was the potential benefit of minimising health care costs, particularly in the case of injuries from automobile accidents by reducing response time and enhancing health facility preparedness. To make the case for formal integration of mobile phones into the health sector to address motor vehicle accidents due to improved access and efficiency need to be quantified and a cost-benefit analysis needs to be conducted and documented to inform policy.

Telemedicine in rural areas

An area of overwhelming concern to both lay users and health professionals is the poor access to telecommunications, transportation, and health services in rural areas. The use of mobile phones in rural areas for health has largely been to overcome such barriers. The two proposed means to address this are improving access to telecommunications in rural areas as discussed earlier and enhancing local health care service provision. For example, individuals in rural areas do not rely on local health facilities because of absenteeism and the lack of specialized personnel. They also do not rely on free ambulance services because of unreliability and time. As a result in the case of emergency healthcare, individuals in rural areas mobilize their own emergency transportation or forgo services altogether. In the case of general health care, they by-

pass local services and arrange transportation to urban-based health facilities. Telemedicine, as well as enhanced health-related telecommunications systems in rural areas, was recommended as a solution to achieve improved health outcomes in rural areas. As suggested below, developing collaborative relationships between rural and urban physicians can potentially help to improve services in rural areas.

Telemedicine can provide better health services, especially to rural areas. Doctors in the small villages of Egypt—and indeed in urban areas can experience the professional value of the Internet [and mobile phone] as a tool to access the latest medical developments, to enhance the level of service provided. Collaborative work with other doctors offers opportunities to consult and to raise skills. (UNDP 2002, p. 83)

To begin to test such a program, one would need to identify rural study and intervention sites that already have the infrastructure to incorporate collaboration with external facilities. Again, a case-control or pre-post intervention evaluation would enable comparisons to be made between non-institutional collaboration and formalized relationships. In Minia, such collaboration could be established between rural facilities and the teaching hospital in Minia town. Having a localized telemedicine system could also enable on-site and off-site supervision and a direct sense of the context for which guidance is being provided.

Telemedicine systems in other settings including between Cairo facilities and other countries ought to be intensively studied to inform the establishment of such a study in rural areas. Components that would need to be addressed include ensuring that the telecommunications infrastructure of study sites can support the Internet as well as mobile phone technology. The study sites would also need to identify the specializations for which local members of the community seek treatment guidance from urban areas that can be addressed locally. Formal relationships with those specializations should be developed, advertised in the local community, and monitored. Systems should be in place to collect data on patient attendance, client satisfaction, and referrals. Training programs for health professionals to maximize mobile phones and other ICT in their

work particularly in rural areas should be tested on a small scale and potentially included as a part of medical school curricula. Beyond evaluating the use of technology at the organizational level research programs should be designed in such a way to assess the overall health impact and cost-benefit of shifting treatment from urban areas to local facilities when appropriate, forgoing transportation and increased costs for services.

The success of operations research is contingent upon having managing partners embedded within the institutions of study (health facilities, transportation and rural communities, etc.), addressing a high priority concern, mobilizing external funding, and creating intensive and reliable data collection mechanisms (Brailsford 2005). First, a needs assessment must be conducted including consultations with potential beneficiaries, implementing partners, and policy makers. Second, all research plans must be strategic with clearly defined expectations and indicators to measure success (Bhatnagar 2000). This will help enable a much needed shift in the field of ICT for health from anecdotal evidence to measurable impact (Shields et al. 2005).

Conclusion: Recommendations and future research directions

Many of the recommended services and systems already exist in Egypt. The capacity for expanding and adjusting services so that they are more beneficial to citizens ought to be considered. A key recommendation would be to explore how such services that are currently available through the private sector could be tailored and made available to the public. This would need to be done in a fashion that provides appropriate training, supervision, maintenance, and quality control. Directly related to this is the need for more research to assess the actual impact of mobile phones within various aspects of use. Their utility as a time and money saving tool within the business sector should also be measured within the health sector. Their capacity as a communication device should be tested in order to ascertain the most prodigious and appropriate applications.

Chapter 7: Discussion of results

In Egypt, as in other countries, mobile phones produce both direct and indirect health benefits, especially when it is acknowledged that health encompasses medical interactions and general well-being. Among health professionals work-related uses generate direct health benefits and social uses contribute to well-being. Among lay users the effect is the opposite, work-related uses contribute to social well-being, and a by-product of possessing the technology is the increased capacity to mobilize support for emergencies and routine health care. Throughout my research and more explicitly during data analysis, the main focus has been to understand the domestication of mobile phones for health coupled with the notion that based on the data generated recommendations for more formalized health interventions could be made and tested.

Historically mobile phones have been largely left out of the discussion of ICT for Health and Development. The focus to minimise the “digital divide” within the health sector has been to explore the management and transfer of health information, either through computerised health-related databases or Internet library services where electronically available medical journals can theoretically be accessed from anywhere. In a recent research study and on-line consultation commissioned by the World Bank’s *infoDev* Program the focus of *ICT for Health* discussions are expanding to look at a broader range of ICTs, including mobile phones, as tools in achieving health objectives in developing countries (Shields et al. 2005). Using case studies developed through a systematic analysis of qualitative data I have presented how mobile phones in society are changing access to and the delivery of health services in Minia, Egypt. These data collected to capture the domestication of mobile phones for health in Egypt contribute to the existing literature. It provides a review of mobile phone use by the health sector in a developing country context of particular interest in eHealth programs and policies. They also provide insight into the professional domestication of mobile phones by health care workers as well as families in a non-Western society, contributing to the growing body of empirical studies of mobile phones in society which until very recently has not included studies from a developing country context or any that are specifically focused on health.

The four study objectives presented in the Thesis introduction provide a broad framework for exploring how mobile phones are changing health care in Egypt within the health sector as well as in domestic settings. The first two study objectives explore how with improved telecommunications mobile phones are changing health service delivery within health systems and access within domestic settings as well as interactions in between the two paradigms. The second two objectives lead to recommendations for future programming and research based on study findings comprised of both empirical data from Egypt as well as a review of the literature. The three empirical data case studies presented earlier in the Thesis, namely the role of mobile phones in emergency and routine health care, and family communication and well-being; along with the review of limitations to the use of mobile phones for health and recommendations for formal integration and future research contribute to each of the study objectives.

In this discussion, I present how empirical study findings, literature, and theoretical frameworks contribute to achieving the objectives through an exploration of six themes that emerged during the research process. The first is the contextualization of mobile phones within a broad network of technologies and people. Here, I consider how technologies are being combined to maximize benefits, how spill-over effects are extending benefits beyond mobile phone subscribers, and how environmental factors are influencing inequitable access to both telecommunications technologies as health services. The second and third themes I will discuss are the domestication of mobile phones in Egypt by the health sector and the domestication within families. The fourth is a description of how gender dynamics in Egypt are changing and how mobile phones might also be supporting these changes. Within both the discussion of domestication within families and gender are considerations for how social change may be driving technological adoption and vice versa. In the fifth thematic discussion, I present how findings from Minia potentially relate to other parts of Egypt as well as to other developing country contexts. And, lastly, I reflect on the strengths and challenges experienced through the use of selected literature as well as methods. This discussion

section explores how the methods and literature have contributed to the content generated within this study.

Mobile phones as part of a broad network of elements and interactions

As recommended within the review of literature, it is critical to understand ICT and in this case mobile phones in a broader context of use as well as health and development objectives. In Minia, as presented in the case studies, there is a complex web of elements working simultaneously to advance and impede the use of mobile phones as a tool for health. In this section, I will review how network elements and interactions provide a macroscopic foundation for understanding how mobile phones are being domesticated within the health sector and in domestic settings for health. This includes the importance of the combined usage of a range of information and communication technologies available to and being used by health professionals and lay users to access health services and coordinate service provision. Consideration is also given to how existing technologies are being shared within the population such that even those who do not have direct access to mobile phones can still reap the benefits of their fellow citizens' ownership. Within the network, environmental factors are also influencing utilization patterns and the creation of "middlemen and women" to facilitate access to health services and information.

Literature from Science and Technology Studies (STS) provided initial guidance to ensure that the sample of respondents was a comprehensive reflection of potential lay users as well as health professionals enabling me to capture a broad range of network interactions during fieldwork in Egypt. It also informed the consideration of objects as elements within the network, expanding my consideration for the inclusion of discussions regarding the role and usage of technologies apart from mobile phones. These included emergency wireless systems, fixed-line telephones at home and in health facilities, and pagers. The qualitative research methods utilized allowed the flexibility to include additional respondents into the sample as key network element interactions became clearer in the early days of field work. As such, I interviewed ambulance workers as well health facility telephone operators to gain increased understanding from their points of

view as to how health services have changed as a result of overall improved telecommunications not just mobile phones. This also helped me to identify and explore in some detail the critical role that is played by family members as part of the mobile phone for health network and allow for the expansion of the network.

Combined use of telecommunications technologies

Based on a review of relationships between the various categories in the mobile phone for health network in the empirical data, I was able to identify four complementary technologies being used for health promotion, namely pagers, emergency wireless systems in ambulances, mobile phones, and most significantly the the fixed-line telephone. Pagers, although still in use by a small minority, were generally deemed unsuccessful by physicians in Minia because of the traditional difficulty in finding a fixed-line telephone from which to contact the originator of the page. This technology has almost been completely replaced by mobile phones which have both a caller identification function as well as the capacity for direct communication between health facility-based staff and off-site health care providers.

The emergency wireless system, *le silki* or “no wires,” was described by many health professionals during data collection as a significant contributor to improved health outcomes in the governorate in conjunction with access to emergency transportation and ambulatory care. Calls are received in one central location and directed to the ambulance unit nearest the place of requested action. The specialized training in how to communicate case descriptions, treatment protocols, etc. using the emergency wireless system has also been said to have improved health outcomes related to the use of this technology. Their overall contribution to increased efficiency in responding to health-related emergencies was more limited than mobile phones as they are managed by a small group of specially trained operators and emergency care providers. At the time of the study as discussed in the emergency care case study, such services were directly accessible only via fixed-line telephones by dialling “123” or via mobile phone through intermediary support from police by dialling “122.” Similar to mobile phones, there has

been little research to determine the specific health impact that emergency wireless systems have had within emergency health care.

Fixed-line telephones were heralded as the preferred mode of communication by health care professionals and lay users alike throughout my data collection. In developing the study design and preparing for field work, I underestimated the role of fixed-line telephones in combination with mobile phones. It was in the combination of telecommunications technologies that maximized health benefits were clearly attained by health professionals and lay users. Those who did not have fixed-line telephones in the home at the time of the study still expressed a desire to have one installed as soon as it would be possible, not wanting to rely completely on having the mobile phone. This was largely due to the cheaper long-term cost of a fixed-line telephone in spite of higher costs of installation. The added perceived benefit of fixed-line telephones was the capacity to connect a computer to enable Internet access. The response to questions regarding the introduction of a new technology alongside widespread use of its predecessor posed by Leslie Haddon (Haddon 2004) is that mobile phones complement pre-existing technologies while creating additional capacity for communication while in motion.

In Minia, mobile phones are not perceived as a replacement for fixed-line telephones. Although most respondents did not have fixed-line telephones in their homes, they had access to community-based calling centres, which provided some level of experience using the preceding technology. Mobile phones, however, provided the added capacity of individuals being reachable directly anywhere, anytime and being able to contact others from anywhere at anytime. Through a review of relationships between fixed-line telephone and mobile phone users who previously or concurrently had fixed-line telephones, they seemed more willing to explore additional uses of mobile phones, including SMS as part of their incorporation of the technology into their everyday practices. This is contrary to an assertion made by Wacjman that past experience with a preceding technology tends to limit uses to the ones that are already familiar (Wacjman 1995), but then complements the findings of other empirical mobile phone studies as described by Rich Ling (Ling 2004). The increased use of SMS in Minia is likely

associated with its comparatively lower cost to initiating a call, in lieu of access to a fixed-line telephone.

