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Introducing mobile technologies to strengthen the national continuing medical education program in Vietnam

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Dissertation

INTRODUCING MOBILE TECHNOLOGIES TO STRENGTHEN THE NATIONAL CONTINUING MEDICAL EDUCATION PROGRAM IN VIETNAM

by

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DEDICATION

I would like to dedicate this work to my favorite people in the world, my mother Charlene McNabb, father Scott McNabb, my brother Patrick McNabb, and nephew Noah McNabb. I am so grateful to be a part of the McNabb family. Thank you for the encouragement and never ending support. I would like to also dedicate this work to my best friend, Lindsay Burchfield, who is an honest, genuine, thoughtful and ever patient woman. I love you dearly Lindsay. Finally, this work is also dedicated Amy Cooper, my amazing, supportive, and brilliant roommate.

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INTRODUCING MOBILE TECHNOLOGIES TO STRENGTHEN THE NATIONAL CONTINUING MEDICAL EDUCATION PROGRAM IN VIETNAM

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ABSTRACT

BACKGROUND

In 2009, the Government of the Republic of Vietnam adopted legislation requiring all clinicians to complete continuing medical education (CME) credits in order to maintain licensure. Several CME in-person and distance-based courses have been developed and as of 2015, a national distance-based electronic learning (eLearning) network was being established. However, the uptake of CME courses remained low despite high clinician demand. Vietnam's high mobile phone ownership rate of 1.4 mobile subscriptions per person presents an opportunity to leverage this for CME