As such, it is important to summarize when each technology might be best applied to support health objectives. Fixed-line telephones are generally more cost-effective than mobile phones, making them a first choice for both health care facilities and households. For health care facilities in both urban and rural areas, fixed-line telephones are preferable because they tend to be more reliable, do not require recharging, do not interfere with medical equipment, and they enable Internet access. They are as implied by the term, however, fixed, making them most useful for health professionals that work in fixed locations. Where fixed-line telephones are not available in health facilities mobile phones would be beneficial, particularly in peri-urban and rural health facilities where health care workers often feel isolated.

Mobile phones are beneficial for emergency health care professionals, specialists that are “on call,” and health care administrators, especially those who are responsible for staff and facility management. As described in the field findings, mobile phones are preferable for coordination and changing directions as needed, while fixed-line telephones are preferable for consultations. In countries where the mobile phone infrastructure is replacing that of fixed-line telephones, mobile phones should be considered a replacement for fixed-line telephones and programs to provide them to health facilities put in place.

When exploring the combined use of telecommunications technologies, failures with fixed-line telephone services in health facilities impede and discourage potential contacts between or among lay users and health professionals. The perceptions regarding health service quality and reliability of fixed-line telephone services in health facilities support observations which indicate that simply increasing the number of mobile phones among health professionals and lay users was not sufficient to address fundamental deficiencies within the health sector that must also be addressed to fully maximize their utility. As such all of the network elements must be understood and functional in order to maximize

the improvements in telecommunications within health services. It also underscores the sentiment within ICT for health discussions that ICTs are a tool that can support health, but that caution should be taken that health systems are not further burdened by their integration, but enhanced (Shields et al. 2005; World Health Organization 2005).

Telecommunications “herd immunity”

The value of connecting to a network depends on the number of other people connected to it (Haddon 2004). As I observed in Minia each increase in the number of doctors and other health service providers as well as lay users that have mobile phones and/or fixed-line telephones improves their utility. For health professionals and lay users that did not have mobile phones, they were able to reap the benefits as there were enough people with the technology to enable them to reach and be reached by others as needed. In the public health lingua franca I liken this to a sort of *telecommunications herd immunity* or threshold effect for health professionals and the general public.

Herd immunity may be defined as the resistance of a group to an attack by a disease to which a large proportion of the members of the group are immune. If a large percent of the population is immune the entire population is likely to be protected, not just those who are immune.

Leon Gordis in Epidemiology (Gordis 1996)

In vaccination programs, the notion of *herd immunity* states that if a specific critical mass of individuals within a population have been immunized against a disease that the entire population benefits and is protected from the disease. In my study in Egypt, I found that the increase in the number of mobile phone as well as fixed-line telephones is benefiting many more than simply individual owners and subscribers. It is benefiting the general population as the overall teleaccessibility (number of lines per 100 households) increases. The way this manifested itself in the study was that a number of respondents shared their accounts of altruistic behaviours in which they either found themselves in an emergency situation where someone called for help on their behalf or vice versa.

Similarly in a multi-country study conducted in Europe, the concept of benefiting from a mobile phone without owning one was observed. An average of nine percent of respondents claimed to have “access” to a mobile phone without owning one. In some countries this figure was as high as 19 percent, namely the Czech Republic, where respondents described borrowing a mobile phone on an as needed basis (Haddon 2004). In Egypt, this was also observed in the collective ownership of a mobile phone by a household, whereby individual family members who were travelling would be given the phone “just in case” of emergency.

In social networks trends for the adoption of mobile phones include the pre-existence of a critical mass of others within the network that have access to the technology. Haddon (2004) cites two reasons for this trend. The first is that with more users there is more help available to gain familiarity with potential uses. Second, fewer users within a network likely yields a more limited the range of use (Haddon 2004). In the case of telemedicine and improving access to health services, the more health professionals that have access to telecommunications the more accessible they become to each other as well as to their patients. This also provides a broader environment for learning new ways of applying the technology as functions become more familiar to larger groups of people.

Limitations to effective networking

It is important to note that the benefits of mobile phones for health can only be maximized if all of the elements in the network, including health facilities and existing fixed-line telephones are perceived to be “accessible.” Within the empirical data the key findings with respect to limitations to maximized use of mobile phones for health in Minia Governorate were 1) cost, 2) risk perceptions, 3) reliability of telephone systems in health facilities, 4) safety, liability, and cost recovery for unknown contacts as well as information and services provided at a distance, 5) lack of understanding and use of range of functions available through mobile phones, and 6) poor quality of health services. It is also important to acknowledge the potential obstacles posed by differential access to mobile phones within the hierarchy of health professionals. Overcoming barriers is a strong feature within the literature on ICT for health and development in poor countries

as the primary objective is to ensure effective use of the technology and positive outcomes. This aspect of technology study explores aspects of barriers such as literacy, hierarchical access to technology, appropriate infrastructure to support the use of technology, and cultural factors that inhibit the use of technology.

Understanding how the complex flows of interactions and information transfer yield or impede the adoption of technology for purposes such as enhanced health service delivery is important. Barriers, such as perceived poor quality of rural health services or health information centres, contribute to ineffective networking. Public perceptions of health service quality and systems as a concept influenced how respondents described how mobile phones were being used to engage with health facilities and health care workers. Although I did not specifically seek it, respondents provided general commentary on the overall structure and functionality of the health care system in Minia while describing their health-related uses of mobile phones. In the study sample, there was a broadly expressed preference for urban health facilities by respondents in rural areas who complained of absenteeism and poor service delivery in rural health facilities. For example, the overall preference for urban health facilities resulted in a use of mobile phones by lay users to organize transportation and remote consultations with public and private urban-based health professionals.

This theme of networking effectiveness highlights two general forms of inequity in Minia. First is the differential access to telecommunications technology between urban and rural areas. Second is the differential access to health care facilities and related transportation between urban and rural areas. Citizens living in rural areas may be paying more to access health care because of the lack of quality local services and high cost of transportation than they ought to be paying. The general concern within the study sample particularly of inequity between urban and rural areas led to their recommendations for the installation of emergency call boxes in rural areas as well as telemedicine for specialized information. In terms of the domestication of technology, each of the barriers listed above prohibits domestication or results in a specific sort of domestication of mobile phones for health, creating less than optimal usage patterns.

Interactions shaped by environmental factors

During the study, there were a number of environmental factors cited by respondents that influenced usage patterns of mobile phones in relation to health. As discussed in the review of theoretical frameworks, technology users tend to modify their behaviours based on the structure of the technology itself as well as other environmental factors linked to usage options or limitations (Woolgar 1990; Akrich 1992). Within the context of accessing health care services, multiple manifestations of the “configured user” (Woolgar 1990) emerged from the empirical data. “Configuration by environmental factors” was observed in terms of constraints expressed by both lay users and health professionals that influenced usage patterns in a specific direction. The two primary environmental factors that influenced usage were mobile phone pricing and credit structures and emergency call systems.

In the case of many respondents, their use of mobile phones was configured primarily by cost as well as knowledge of how to use the functions available on the mobile phone. Cost, as a barrier, has resulted in a configuration of use by health professionals that limits the benefits derived from access to mobile phones. Many spoke of not using the mobile at all due to cost constraints. Individuals redefine the use of technology beyond that which is intended by designers and mobile phone service providers based on their social and economic context and constraints (Woolgar 1990; Akrich 1992; Wajcman 1995). In my study sample, when a cheaper alternative was available, respondents reported using it. When it was not, they minimized their usage time. This is similar to observations made in other mobile phone studies, whereby length and time of call is adjusted in such a way as to minimize cost (Hamill 2000; Haddon 2004).

The question raised in the ICT for health on-line discussion about who should pay for airtime used by health professionals to enhance the achievement of their health care duties is important (Shields et al. 2005). In my study the usage patterns among physicians that were influenced by cost limited the maximized use of mobile phones to support health objectives. This is a question that ought to be addressed by health systems

administrators after consideration of the cost-benefits of allocating resources to support improved telecommunications among health care professionals. Subsidized mobile phone service for key health care professionals is often recommended as a response to the question of payment of mobile phone service. However, prior to such implementation, one must consider how utilization will be monitored to minimize abuses. In the context of Egypt, where many health care providers maintain a private practice alongside public service, the other concern is the potential for increased absenteeism in public health facilities.

Public health colleagues working in poor countries have also raised concerns regarding their observations that mobile phones are an economic burden to some subscribers that detract resources from more basic needs. In my study, the issue of credit management did emerge among a sub-set of lay users who described substituting necessities such as food and clothing to pay for mobile phone service. This did not come out in other mobile phone studies, perhaps because other societies have a longer history of managing credit and their resources are not as limited as those in poor countries.

Another configuration by environmental factors, the hardware's capacity to show who was calling also enabled the technology to be used as a signalling device in addition to a direct transfer of information or facilitator of dialogue. This provided another cost-effective means of gaining health benefits. The Egyptian mobile phone system, similar to other countries, is designed in such a way that the caller pays for the phone call. As such, "configuration by users" was observed in the evolution of "missed call" signalling patterns and the use of text messaging to contact multiple physicians to respond to medical emergencies. These patterns of use support other mobile phone research, while providing explanations for their evolution in a non-European setting similar to observations made by Donner (2005b) in Rwanda (Donner 2005b).

A major trend in usage patterns emerged in response to problems with emergency call numbers from a mobile phone that necessitate the reliance on household members to use fixed-line telephones to contact emergency care services. These calling patterns stem

from bad experiences with the direct use of emergency call numbers from a mobile phone with calls being routed through Cairo. This circumvention of the emergency calling system illustrates what Woolgar describes as “configuration by environmental factors” described in the literature review (Woolgar 1990). It is not the technology alone that inspires creative innovation in uses (Bijker 1997; Law and Hassard 1999), but flawed systems as in the case of ineffective emergency call numbers and long waiting times. The high visibility of these patterns in the empirical experience of respondents in Minia illustrates that a critical mass of individuals has converged into the same pattern of use. To work around these factors mobile phone users in emergency situations contacted intermediaries to mobilize support on their behalf including family and friends with fixed-line telephone access.

Domestication of mobile phones by health professionals

The “domestication of technology” is a framework that explores the evolution of technology from a new object in the life of a user to an everyday object. The domestication of mobile phones for health in Egypt has involved the integration into the daily functions in two distinct, but interrelated settings: the health sector and the household. The units of observation in the case of domestication of mobile phones for health include health professionals and individual lay users, grouped health professionals, grouped lay users, and interactions within and across units. How professional and social networks, including families, are effected by the use of mobile phones is a recurring theme throughout the mobile phone literature (Haddon 2000; Bautsch et al. 2001; Agar 2003; Geser 2003; Levinson 2004; Ling 2004).

With respect to the domestication of mobile phones by health professionals, the uses tended to focus primarily on administration, coordination of services, and attaining specialized information for case management. Lie and Sorensen’s approach to what they call “Technology in Use” focuses on what becomes a “typical” usage and how users are defined by technology (Lie and Sørensen 1996). Although the literature does not explicitly address access to and coordination of health care, it does explore the use of

mobile phones as a professional tool. In the context of health-related uses of mobile phones, one could look at health care providers in Egypt as a professional group with their own hierarchies and organizational culture.

Emergency health services

For health care professionals involved in providing emergency health care, mobile phones have become a part of everyday professional practices. The domestication of mobile phones to address such situations is directly linked to improving administration and coordination of emergency services. Coordination primarily focuses on how mobile phones are used by health professionals to contact ambulances to transport patients, health facilities to prepare for cases, and health professionals to provide remote patient care and access specialised information to improve patient care. Related outcomes have been expressed in terms of fewer fatalities and complications; more efficient management of health personnel; and improvements in direct consultation between lay users and physicians as well as between physicians (telemedicine). As discussed in the literature review the capacity and potential benefits within emergency and other health services for coordination in motion and “micro-coordination” (Ling 2004) are significant. In this case, health administrators and off-site physicians are able to initiate/mobilize action and modify direction as needed.

A primary outcome of mobile phone use is increased efficiency. Mobile phones are heralded as time and money saving devices. These benefits along with notions of “permanent availability” (Roos 1993) and stand-by roles that demand permanent readiness (Geser 2003) find their direct manifestations within the case study developed on the use of mobile phones to coordinate emergency care services. In terms of changes in health services, efficiency of service provision and enhanced coordination potentially have life saving effects. Such notions of improved “access” and “efficiency” are noteworthy effects that have clear parallels within the broad range of empirical mobile phone studies and reflections on the use of mobile phones by society (Roos 1993; Ling and Helmersen 2000; Bautsch et al. 2001; Geser 2003). Although the analysis done in

the United States comparing increased calls from wireless devices and the reduced time to fatal crashes, there was limited detail on the coordination efficiencies once contact was made by a victim or witness (Horan and Schooley 2002). In addition, I have found that there are potential changes within health service delivery also associated with mobile phones that might serve to complement the time saved in arriving at the scene of a fatal crash. As presented in the recommendations for future research, a more detailed approach to the service delivery aspects of addressing motor vehicles will inform how best to maximize the technology.

Routine health care

The second major category of domestication of mobile phones within the health sector was improved access to and coordination of general and routine health services. The key findings based on empirical data from Minia with respect to changes in general health services were that mobile phones and overall improvements in telecommunications 1) facilitate the capacity of health professionals to work in multiple locations and assume multiple roles, 2) enable the provision of remote patient care, 3) enable the practice of informal and formal telemedicine, and 4) improve disease surveillance and prevention for food-borne diseases. Mobile phones provide the capacity for the transfer of information and communication irrespective of location. They enable the enhancement of interactions among members of the mobile phone for health network and provide an increased sense of control over health outcomes for both patients and health professionals.

Empirical mobile phone studies and reviews provided information to understand various aspects of the delivery of general health services. For example, facilitating work in multiple locations, directing action from a distance, maintaining contact irrespective of movement, combining and switching between divergent roles, and living more spontaneously are components of Geser's list of twelve opportunities achievable with increased access and use of mobile phones (Geser 2003). All of these elements were clearly found within the empirical data regarding changes in general or routine health

service delivery. In Egypt, physicians often maintain multiple roles in multiple locations. Mobile phones have reinforced these roles and movements between private practice, public facilities, and academic institutions by enabling physicians to actively participate in events occurring simultaneously in multiple locations. They are also enabling the coordination of health service delivery at a distance.

Through dialogue with public health colleagues at the start of my study, I brainstormed the potential health applications of mobile phones in developing countries. The following list was developed: 1) telesurgery/ telemedicine, 2) drug/ treatment compliance through SMS text message reminders, 3) health administration, 4) disease surveillance, and 5) remote access to internet- based medical research. What has come to Egypt through the introduction of mobile phones is what Richard Heeks describes as the change derived from most information and communication technologies. These are the enhancement of information transfer and processing as well as communication. Through the movement of data from location to location one can expect to attain information and guidance for learning and decision making (Heeks 2000). This has been particularly true in the context of telemedicine in Egypt.

Telemedicine

Based on data collected in Egypt, telemedicine was observed, but in a manner that is generally not imagined. In Minia, telemedicine was described by health professionals; however, it was primarily informal between peers seeking a second opinion on a challenging case rather than contacting specialists in Cairo or abroad. This does not mean, however, that there would be no need for such systems to be developed in the future for Minia. In fact, in some discussions among lay users in rural and peri-urban areas they mentioned that key reasons why they prefer to go to urban health professionals is the lack of specialists in their local health facilities. A review of the sorts of specialized information needs at rural and peri-urban health facilities may provide the basis for a more formalized system of telemedicine to maximize the benefits and usage of non-urban health facilities through improved access to specialized information. As with

examples of telemedicine consultations in Uganda (Stecker 2002), such applications could save money and time as well as unnecessary travel for patients. It also has the potential to relieve some of the burden experienced by urban-based health facilities.

Beyond the best use of technology is a broader discussion of when physical contact cannot be substituted by either a fixed-line telephone or a mobile phone. This is particularly relevant to the discussion regarding telemedicine for diagnosis and decision support for treatment. The types of guidance that can be provided vary depending on the capacity to assess a case with or without images, a physical examination, and/or laboratory tests. In the case of the TB diagnosis program in South Africa, samples are taken from decentralized health facilities to a central lab for analysis, and results are communicated via mobile phone to the health care workers to follow up treatment (Hedberg 2002). Health conditions with more complicated diagnostic measures might not benefit from remote consultations, requiring in-patient diagnosis and treatment. Specialised protocols and training would be needed to identify the situations in which phone consultations are appropriate and when they are not as well as how best to maximise their benefits, including the sorts of information to be gathered and communicated.

Health administration and information

In Egypt, health administration was the primary use of mobile phones by the health sector. Disease surveillance was mentioned by two respondents in Minia with a particular focus on food-borne diseases. Unlike programs throughout Sub-Saharan Africa that have now incorporated where possible the use of mobile phones to encourage TB and HIV treatment compliance, health professionals in Minia did not widely use mobile phones to address infectious disease concerns per se. Differences observed between Egypt and other developing countries may be due to demographic change and recent shifts in Egyptian health priorities from infectious diseases to more chronic health conditions that come from improvements in health care as well as an aging population (Mehanna and Winch 1998).

With respect to access to health information, although this has been the focus of many academic discussions and policies to minimize the “digital divide” between rich and poor countries within the broad field of ICT for health (Shields et al. 2005), there was a complete absence of any evidence that health professionals in Minia are concerned with the recent enhanced capacity they have to access health information via the Internet. When asked, most replied that they do not actually use the Internet for their professional work even though the Egyptian government provides free call numbers to dial into such services. Challenges with the Internet in many poor countries include lack of infrastructure for electricity and fixed-line telephone lines. Mobile phones by-pass these with the creation of batteries and chargers that do not require electricity. In many countries the Internet can be accessed through mobile phones making access to information more attainable by greater segments of the literate population in poor countries. This combination of technologies will have a significant impact on the future of telemedicine in developing countries (Med-e-Tel 2006). Again as discussed in the review of literature, mobile phones as they are influenced by and influence society are a co-production that will continue to evolve and provide the basis for future technology development.

Domestication of mobile phones within families

When exploring the domestication of mobile phones for health within Egyptian families, two broad interrelated categories of integration emerge. Mobile phones are used by family members to address emergency and general health care in an effort to restore well-being and as a tool to maintain well-being both as a means to an end and an end in itself. Mobile phone use in domestic settings is not represented explicitly in any of the bodies of literature that I explored. In the ICT for health literature, which mostly focuses on the health sector, there is a critical gap with respect to the use of ICT by patients as they integrate the technology into their daily lives as a tool to enable access to health services. As such, this study contributes the perspective of lay users with respect to how they have used a specific ICT, namely the mobile phone, to gain access to emergency health care

services. In this particular aspect of mobile phone use within domestic settings, the literature on ICT for development highlights the critical need to consider the cultural context of technology integration for a specific purpose (Avgerou and Walsham 2000; Duncombe and Heeks 2002).

In Egypt the family is the focal point for distribution of mobile phones among those who are travelling in case of emergency as well as health care decision making in emergency situations. In order to design an effective intervention to enhance access to emergency transportation and health services the family as the centre for consultation and coordination must be considered. Future studies that aim to explore health outcomes related to mobile phone use in emergencies must consider the perspective of beneficiaries not only service providers as both groups are using the technology and are collectively engaged in the response.

Other aspects of mobile phones that are of particular relevance to emergency care in domestic settings include their efficiency in mobilising support and their capacity to enable contact among family members who maintain stand-by roles irrespective of location (Roos 1993; Palen et al. 2000; Geser 2003). Unique to this aspect of mobile phone use in domestic settings is the sense of altruism that stems from the reality that there are enough mobile phones in society to mobilize emergency care for citizens beyond the actual subscribers themselves (telecommunications herd immunity). In the case of mobile phones in emergency health care individuals in and outside of the home are able to maintain stand-by roles as both users and beneficiaries on behalf of their own families and the families of others.

The role of the family as an intermediary

Findings from empirical data that link family communication to changes in health care, related primarily to family members serving as intermediaries, facilitating access to emergency health services and mothers providing guidance on treatment seeking activities. Oftentimes technology advancements are thought to eliminate “middlemen”

(Digital Opportunity Initiative 2001) and increase efficiency. In relation to changes in accessing health services in Minia, Egypt a new sort of “middleman and woman” has evolved, what I have called the *intermediary*. In the case of information transfer and communication, the family has become the new primary intermediary as a central point for communication to access emergency transportation, health services, and information. The use of intermediaries in Minia was largely due to the desire for individual mobile phones users to work around the cost structure of mobile phone companies and the delays and frustrations with receiving accurate guidance from emergency call centres.

The trends in domestic health communication primarily focus on the role of family members as intermediaries in mobilising support in emergency health situations. In Egypt, the family is the focal point for decisions regarding mobile phone use as well as health. Addressing emergencies was presented as a key motivation for the purchase of mobile phones for use in domestic settings. Mobile phones are a part of the household strategy to preserve physical well-being and mitigate the impact of difficult situations particularly in relation to automobile and other travel related accidents. The mobile phone was also presented as a key instrument in minimizing the impact of emergencies through faster mobilization of transportation of family members to health facilities. This was observed as family members travelling outside of the home that either experienced or witnessed emergencies (mostly automobile accidents) used their mobile phones to contact their own family member at home to mobilize support on behalf of a stranger. The family as an intermediary was also observed to maintain a prominent role in the decision-making process regarding treatment.

Mothers were found in Minia to serve a critical advisory role to children who are no longer physically residing in the household because they have married or migrated for work or school. Although I had only one example in the study sample, I would expect to find other occurrences of new mothers who have moved away from their paternal home availing themselves of the improved telecommunications infrastructure and relying more heavily on their own mothers for advice than their mothers-in-law (with whom they traditionally live) which has generally been the norm (Hatem 1987; Harrison et al. 1993).

Preserving well-being

The major cross section between mobile phones, health communication, and domestic settings in the context of Minia, Egypt is the strategic use of mobile phones for the preservation of well-being by families. Feedback received in interviews in Egypt include that mobile phones are carried and distributed to family members *ih'tiyati* “just in case” they require remote assistance to deal with an emergency or unexpected situation. The domestication of mobile phones by families is interlinked with the household strategies for the preservation of physical well-being and mitigation of impact of health care emergencies. This is strongly supported by literature focused on mobile phones as the role of the technology for the preservation of safety and security becomes more visible (Agar 2003; Haddon 2004; Ling 2004).

Other indirect health-related benefits observed within family communication for well-being include the potential for increased household income through enhanced business opportunities for men and opportunities for more formal work outside of the home for women. They also include enhanced access to educational opportunities particularly for university-age girls, improved family communication (husband-wife and parent-child), enhanced youth relations and interactions, and increased self esteem for boys. Although the focal point of most of the literature on mobile phones in developing countries presents the benefits of the technology for income generation in terms of saving money, reducing transportation costs, ensuring fair market prices, etc. (Bayes 1999; Donner 2005c; The Economist 2005), this did not feature strongly in my study. Individuals had mobile phones for business purposes but it was difficult for them to quantify the benefits. Although household income is a strong indicator for improved health outcomes as part of the wider social determinates of health (Wilkinson and Marmot 2003), limited data did not make it feasible to illustrate the economic benefits derived from mobile phones.

Addressing poverty as a means of improving health through the use of ICT was discussed during the *InfoDev* ICT for health on-line consultation, but deemed too indirect to fully

appreciate the impact of ICT on health (Shields et al. 2005). Other resources have documented the role of ICT in improving income (Heeks et al. 1995) and the role of improved income on health, but nothing has been located within the literature that links improved income from ICT to health outcomes. One could, however, make the case for further study in this area. It would not only contribute to a further understanding of the social determinants of health through mobile phones, but would provide additional insight into related aspects of household livelihoods and quality of life.

These dynamics were clearly observed in Egypt, where initial uptake of mobile phones was among male small business owners and formal/ informal transportation workers (drivers). In Minia, however, the primary focus for transport workers is in the preservation of physical well-being of drivers and the psychological well-being of their wives and children due to the high prevalence of automobile accidents in the country (Shahine 2002). The mobile phone in Egypt has followed a similar trajectory as in other countries, entering society primarily for its utility as a business tool and evolving into an everyday object as well as a key actor in mass culture (Agar 2003).

In relation to household dynamics, mobile phones have also been described in the literature as both an “enabler of freedom” and a “leash” that enables family members to be released and reigned in as needed to address particular issues or to provide information regarding their whereabouts and physical condition (Geser 2003; Levinson 2004; Ling 2004). In Egypt as observed elsewhere, parents are more able to monitor their children, while at the same time children are spending more time outside of the home away from the home area (Ling 2004). These have been viewed by some as positive and others as negative contributions to adolescent development both in the empirical data as well as the literature. Levinson speculates that with constant contact between parents and adolescents that those children in a critical phase of development might not have the freedom they need to learn to make decisions for themselves (Levinson 2004). Ling, on the other hand, in a more detailed analysis of an in-depth study of teen uses of mobile phones observes the delicate balance between the desire by parents for control over their children and the desire for their children to mature into responsible adults (Ling 2004).

In Minia, mobile phones are perceived to ensure constant contact and preserve well-being, particularly when they are provided to adolescents as well as parents who are increasingly travelling for educational purposes and employment opportunities respectively.

Everyday uses in Minia include contacting family members to gain assurance of their physical conditions and well-being and being available and accessible to deal with “unexpected situations” and emergencies as they occur. Where the dynamics of Egyptian culture clearly emerged throughout my research as part of the domestication of mobile phones for well-being was in relation to the issue of gender. Within the literature reviewed there was very little that explored direct usage by families of mobile phones to access health services and health-related information in developing countries. In other settings, the role of the family as the centrepiece for the use of mobile phones (Haddon 2004) and their use specifically for safety and security (Ling 2004) featured prominently.

Mobile phones, health, and gender

Improved telecommunications enables new forms of social and health-focused interactions particularly for women. Although my Thesis is not strictly about gender the links between women as a focal point of family well-being and the primary care takers of household members makes it an important subject to acknowledge and discuss. Because technology is generally acknowledged as belonging to men, women are rarely consulted as part of the development process (Wajcman 1995). Fortunately, developers do not control the final uses of technology, and women oftentimes define new possibilities for the use of technology (Wajcman 1995). The mobile phone has followed a similar trajectory as that of the fixed-line telephone, which was initially sold as a business tool but then evolved into a social tool through increased usage by women (Wajcman 1995; Agar 2003).

Similar to a study conducted by Roos (1993) in Finland at a similar stage in mobile phone uptake as when the field work was implemented in Egypt (2002), there was an under

representation of women in the study sample in Egypt particularly in rural areas where social change is visible, but oftentimes slower than in urban areas. In the case of my research on mobile phones in Minia, it was incredibly challenging to find respondents with the following characteristics: female health professional (urban), female health professional (peri-urban), female lay user (urban), and female lay user (rural). Female health professionals in urban health facilities in Minia tended to be nurses who relayed that their income was not sufficient to afford a mobile phone. Other female health professionals in the sample blamed their lack of mobile phone access on their specializations, access to fixed-line telephones at home and at work, and household priorities that made it more important for either her husband or a travelling child to have the household mobile phone. Female lay users, when they could be found, fell into one of two categories: 1) a women with a career or studies that required travel and/or residence in another part of Egypt or 2) a woman whose husband had a career that required travel and/or residence abroad or another part of Egypt, reinforcing movements towards migration for work and the increase need for female labour (Ali 1998; Singerman and Ibrahim 2003; Barsoum 2004).

Mobile phones among women enable their work outside of the home. Their husbands and children can more easily contact them, and they can continue to earn money to support the household. There is a shift from living a double life to co-existing in parallel worlds. For example, women can remotely parent when they are at work or can respond to work when they are engaged in parenting activities with their children (Geser 2003). In emergencies, they can use the mobile phone to contact other family members to seek advice as well as mobilize financial and emotional support. Many women with mobile phones primarily used them to multi-task as they fulfilled their household responsibilities while seeking economic opportunities outside of the home. This closely supports the notion of the *umbilical cord* highlighted in the mobile phone literature (Ling 1999b; Geser 2003) as well as modern historical commentaries of Egyptian society such as the one by Jankowski below:

The family remains the dominant corporate unit, structuring much of life for both its male and female members. Its patriarchal character continues to invest formal authority (although not necessarily all influence) for family affairs in the hands of men. Labor migration by Egyptian men to work in other countries has had appreciable side-effects for rural women, both increasing the participation of women (and children) in the labor force because of the shortage of male labor and giving wives a greater role in family decision making due to the temporary absence of their husbands.” (Jankowski 2000, pp. 195-196)

Such opportunities to engage with individuals outside of the home increase a women’s access to a broader social network as well as economic security. This ultimately impacts on access to health services and information. The entry of women into the work force has supported two complementary aspects of mobile phone use by women, namely “remote mothering” while at work and “remote work” while at home (Geser 2003). Mobile phones are enhancing this dynamic for particularly women in the Egyptian middle class.

The notion of power and powerlessness as described by Wajcman in the literature review on gender and technology reinforces the use of technology as a means to maintain control over women (Wajcman 1995). On the other hand, the contribution of mobile phones to the empowerment of women as observed in Minia is not negligible. Within the empirical data there were several examples of how mobile phones were easing social change as adolescent females avail themselves of educational opportunities away from home and mothers begin to migrate to other governorates in pursuit of better careers. The transition is visible. An example of this from the empirical data was observed in the dialogue of the husband and wife from an isolated village in Minia Governorate (transcript shared in section on husband-wife relations). The wife explained that she did not know how to use the mobile phone apart from answering phone calls from her husband and brother-in-law. In situations such as this, “men affirm their masculinity through technical competence and posit women as technologically ignorant and incompetent” (Wajcman 1995). For the wife, although her use is limited, she still

expressed a sense of peace knowing that her husband can contact her at anytime if there is a problem and to reassure her while he is away from home.

It was significant that the focus of women's transcripts was on family communication while that of men focused on work and work-related benefits. Technology is often viewed as a masculine culture (Wajcman 1995). Its uses in Egypt have broadly followed engendered stereotypes. Men primarily use mobile phones for work, while women primarily use mobile phones to maintain psychological well-being and social relations among the increasingly distant family members. Mobile phones in many ways have solidified the traditional relationship structures between men and women as can be seen within the discussion of family communication. At the same time, they are enabling new opportunities and experiences particularly for young boys and girls who were traditionally separated in society to communicate directly with one another with minimal interference from their parents. This will likely continue to influence changes in gender relations for years to come.

The domestication of mobile phones for health within the health sector and in families is an ongoing process. The technology is changing how health services are both accessed and delivered. It is also catalysing and easing aspects of social change within society that involve movement away from the home either for education or employment. Mobile phones are also influencing gender relations, between women and technology and men and women alike.

How findings apply to other contexts

As with the study of technology in any society it is important to acknowledge how results might be linked to a particular population and how they are universal. Experiences in Minia generally reflect the overall Egyptian experience with mobile phones based on a review of popular Egyptian media as well as in regards to informal discussions with family, friends, and professional colleagues in other parts of the country, including the Nile Delta and Cairo. Major differences include access to emergency services when

comparing Minia to Cairo, particularly with respect to the ineffective use of the standard emergency call number “123”. As described earlier, this number works in Cairo but for those outside of Cairo the number also connects to a call centre in Cairo that is not linked to emergency services elsewhere.

The experiences of individuals in rural areas in Minia are likely to be similar to that of rural areas in other governorates in Upper Egypt. Although access to services in the Delta tends to be better, similar experiences include better quality of health services in urban areas making the mobile phone similarly useful for coordinating transportation as well as accessing health information at a distance. Cairo, which already had a sophisticated telecommunications infrastructure, is also experiencing enhanced service delivery and anecdotal reductions in emergency response times, perhaps similar to those experienced in the United States (Horan and Schooley 2002).

With respect to interactions for health outcomes, individual and combined uses of mobile phones and fixed-line telephones in Minia are likely to reflect those in other parts of Egypt. The trajectory of access to health information as well as telemedicine consultations, tended to be as follows: professionals in rural areas contact those in urban areas in Minia, those in urban areas in Minia contact other colleagues in Minia or Cairo, and those in Cairo similarly contact other colleagues in Cairo or seek guidance from abroad.

In relation to distribution according to the demographic and economic environment in Egypt mobile phones have not yet been accessed by the poor. Their potential within the health sphere will be to make advancements within the middle class and lower middle class with the poor able to access its benefits through the altruistic behaviour of individuals who witness emergencies or neighbours with a fixed-line telephone or mobile phone. Similar implications apply to rural citizens, who remain less likely due to household income to access mobile phones or install fixed-lines in their homes.

Egypt as a country is fully engaged in both policy development and application of global telecommunications governance regulations internally as well as externally. In terms of cross border interaction, Egypt's telecommunications industry has expanded significantly into Sub-Saharan Africa, North Africa and the Middle East. As such, lessons learned in Egypt with respect to the health sector may be applied to other country contexts as appropriate through Corporate Social Responsibility as well as social marketing initiatives. A new global culture is emerging around mobile phones which may have specific permutations depending on the local context as illustrated throughout this case study of Egypt.

Egypt as a context for exploring the domestication of mobile phones for health can be used to inform public health efforts in both developed as well as developing countries. Its uses in mobilizing and coordinating emergency health care are universal. Establishing an advanced warning system for health facility staff of incoming cases for better preparedness and service delivery is one potential intervention for a more systematic application of mobile phones in emergency situations. Its potential uses with respect to general health services become more dependent on the cultural norms surrounding treatment seeking and provision. A more strategic use of mobile phone functions such as text messaging to mobilize multiple practitioners is a cost-effective means to integrate the technology into health service delivery systems. In Egypt, the extended application to food-borne epidemics also raises the potential for their use in addressing public health concerns such as Avian Flu. Where other technologies are available mobile phones ought to be used in combination with two-way radios, fixed-line telephones, and satellite phones to maximize benefits and minimize cost. Overcoming barriers to accessing health services including distance, cost, and poor service quality must be addressed in any formal integration program.

Strengths and challenges of research process

Throughout my research, two major discussion points emerged regarding methodology. The first looks specifically at the *potential health benefits* of the introduction of mobile phones into society. The content generated in the study is the result of the background

literature consulted, specific data collected in Egypt in 2002-2003, and an analysis of linkages between the two as well as my own personal observations and experiences. The second major discussion point explores the *approaches to the study of potential health benefits* of mobile phones in society. As with other technologies, the study of mobile phones for health in society is time sensitive as technologies and the societies themselves change over time. Because of such changes, it is important to look at the content generated for opportunities to influence short and long-term public health applications and integration programs and approaches to inform the long-term systematic study of ICT for health.

The methodological choices made in conducting my study were both advantageous and limiting as an approach to the study of technology for health. In summary, my approach began with a review of the context of Egypt, eHealth in developing countries, empirical mobile phone studies, and Science and Technology Studies as a platform for study design and discussing findings, field work which relied on ethnography and qualitative research methods, and an analysis process that explored complex linkages between theory and data. The approaches used for this study yielded informative content for understanding, programming and decision making related to the use of mobile phones for health promotion.

Strengths

Of the theoretical frameworks used to inform the design of the study, the *domestication of technology*, as a theoretical framework proved most useful for the study design by promoting the exploration of the integration process from initial awareness of the technology and acquisition to initial use to full integration into daily life. When looking at the use of mobile phones for health, the domestication of technology proved instrumental to understanding the full integration into day to day work of health professionals; it was less useful for exploring lay users health-related experiences with mobile phones as these were not day to day uses in the broader range of their mobile phone usage patterns. Other empirical mobile phone studies have also been particularly

useful in confirming study findings in relation to the use of mobile phones as a work related instrument by health professionals and in exploring how mobile phones are used within domestic settings.

By looking at health professionals as a new domain, the case can be made for how the organizational culture of this group is changing as a result of the incorporation of mobile phones into their everyday lives. In the mobile phone literature, work-related uses of mobile phones is a major feature unfortunately there was very little literature that focused on the specific nature of health service delivery and use of mobile phones by physicians, nurses, and other health care providers. This study as such is visible contribution to the growing body of empirical studies of mobile phones in society.

The use of ethnographic and qualitative research methods enabled me to identify the processes whereby individual health professionals and lay users determine their relationship to mobile phones and each other through the use of the technology. Reflexive autoethnography in the study of an object of globalization, such as the mobile phone, enabled the acknowledgement that Egypt will have similar experiences with the technology as other contexts, while maintaining some uniquely Egyptian attributes. Two contexts of change were observed. The first was the changing organizational culture of the health sector with respect to service delivery and the second was family-centred culture and practices of Egyptians, particularly with respect to accessing emergency care and advice.

As an insider to Egyptian culture, I expected that the experience would be more unique than universal. However, I discovered that due to the universal nature of mobile phones the experience mirrored those potentially experienced in other contexts, including the United Kingdom. Mobile phone applications by and among health professionals were simple and straightforward, mirroring fixed-line telephones with the advantage for mobility. Mobile phone applications by lay users were a bit more complex with the dependence on intermediaries. Key decisions to limit the scope of empirical data analysis and presentation to only explore direct and indirect health were helpful as it helped to

maintain a practical focus to the study. Within indirect health benefits, the focus on well-being in Minia, as would be the case almost anywhere in Egypt, naturally centred on the family and provided a clear link to family involvement within the direct use of mobile phones for health.

Qualitative research methods were essential for producing descriptive explanations and case studies of how mobile phones are in fact contributing to direct and indirect health benefits. Reasons for the domestication patterns were directly associated with observable environmental conditions as well as cultural perceptions and practices that are so much a part of daily life of Egyptians. The trends within discussions and triangulation with observations and informal discussions with public health colleagues in other parts of Egypt and the media indicate that the experience in Minia is similar to the rest of the country. As such a similar process in another part of Egypt could be used that would generate similar empirical data. As with these sorts of methods, the primary hypothesis generated was that given some structure mobile phones could be more strategically applied to the coordination and administration of health services. Methods used proved helpful to identify intersection between mobile phones, culture, and health. Future research should explore in more detail the actual health impact that mobile phones are having in the areas that have been identified by this study.

Challenges

The selected bodies of literature consulted throughout the research process have grown significantly, particularly in the past two years. In a literature review of mobile phones in developing countries Jonathan Donner asserts that “Though the number of studies focused on mobiles in the developing world is growing steadily, these studies have been emerging in relative isolation from each other, separated by regions, and by disciplines.” (Donner 2005a, p. 1). In this collection of literature the scholarly articles and selected reports were mostly published between 2003 and 2005. What has not emerged to date, however, are mobile phone and health studies in developing countries. Case studies of other ICT use for health in developing countries did not provide the amounts of

comparative data as I had expected. In reviewing information on health-related uses of mobile phones that was collected during field work in Egypt in light of STS that I explored throughout my research experience, I was reminded of the complex nature of the study of technology in society.

The Science and Technology Studies (STS) theories that I reviewed at the start of my research contributed to the design of the study, but were difficult to apply to the discussion since there none that were comprehensive enough to cover all aspects of my research. ANT as a theory was particularly useful in the design of my study to ensure that I considered for inclusion key network elements in the study. A formal use of Actor Network Theory (ANT), however, was not used for data analysis as it involves rigorous and systematic review of individual network elements, which would generate data on the elements and interactions that prioritize examining the network itself and generating significant amounts of data that address more than the special focus on health benefits. The review of network elements was helpful to identify key mobile phone-related trends involving interactions between health professionals, lay users, technologies, and service outlets.

Similar to ANT literature, the Public Understanding of Science (PUS) literature was also useful in the design of the study as it encouraged me to consider the duality in the influential nature of media and peer to peer transfer of information regarding mobile phones on public perceptions as well as public perceptions on the use of technology. In the analysis, PUS was only peripherally useful for addressing a perceived barrier to the maximization of mobile phone use for health, namely risk perceptions of the harmful side effects of mobile phones. This theoretical framework proved less useful to understand health benefits and more useful in how individuals expressed a range of barriers to maximized use of the technology including a lack of understanding of certain functions as well their risk perceptions of the radiation generated by mobile phones and mast heads.

The study design was conducive to addressing each of the objectives; however there were a few limitations that ought to be mentioned. The first was the challenge that I

experienced in attaining what I considered to be a more balanced sample. Key challenges included finding rural-based health professionals as well as women with mobile phones mostly in rural areas but as well in urban. This ultimately resulted in data that reflected predominantly urban values of male health professionals (usually physicians) and business people and their experiences. It also confirmed what is currently known about the culture of health as well as gender in Egypt.

The second challenge was organizing and analysing the volume of data generated during in-depth interviews. The line of questioning utilized, based on the Ethnographic Field Guide, generated a great deal of data that would provide a useful information to future empirical mobile phone studies based on documented trends of mobile phone use in Egypt. During the analysis process data that focused on actions and behaviours proved more useful than those that dealt with concepts and thoughts about the potential health benefits. As a result much of the empirical data of a conceptual nature were minimized in the presentation of study outcomes and trends. Despite the volume of data, with the assistance of another technology, the ethnographic software package, Nudist, I was able to manage and compile data for analysis. In using Nudist, having a balance between codes that were neither too narrow nor broad was critical. In some cases coded data was merged to enhance analysis and in others they were further divided. The software made it easier to code text and pull together relevant pieces for comparison and analysis. Although the coding process is labour intensive, data retrieval and sorting is faster.

And finally, there were few linkages between data collected during the media review and the interview data. Because much of the coverage in the three newspapers were advertisements for mobile phone hardware and services the relevance to my research was limited. There were a number of illustrative examples that did come out in the media primarily in the form of cartoons that mirrored key trends described by respondents and a few articles that were traced to validate and complement empirical data that was shared about the Abu Korkas Bus Accident and motor vehicle accidents in general as well as the social commentary on risk perceptions of the harmful effects of mobile phones. Expectations that somehow linkages between how mobile phone companies advertise

their products and how they are used did not materialise in the context of a public health account of the health benefits of mobile phones, but more so on business, family, and social life.

Conclusion: Discussion of Results

In exploring the role of mobile phone use for health, improvements in the overall telecommunications infrastructure as well as health service delivery systems are changing the way that services are being accessed and coordinated in Minia. Herd immunity among mobile phone users in urban areas alongside a range of communication tools and patterns were beginning to emerge at the time of the study within the health sector. These will be invaluable for future health service planning, coordination, and enhancement. There is also a broad acknowledgement that improvements to the health system beyond telecommunications have been and will continue to be critical to the success of any of the recommendations provided.

Once individuals have understood how mobile phones work and the interactions they enable with a range of actors in the health service and prevention network their use in everyday life becomes routine. The domestication of technology illuminates the processes, environmental conditions, and experiences that result in the practical integration of technology into everyday life. In the case of Egypt, phone consultations, direct contact to health care workers, and enhanced access to emergency care services are becoming everyday occurrences that are creating new demands that will require future exploration for the practice of medicine. In domestic settings mobile phones are creating new intermediaries for accessing health services and related transportation as well as creating new opportunities for women in an environment of social change. Overall, the approaches used to study mobile phones and health in Egypt have proven effective and have enabled me to generate and discuss data making direct contributions to achieving my study objectives in addition to addressing some gaps in existing literature.

Chapter 8: Conclusion

The contribution of mobile phones to enhancing health and health service delivery in many contexts has generally been taken for granted (Agar 2003). However, the expansion of mobile phone networks and services to developed and developing countries presents a largely overlooked strategic opportunity for the health sector to maximize increased access to the technology for meeting health objectives (World Health Organization 2006). This opportunity is particularly important for many developing countries where, prior to the introduction of mobile phones, the majority of a country's citizens did not have access to telecommunication technologies of any kind. Until recently, there was limited attention paid to the potential impact that improved telecommunications or more specifically that mobile phones might have on health. This Thesis is a contribution to understanding this impact as well as some of the challenges in realizing it.

Mobile phones have the potential to enable communication in places where it was not possible in the past in addition to offering instantaneous dialogue and information transfer without dependence on literacy. This solves some issues, but also problematicises others in the delivery of healthcare. For instance, patients can more rapidly access advice from physicians; however as presented in the discussion, this raises questions regarding the sorts of situations that can be addressed without a physical examination through verbal descriptions. The benefits of mobile phones with respect to improving access to and coordination of services and various types of support are balanced by their potential for causing harm as illustrated by the case studies on emergency and routine health care, family well-being, and the limitations to formal integration. However, acknowledging and making efforts to minimize the potential harm will create an enabling environment towards maximizing the potential benefits as illustrated in the recommendations for formal integration of mobile phones by the health sector.

According to the World Bank, Egypt had progressed from 51.1 fixed line and mobile telephones per 1000 people in 1996 to 107.7 in 2000 (World Bank 2001). Based on reports from the two major mobile phone service providers at the time of my study, there were over 3.3 million mobile phone subscribers in Egypt for a population of 65 million people. Since then the number of subscribers has climbed to 14 million, representing 20 percent of the country's population (World IT Report 2006). Unlike in many other developing countries, which have chosen to bypass fixed-line telephones, competition from mobile phone companies in Egypt has influenced increases in fixed-line telephone services to 10.4 million (World IT Report 2006). The result is a dramatic improvement in telecommunication capacity irrespective of modality.

Mobile phones are playing a beneficial role within the health sector in Egypt. They facilitate access to emergency and routine health services for the general public, extending benefits to a broader segment of the population than direct subscribers. Health care professionals are availing themselves of the technology and finding that they are better able to coordinate, manage, and deliver health services and provide on- and off-site patient care at anytime from any place. Families are finding that mobile phones enable a connection to spouses, children, and siblings who are away from the house, providing an increased sense of safety and security. By exploring the role that mobile phones are already playing in the daily lives of people in Minia, a case has been made for more formalized application of the technology within the health sector to potentially maximize their impact.

Most health professionals interviewed for this study acknowledged that mobile phones have made an important contribution to their work, but found it difficult to stipulate exactly what the health impact has been. This is largely due to the unplanned nature of its use thus far. The uncalculated impact was expressed well by an emergency room physician from Cairo working in Minia who served as a key informant in my study as he recounted that mobile phones are having what he referred to as a "significant" impact on the health system in Egypt. The following quote summarizes well several findings from my study. He begins by asserting that for mobile phones to be of any health benefit that a

critical mass of physicians must have and use mobile phones in their work. He then proceeds to describe the benefits and pitfalls of direct access to the technology.

If you are only one doctor with a mobile phone, then it does not serve a purpose. But if there are many with the phone then you can get somewhere.

Probe: *So what is it good for?*

If I need advice or someone needs advice from me, if I need to get in contact with someone directly, if I need consent or permission to do something it is much easier with a mobile. I can get the right people at the right time to the right place. This is not to say that the whole system is great. There are still many places in large cities especially Cairo where there are dead spots. In the heart of large buildings this is a major problem. This creates problems. Now with advances in telephones we can recognize important calls (caller ID is a popular service in Egypt now for ground lines).

Probe: *So how would you quantify the health impact?*

You can't do this in a percentage... There is an impression, yes, but no statistics. But on the other hand people who should be in hospitals all the time leave their duties, saying, "I have a mobile and you can contact me any time." This is not right and failures with the mobile phone networks and traffic. In spite of its usefulness, it encourages people to do wrong things.

Emergency Response Specialist from Cairo

To highlight key aspects of the benefits of mobile phones, this physician makes a number of critical statements: 1) the benefits of mobile phones by physicians and other health professionals increase when more of them have access to the technology, 2) mobile phones enable direct access to other health professionals and specialized information, and 3) the capabilities of mobile phones should not be overestimated.

As described in the context of the combined use of technology and telecommunications "herd immunity", the greater the proportion of fixed-line telephones and mobile phones per population the greater the benefits are for the entire population, not just those who own a mobile phone. In relation to remote consultation among physicians, benefits

increase when more physicians have mobile phones or are contactable by other members of the network through fixed-line telephones. Direct access between physicians and physicians and patients provides an enabling environment for telemedicine via mobile phones, however, systematic guidance is needed to determine when the technology can and cannot be used to substitute physical examinations and other in-patient diagnostics. Despite enhanced telecommunications capacity, limitations within phone connections and networks as well as health care services must be acknowledged and minimized to ensure maximum benefit.

Having set the context surrounding the integration of mobile phones in Egypt, this chapter provides key conclusions regarding the study results and approaches as well as recommendations for critical next steps to maximize the health benefits of mobile phones by the health sector and in the general population.

Summary of study findings

This PhD Thesis contributes first and foremost to the practice of public health in developed and developing countries with a specific focus on settings which did not have functional telecommunications infrastructures before the introduction of mobile phones. It also contributes a developing country as well as a health-care specific case study to the growing literature on mobile phones within society. Through the analysis of empirical data, the following six findings were identified and provide major contributions to ongoing learning about the potential of mobile phones to support health objectives.

1. Mobile phones enable access to and coordination of a broad range of emergency health services. [Study Objectives 1 & 2]
2. Mobile phones improve access to, and coordination of, routine health service delivery and specialized information. [Study Objectives 1 & 2]
3. Mobile phones indirectly support health through improved well-being from enhanced family communication. [Study Objective 2]

4. Limitations to mobile phone use for health should be addressed within any program or sector-wide intervention aiming to formally integrate the technology. [Study Objective 3]
5. There are simple solutions that can minimize existing limitations as well as enhance health benefits from improved access to telecommunications. [Study Objective 3]
6. Future research should focus on determining the cost-benefit and health impact of the use of mobile phones in addressing motor vehicle accidents and exploring the potential benefits of a rural based telemedicine program. [Study Objective 4]

Each of these findings contributes to the overall aim towards a greater understanding of the direct and indirect health benefits of mobile phones as well as the four study objectives established to provide structure to achieving this broader aim as indicated above.

The first study objective endeavoured to identify changes within health services related to the introduction of mobile phones. To this end mobile phone use is enabling lay people to more easily access health services as well as transportation and health professionals to coordinate and consult as they provide these services to address emergency as well as routine health care needs. The domestication of mobile phones for health professionals is facilitating health service administration, remote patient monitoring, and disease surveillance and prevention. The benefits expressed were an increase in work efficiency and mobility. For lay users improved access to transport and health services (emergency and otherwise) were the primary benefits, particularly for those living in rural areas where health services are perceived to be unreliable. For both groups access to health information is also improving with mobile phones, including telemedicine consultations, health care provider- patient exchanges, and referral systems.

The second study objective endeavours to explore perceived changes in domestic communication for health. The family is the key unit of individual and collective action in Egypt. This was not purposefully investigated within the study, but came out in people's descriptions of their mobile phone use. Families in Minia serve as points of support mobilization in emergencies; mothers serve as intermediaries; and family

communication is the focus for the promotion of well-being, safety, and security. Mobile phones have become available at a time of dynamic social change in Egypt that is characterized by increasing distances between members of immediate and extended families, especially for women. Egyptian households are shifting from extended family units to nuclear families living in different parts of the same governorate, different governorates, and in many cases with individual members in different countries.

It was my observation that mobile phones are perceived to ease and stimulate social change in Egypt. For children of aging parents in a country with an increasing burden of chronic illness, they are able to provide psychosocial, financial, and transportation support from a distance. Adolescents are breaking traditional barriers between males and females through the enhanced privacy and direct contact that mobile phones provide. Young women are more able to travel for work and study as parents and male siblings perceive that they can have direct contact with them to maintain control over their activities. For some households, mobile phones catalysed behaviours that contribute to the ongoing trends within society. For others, the new models for social interaction were already incorporated into the family's approach to life and mobile phones provide additional maintenance for coordinating and providing instantaneous support when needed.

The third study objective aims to provide some reflection on the potential areas for formal integration of mobile phones to support health promotion. As such two inter-related approaches ought to be considered. The first is the minimization of barriers that hinder or limit the potential that improved access to telecommunications can offer to the health sector. The second is to implement interventions aimed towards their enhanced utilization. To minimize limitations, attention and consideration is required in the following areas. First, emergency health care call numbers from a mobile phone must be decentralized to each governorate or district with appropriate training for call centre staff. Second, the cost of mobile phone calls to and from health care providers ought to be reviewed. Fixed-line telephone service in health facilities and emergency call boxes in rural areas ought to be prioritized and utilized for telemedicine consultations and

emergency services in an age of increasing and more affordable connectivity. Subsidies for mobile phone service for health professionals where the benefits are deemed to outweigh the cost to the health should be explored. Standard protocols for remote patient care and patient consultations by phone must be put into place along with the relevant training, accountability, and cost-recovery mechanisms for services rendered at a distance.

Finally, the fourth study objective proposes to identify key areas for future research to support the more strategic utilization of mobile phones by the health sector. To this end, the two primary areas that surfaced during my research were in relation to addressing motor vehicle accidents and the health care needs of people living in rural areas. Similar to the analysis conducted in the United States on the reduced time to car crash with the increased use of wireless technology by the general public (Horan and Schooley 2002), there is a need to explore more systematically the time and cost savings associated with the introduction of mobile phones in Egypt. This would potentially involve investigating the mobilization of support at the scene of an accident as well as key aspects of an early warning system for health facility preparedness. Rural telemedicine programs that are currently being implemented in other countries for the remote diagnosis, referral, and treatment of specific conditions ought to be piloted tested and evaluated in Minian villages. The aim would be to assess their potential in improving utilization of local services as well as saving time and transport involved in accessing urban health care providers.

New directions and opportunities

In Egypt the exploration of the role of mobile phone use to access and deliver health services provides a starting point for planning movements towards the strategic integration of this widely available technology by the health sector. It has been particularly useful to do this in the context of how mobile phones are also used in domestic settings. The characteristics of mobile phones as a technology and their spread into society are rapidly changing. Mobile phones now enable access to the Internet, have

the capacity to take and transmit photos, and can be found in almost any part of the world. In developing countries, the networks have spread to rural communities throughout remote areas in Africa, Asia, Eastern Europe and Latin America. For these countries, many of the recommendations in the case of Egypt apply as the strategic application of mobile phones for health in many contexts is still in its infancy.

In 2005, at its 58th session, the World Health Assembly adopted a resolution that established an eHealth strategy for the World Health Organization (WHO). To implement its formal program on eHealth, the WHO created the Global Observatory for eHealth. As a first step, the observatory has conducted a world wide survey to measure the eHealth capacity and interests of member countries. The formal report from the survey is expected for release in May 2006 (World Health Organization 2005). Key steps are being taken within this effort to promote the monitoring and evaluation of eHealth services for more strategic decision making. With the growing interest in mobile telemedicine and the use of mobile phones within the health sector at the end of 2006, the WHO program has begun exploring the development of a mobile health strategy.

There are many situations in which individuals, NGOs, and public and private health care institutions are using mobile phones as part of their health programs, but very few that are measuring their impact or contributions to the program. This effort by WHO to evaluate the use of technology in health is welcome. Developing countries should be seen as sources of knowledge and information based on their experiences with technology. It is important to learn from their insights to inform future design and promote technological cooperation (Juma et al. 2001). In developed countries, mobile phone companies are working with the health sector to develop communication systems and health applications that enable enhanced monitoring of and communication with patients suffering from chronic diseases. This cooperation ought to be extended to developing countries to enable the creation of low cost devices that facilitate enhanced health service delivery in resource poor settings.

The ideal scenario for the development of health-related technology applications linked with mobile phones, borrowing from a broader ICT for development review, is “a mutual learning process, where the executives from the [health sector] learn about the nature and possibilities of [mobile phones] from a strategic viewpoint, and the systems developers learn about the strengths and weaknesses, preferences, and dislikes of the [health sector]” (Malling 2000, p. 21). In the case of transferring or reconfiguring mobile phones for use in poor countries some knowledge of the values, processes, skills and structures of those contexts will enable the development of even more appropriate locally acceptable technologies (Heeks 2002).

Because the focus of eHealth programs is on the use of ICT within and by the health sector, there is a need to also consider technology utilization within the general public as illustrated in this PhD Thesis. With increased access to mobile phones and other technologies may come increased demand for health services. This gap in eHealth analyses in poor countries ought to be addressed as telemedicine begins to shift from intra-facility support to facility to home support for remote monitoring of the chronically ill and elderly. These two populations were observed in my study as well as others to increasingly buy the technology to preserve their well-being and peace of mind just in case a health problem should arise (Ling 2004).

As new technologies are developed and deployed it is paramount that both the business and public health communities understand the dynamic relationships evolving between the development of a particular technology and health. In order to ensure their value in poor countries mobile phones must be viewed as a production good rather than a consumer good (Kaul 2001), which is often the case in rich countries. This means looking for ways in which people in poor countries can apply the technology more fully to achieve social goals and objectives, including those that “produce” better health.

Strategic partnerships for health

Egypt as a country is well positioned to consider formal integration of mobile phones into the health sector. It has a well developed health infrastructure, a political commitment to maximize technology for social impact, and an ever growing critical mass of mobile phone and fixed-line telephone users in both the general population as well as in the health sector. By exploring the direct and indirect health benefits and the progression of changes in health services and domestic settings due to improved telecommunications a case for formal integration can be made. Many of the services recommended to improve access to health care services through improved telecommunications already exist within the private sector in Egypt. It would be prodigious for the Egyptian Ministry of Health to explore how such health-related call centres, directories, and patient information management systems might be extended to a greater proportion of the population through Public Private Partnership initiatives.

The traditional focus of public health professionals includes reducing the incidence of disease, managing health systems more efficiently, and improving overall quality of life for their target populations. Although relevant, many have not systematically explored how best to acquire benefits from access to improved telecommunications systems in their work. Based on this study of the domestication of mobile phones into everyday life, health professionals and lay users are experiencing the benefits of the technology in their professional as well as personal lives. What remains to be observed is a movement towards the formal integration of mobile phones to maximize the potential benefits by the health sector. Outcomes of this study include recommendations for direct modification of existing systems within the health sector, pilot programs for testing out new systems, and operations research from which future programs can be designed.

Throughout the course of the past few years, I have observed a revolution within the health sector in developing countries and among multi-national corporations in general. At first, both factions seemed to ignore the potential for integrating the philosophies of the other in their day to day practice. The transfer of knowledge, skills, and information

that is an inevitable consequence of globalization is having repercussions on the health of the societies. Although mobile phone corporations mostly view technology in light of market competition rather than a vehicle for improving the human condition, applications of technology have potential to deal with issues such as good nutrition, health and environmental management (Beard 2000; Westrup 2000; Juma et al. 2001). In keeping with the multi-directional flows of information between actors poor countries ought to be viewed not as problems, but as key informants to the development of technologies that will contribute to their solutions (Juma et al. 2001).

As companies grow and increase their engagement in new countries their contribution to the quality of life of their employees as well as the host society becomes increasingly important. Corporate social responsibility as well as Kofi Anan's "responsible globality" (Beard 2000) are the "buzz words" for companies striving to have a positive social impact in order to maintain and expand their domestic markets in the face of increasing popular aggression towards globalisation.

As indirectly illustrated in this study, mobile phones can be leveraged to increase participation in the economy as well as target social development objectives. The common goals and tensions between mobile phone companies and those interested in their social impact must be identified and negotiated. An outgrowth of social responsibility, the social marketing of mobile phones to the health sector involves the direct marketing of mobile phones by mobile phone service providers to the general public and the health sector with the proactive motivation of contributing to improved health outcomes. It also extends to the creation of health-specific software applications within mobile phones.

In the movement towards enhanced Public and Private Partnerships, a mutual learning process between technology companies and the health sector is needed. The focus of this is to explore the potential for cost subsidies for health professionals, the social marketing of mobile phones to the general public and health sector for health, and the development of health-specific mobile phone applications. Such programs should be designed to more

strategically use mobile phones as a tool for achieving existing health objectives. Appropriate measures of evaluation ought to be integrated into the implementation process to assess the impact of interventions to help inform future programming and policy development (Shields et al. 2005).

Conclusion

This PhD is a step towards the strategic exploration of the role that mobile phones are playing within the health sector and the general public for health. In many developed and developing countries, the role of mobile phones and an overall increase in access to telecommunications in health has largely been undocumented. For developing countries, efforts to address chronic and infectious diseases simultaneously pose a significant burden to an already overworked health care system and human resource base. Mobile phones within the general population and among health professionals are creating new opportunities for improving access to emergency and general health services and improving coordination and collaboration among users in most countries. The potential result is increased efficiency and effectiveness of health service delivery.

Using case studies developed through a systematic analysis of qualitative data collected in Egypt, this PhD Thesis provides some understanding of how mobile phones have been ‘domesticated’ for health in Egypt and where key limitations to formal integration exist. Training, infrastructure development, target group definitions, and accountability need to be a part of the appropriate selection and integration of technology. This study provides key recommendations for how to address these limitations, what services might enhance the contribution of enhanced access to telecommunications for achieving health objectives, how the health sector might consider partnering with mobile phone companies, and the sorts of future research that will further the public health community’s understanding of the dynamic contribution mobile phones might be able to make in access to and delivery of health care.

Based on study findings, proposals to more fully explore the potential of mobile phones as a tool to achieve health objectives can and have been made. There is the need to shift from informal domestication to more formal institutionalization of mobile phones through the development of protocols and support systems. Such programs require political will and commitment from policy makers, health professionals, and potential beneficiaries. Key strategic areas for programming include emergency response to ensure that access to transportation is streamlined, eliminating the need for intermediaries to facilitate mobilization of support. They also include the continued expansion and improvement of telecommunications systems to rural areas and health facilities. Partnerships between the public sector and mobile phone companies should consider formal integration of mobile phones into health service administration and delivery, the development of health-specific technologies and calling plans, and the social marketing of mobile phones to health professionals. Operations research can begin to address emergency as well as general health service delivery in two strategic areas, namely addressing motor vehicle accidents and improving access to specialized information through telemedicine in rural areas. Each area could help inform future programming in Egypt and other developing countries striving to maximize newly achieved improvements in telecommunications for health.

As indicated at the beginning of this chapter, the number of mobile phone subscribers in Egypt has risen to 14 million as of January 2006 (World IT Report 2006). At the time of my study, there were approximately four million subscribers. As one might imagine, it has been both fascinating and challenging to study the effects of an object that is continuously changing so dramatically. The increases in telecommunications capacity and the expansion of those tapped into the network will continue to grow. This will be likely to multiply the effects of change that were observed during my field research as well as introduce some new ones. Therefore, it is incumbent upon the public health community to take a closer look at the potential gains that mobile phones have to offer while making efforts to minimize the unintended consequences they may be creating.

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Appendices

Appendix A: Map of Egypt



Source: http://www.egyptmyway.com/maps/egypt_map.html

Appendix B: Ethnographic Field Guide of Health-related Uses of Mobile Phones

Health professionals

- How are mobile phones being used by the health sector?
- What trends in the health sector have developed as a result of mobile phones?
- How are these trends influencing health service delivery?
- How are the demands on health facilities and personnel changing?
- What has been the response to these changes?
- What aspects of health have been impacted as a result of mobile phones?
- What are the potential future health applications of mobile phones?

Individual mobile phone users and non-users (Lay users and health professionals)

- What was their experience with telephones prior to the introduction of mobile phones? (Probe about health-related uses of landlines)
- How and when did people first hear about the phones?
- What was their initial response?
- When did they start using them and why did they choose to do so?
- Non-users- Why have you chosen not to use the phones?
- What is the terminology surrounding the phones and what is the meaning and evolution of these terms?
- How do they understand the transfer of information to be determined?
- What is their perception of the way that the technology is structured?
- How is life different as a result?
- For what purposes are they using them?
- What is the perceived relationship between the phones and health?
- What sorts of health messages have been sent and received using mobile phones? (within the past two weeks, if possible to maximize recall)
- What type of response does health information from a mobile elicit?
- How does this compare with other modes of health communication? (information vs. medium)
- What are the potential health benefits?

Appendix C: Empirical Data Analysis Codebook

Codebook for Health Professional and Lay User Interviews		
Code	Expanded Form	Use When
FH_TH_1-2	First Heard Time Frame 1-2 Years	Code all excerpts in which someone mentions the time frame in which s/he first heard about mobile phones as 1-2 years ago.
FH_TH_3	First Heard Time Frame 3 Years	Code all excerpts in which someone mentions the time frame in which s/he first heard about mobile phones as 3 years ago.
FH_TH_4-6	First Heard Time Frame 4-6 Years	Code all excerpts in which someone mentions the time frame in which s/he first heard about mobile phones as 4-6 years ago.
FH_TH_7	First Heard Time Frame 7 Years	Code all excerpts in which someone mentions the time frame in which s/he first heard about mobile phones as 7 years ago.
FH_TH_10	First Heard Time Frame 10 Years	Code all excerpts in which someone mentions the time frame in which s/he first heard about mobile phones as 10 years ago.
FH_TH_OT	First Heard Time Frame Other	Code all excerpts in which someone mentions the time frame in which s/he first heard about mobile phones in a way other than through the number of years.
FH_TV	First Heard Source of Information: Television	Use to code texts when respondents report that they first heard about mobile phones from television.
FH_NB	First Heard Source of Information: Neighbours	Use to code texts when respondents report that they first heard about mobile phones from a neighbour.
FH_NP/MG	First Heard Source of Information: Newspapers/ Magazines	Use to code texts when respondents report that they first heard about mobile phones from a newspaper or magazine.
FH_AB	First Heard Source of Information: Abroad	Use to code texts when respondents report that they first heard about mobile phones from someone who is living abroad.
FH_RT	First Heard Source of Information: Relative	Use to code texts when respondents report that they first heard about mobile phones from television.
FH_WC	First Heard Source of Information: Work colleague	Use to code texts when respondents report that they first heard about mobile phones from a work colleague.
FP_TF_0.5	First Purchased Time Frame w/in 6 Months	Code all excerpts in which someone mentions the time frame in which s/he first purchased a mobile phone as within the past 6 months.
FP_TF_1	First Purchased Time Frame 1 Year Ago	Code all excerpts in which someone mentions the time frame in which s/he first purchased a mobile phone as 1 years ago.

Code	Expanded Form	Use When
FP_TF_2	First Purchased Time Frame 2 Years Ago	Code all excerpts in which someone mentions the time frame in which s/he first purchased a mobile phone as 2 years ago.
FP_TF_3	First Purchased Time Frame 3 Years Ago	Code all excerpts in which someone mentions the time frame in which s/he first purchased a mobile phone as 3 years ago.
FP_TF_4	First Purchased Time Frame 4 Years Ago	Code all excerpts in which someone mentions the time frame in which s/he first purchased a mobile phone as 4 years ago.
FP_RE_EM	First Purchased Reason: Emergencies	Code all excerpts in which someone mentions the reason in which s/he first purchased a mobile phone as just in case of emergencies.
FP_RE_RC	First Purchased Reason: To be Reachable	Code all excerpts in which someone mentions the reason in which s/he first purchased a mobile phone as for other to be able to reach him or her.
FP_RE_TR	First Purchased Reason: Travel	Code all excerpts in which someone mentions the reason in which s/he first purchased a mobile phone as travel.
FP_RE_RA	First Purchased Reason: Relatives Abroad	Code all excerpts in which someone mentions the reason in which s/he first purchased a mobile phone as being able to communicate with relatives abroad.
FP_RE_WK	First Purchased Reason: Work	Code all excerpts in which someone mentions the reason in which s/he first purchased a mobile phone as work.
FP_RE_SP	First Purchased Reason: Social Pressure	Code all excerpts in which someone mentions the reason in which s/he first purchased a mobile phone was because of social/ peer pressure.
FP_RE_GF	First Purchased Reason: Gift	Code all excerpts in which someone mentions the reason in which s/he has a mobile phone was because someone gave it to him or her as a gift.
AD_FW	Advantage: Facilitates Work	Code texts in which the respondent describes an advantage of mobile phones as facilitating work.
AD_ST	Advantage: Saves Time	Code texts in which the respondent describes an advantage of mobile phones as saving users time.
AD_FMC	Advantage: Fast Mode of Communication	Code texts in which the respondent describes an advantage of mobile phones as a fast mode of communication.
AD_IX	Advantage: Inexpensive	Code texts in which the respondent describes an advantage of mobile phones as an inexpensive means of communication.

Code	Expanded Form	Use When
AD_AA	Advantage: Anywhere/Anytime	Code texts in which the respondent describes an advantage of mobile phones as enabling contact with users anytime and anywhere.
AD_DC	Advantage: Direct Contact	Code texts in which the respondent describes an advantage of mobile phones as facilitating direct contact.
AD_PC	Advantage: Brings People Closer	Code texts in which the respondent describes an advantage of mobile phones as bringing people closer.
AD_PY	Advantage: Privacy	Code texts in which the respondent describes an advantage of mobile phones as enabling privacy.
AD_SM	Advantage: Saves Money	Code texts in which the respondent describes an advantage of mobile phones as saving money.
AD_PM	Advantage: Peace of Mind	Code texts in which the respondent describes an advantage of mobile phones as providing peace of mind.
DA_CT	Disadvantages: Cost	Code texts in which the respondent describes cost as a disadvantage of mobile phones.
DA_CT_DE	Disadvantages: Cost: Drain to the Economy	Code texts in which the respondent describes being a drain to their own finances as well as the economy of Egypt as a disadvantage of mobile phones.
DA_HR	Disadvantages: Health Risks	Code texts in which the respondent describes health risks as a disadvantage of mobile phones.
DA_SC	Disadvantages: Social Control	Code texts in which the respondent describes social control as a disadvantage of mobile phones.
DA_DAS	Disadvantages: Dead Air Space	Code texts in which the respondent describes unreliability of network coverage as a disadvantage of mobile phones.
DA_TP	Disadvantages: Technology Problems	Code texts in which the respondent describes technology problems as a disadvantage of mobile phones.
DA_CN	Disadvantages: Changing Numbers	Code texts in which the respondent describes changing numbers as a disadvantage of mobile phones.
OP_MX	Opinion Mixed	Use code when someone describes both positive and negative opinions about mobile phones.
OP_PO	Opinion Positive	Use code when someone describes only a positive opinion about mobile phones.
OP_NE	Opinion Negative	Use code when someone describes only a negative opinion about mobile phones.

Code	Expanded Form	Use When
HP	Mobile Phone Uses by Health Professionals	Use code for health professional interview sections that are noteworthy for which there is not an existing code.
HP_FP	Mobile Phone Uses by Health Professionals: Following up on Patients	Use code when health professionals mention using their mobile phones to follow up on patients.
HP_WSP	Mobile Phone Uses by Health Professionals: Work in Several Places	Use code when health professionals mention using their mobile phones to facilitate work in several places.
HP_RH	Mobile Phone Uses by Health Professionals: Routine Health Practices	Use code when health professionals mention using their mobile phones to perform routine practices.
HP_CR	Mobile Phone Uses by Health Professionals: Coordination of health activities	Use code when health professionals mention using their mobile phones to coordinate health-related activities.
HP_HP	Mobile Phone Uses by Health Professionals: Contacting other health professionals or finding doctors	Use code when health professionals mention using their mobile phones to contact or find other health professionals.
HP_EM	Mobile Phone Uses by Health Professionals: Emergency Response	Use code when health professionals mention using their mobile phones to facilitate health-related responses to emergencies.
HP_EM_MVA	Mobile Phone Uses by Health Professionals: Emergency Response: Motor Vehicle Accidents	Use code when health professionals mention using their mobile phones to facilitate health-related responses to motor vehicle accidents.
HP_NA	Mobile Phone Uses by Health Professionals: Negative Aspects	Use code when a health professional mentions a negative aspect of mobile phone use for health purposes for which there is no other code.
HP_NA_CO	Mobile Phone Uses by Health Professionals: Negative Aspects: Cost	Use code when a health professional mentions cost as a negative aspect of mobile phone use for health-related activities.
HP_NA_AB	Mobile Phone Uses by Health Professionals: Negative Aspects: Absenteeism	Use code when a health professional mentions absenteeism as a negative aspect of mobile phone use for health-related activities.
HCS	Health Care System	Use code when a respondent makes a general comment about the health care system for which there is no other code.
HCS_EM	Health Care System: Emergency Care Experiences	Use code when a respondent makes a comment about the health care system in relation to a specific emergency care experience.
HCS_FS	Health Care System: Free Services	Use code when a respondent makes a comment about the health care system in relation to services that are provided free of charge.

Code	Expanded Form	Use When
HCS_CP	Health Care System: Communication Problems	Use code when a respondent makes a comment about the health care system in relation to a specific communication problem that was experienced.
HCS_SDP	Health Care System: Service Delivery Problems	Use code when a respondent makes a comment about the health care system in relation to a specific problem experienced while accessing health services.
HCS_SDP_TR	Health Care System: Service Delivery Problems: Transportation	Use code when a respondent makes a comment about the health care system in relation to a specific problem experienced while accessing health services specifically related to transportation.
HCS_RC_DIR	Health Care System: Recommendations: Directory	Use code when a respondent provides a recommendation to the health care system in relation to creating a directory of health care professionals for easier access.
HCS_RC_SMP	Health Care System: Recommendations: Subsidize Mobile Phone Costs	Use code when a respondent provides a recommendation to the health care system in relation to subsidizing health-related mobile phone calls.
HCS_RC_PRA	Health Care System: Recommendations: Install Phones in Rural Areas	Use code when a respondent provides a recommendation to the health care system in relation to installing emergency phones in rural areas.
HCS_RC_FEC	Health Care System: Recommendations: Fix Mobile Phone Emergency Codes	Use code when a respondent provides a recommendation to the health care system in relation to fixing the problem with the centralized emergency code numbers.
HCS_RC_FHS	Health Care System: Recommendations: Fix Health Services	Use code when a respondent provides a recommendation to the health care system in relation to fixing a specific problem with health service delivery.
HCS_RC_DL	Health Care System: Recommendations: Install Direct Lines in Health Facilities	Use code when a respondent provides a recommendation to the health care system in relation to installing direct lines in health facilities.
HR_EM	Health-related Uses: Emergencies	Use code to mark text when a respondent mentions using the mobile phone to address an emergency.
HR_EM_FL/HM	Health-related Uses: Emergencies: Fixed-Line or Home	Use code to mark text when a respondent mentions using the mobile phone to address an emergency by contacting someone with a fixed-line telephone or home.
HR_EM_122	Health-related Uses: Emergencies: Police	Use code to mark text when a respondent mentions using the mobile phone to address an emergency by contacting the police.

Code	Expanded Form	Use When
HR_EM_123	Health-related Uses: Emergencies: Ambulance in Cairo	Use code to mark text when a respondent mentions using the mobile phone to address an emergency by dialling 123 which is routed to a call centre in Cairo.
HR_EM_OTN	Health-related Uses: Emergencies: Other Emergency Number	Use code to mark text when a respondent mentions using the mobile phone to address an emergency by dialling another emergency number.
HR_EM_NU	Health-related Uses: Emergencies: Number Unknown	Use code to mark text when a respondent mentions not using the mobile phone to address an emergency because s/he does not know what number to dial.
HR_RD	Health-related Uses: Reaching Doctors	Use code to mark text when a respondent describes their health-related use of mobile phones to reach doctors for reasons other than making appointments and for phone consultations.
HR_RD_MA	Health-related Uses: Reaching Doctors: Making Appointments	Use code to mark text when a respondent describes their health-related use of mobile phones to reach doctors for making appointments.
HR_RD_PC	Health-related Uses: Reaching Doctors: Phone Consultation	Use code to mark text when a respondent describes their health-related use of mobile phones to reach doctors for phone consultations.
HR_LHC	Health-related Uses: Lay Health Communication	Use code to mark text when a respondent describes their health-related use of mobile phones to discuss health issues with a non-health professional.
HR_NU	Health-related Uses: Not Useful	Use code to mark text when a respondent describes mobile phones as not useful in addressing health issues.
HR_CT	Health-related Uses: Coordinating Transport	Use code to mark text when a respondent describes their health-related use of mobile phones to coordinate transportation.
FC	Family Communication	Use when a respondent talks about using a mobile phone to communicate with a family member for which there is not a specific code or in general terms.
FC_HW	Family Communication: Husband- Wife	Use when a respondent talks about using a mobile phone to communicate with his or her spouse.
FC_PC	Family Communication: Parent- Child	Use when a respondent talks about using a mobile phone to communicate with his or her parent or child.
FC_BS	Family Communication: Brother/Sister	Use when a respondent talks about using a mobile phone to communicate with his or her brother or sister.

Code	Expanded Form	Use When
FC_HO	Family Communication: Home	Use when a respondent talks about using a mobile phone to call home.
FC_OM	Family Communication: Other Mobile Phones in the Home	Use when a respondent talks about using a mobile phone to communicate with other household members on their mobile phones.
TM_SO	Text Messaging: Special Occasions	Use to code text in which a respondent talks about using SMS to wish people greetings during special occasions other than Ramadan.
TM_SO_RM	Text Messaging: Special Occasions: Ramadan	Use to code text in which a respondent talks about using SMS to wish people greetings during Ramadan.
TM_HP	Text Messaging: Between Health Professionals	Use to code text in which a health professional talks about using SMS to communicate with other health professionals.
TM_FR	Text Messaging: Friends	Use to code text in which a respondent talks about using SMS to communicate with his/her friends.
TM_FR_GF	Text Messaging: Friends: Girlfriend	Use to code text in which a male respondent talks about using SMS to communicate with his girlfriend.
TM_FAM	Text Messaging: Family	Use to code text in which a respondent talks about using SMS to communicate with members of his/her family.
TM_AB	Text Messaging: Abroad	Use to code text in which a respondent talks about using SMS to communicate with people living abroad.
TM_NU	Text Messaging: Not Used	Use to code text in which a respondent mentions not using text messaging.
PU	Proper Uses	Use code to designate text in which a respondent qualifies a proper use of mobile phones for which there is no other code.
PU_DC	Proper Uses: Doctors	Use code to designate text in which a respondent qualifies use by a doctors as a proper use of mobile phones.
PU_EM	Proper Uses: Emergencies	Use code to designate text in which a respondent qualifies emergencies as a proper use of mobile phones.
PU_WK	Proper Uses: Work	Use code to designate text in which a respondent qualifies work as a proper use of mobile phones.
PU_TR	Proper Uses: Travel	Use code to designate text in which a respondent qualifies travel as a proper use of mobile phones.
MU	Misuses	Use code to designate text in which a respondent qualifies an improper use of mobile phones for which there is no other code.

Code	Expanded Form	Use When
MU_SH	Misuses: Showing Off	Use code to designate text in which a respondent qualifies showing off as an improper use of mobile phones.
MU_HS	Misuses: Harassment	Use code to designate text in which a respondent qualifies harassment as an improper use of mobile phones.
MU_LS	Misuses: Love Stories	Use code to designate text in which a respondent qualifies romantic relationships as an improper use of mobile phones.
TP	Telephone Uses_Other	Use code when a respondent mentions using a fixed-line telephone for which there are no other codes.
TP_NB	Telephone Uses_Neighbors	Use code when a respondent mentions using the neighbour's fixed-line telephone.
TP_CN	Telephone Uses_Centrale	Use code when a respondent mentions using the fixed-line telephone at a centrale.
TP_MT	Telephone Uses_MenaTel	Use code when a respondent mentions using the MenaTel pay phones.
TP_HR	Telephone Uses_Health Related	Use code when a respondent mentions using the fixed-line telephone to make health-related phone calls.
TP_HR_LC	Telephone Uses_Health-related_Long Conversations	Use code when a respondent mentions using the fixed-line telephone specifically for long conversations.
TS_DE	Telephone Service Delays	Use code when a respondent mentions experiencing a delay in fixed-line telephone service installation.
MP	Mobile Phone Uses_Other	Use code when a respondent mentions using a mobile phone for a purpose for which there is no other code.
MP_BC	Mobile Phone Uses_Business Calls	Use code when a respondent mentions using a mobile phone for business calls.
MP_RC	Mobile Phone Uses_Receiving Calls	Use code when a respondent mentions using a mobile phone to receive calls.
MP_EM	Mobile Phone Uses_Emergencies	Use code when a respondent mentions using a mobile phone for non-health-related emergencies.
MC	Missed Calls_Other	Use code when a respondent mentions using missed calls for which there is not other code.
MC_PA_HP	Missed Calls_Prior Agreement_Health Professionals	Use code when a health professional mentions using missed calls based on a prior agreement with the recipient.
MC_PA_LU	Missed Calls_Prior Agreement_Lay Users	Use code when a lay user mentions using missed calls based on a prior agreement with the recipient.
MN_PD	Minutes Used per Day	Use code when respondent mentions how many minutes s/he uses per day.

Code	Expanded Form	Use When
BPM	Average Bill per Month	Use code when respondent mentions how much s/he pays for mobile phone service per month.
MN_HS_OP	MobiNil Health Service Card Opinion	Use code to designate text for respondents that provided comment on the MobiNil health service card.
Single Nodes		
Young People/ Students	Young People/ Students	Use to code text that mentions the use of mobile phones by young people or students.
Girls	Girls	Use when a respondent describes mobile phone usage specifically associated with girls.
Boys	Boys	Use when a respondent describes mobile phone usage specifically associated with boys.
MobiNil	MobiNil	Use when a respondent specifically mentions MobiNil.
Click/Vodafone	Click/Vodafone	Use when a respondent specifically mentions Click/Vodafone.
Mobile Phone Cards	Mobile Phone Cards	Use when a respondent discusses the use of cards to recharge their mobile phones.
MobiNil Insurance Plan	MobiNil Insurance Plan	Use to code transcripts for respondents specifically asked about their opinion of the MobiNil Health Insurance Service.
Uncertainty of how to use	Uncertainty of how to use	Use to code text that mentions uncertainty in using a mobile phone.
Only mode of communication	Only mode of communication	Use to code transcripts in which respondents describe that the mobile phone is their only mode of communication.
Receiving calls	Receiving Calls	Use to code transcripts in which respondents discussed using their mobile phones only to receive phone calls.
Giving number	Giving number	Use to code text in which a respondent describes to whom s/he would give out a mobile phone number.
Le Silki	Le Silki	Use to code transcripts in which respondents discuss the use of emergency wireless systems.
Pager	Pager	Use to code transcripts in which respondents discuss the use of pagers.
Health Impact	Health Impact	Use to code text in which a respondent attempts to quantify health impact of mobile phones.
Case study	Case study	Use to code transcripts that could serve as case study.

Code	Expanded Form	Use When
Changes in Egypt	Changes in Egypt	Use to code texts in which respondents describe specific ways in which they observe that mobile phones are influencing social change.
Before mobiles	Communications before mobile phones	Use to code text in which respondents discuss how they communicated before they had mobile phones.
Telecoms Employee	Telecoms Employee	Use to code the transcripts of telecommunications employees.
Driver	Driver	Use to code the transcripts of drivers.
Ambulance worker	Ambulance worker	Use to code the transcripts of ambulance workers.
Government mobile service	Government subsidized mobile phone service	Use to code text in which respondents discuss the desire to have mobile phone services provided by the Egyptian government.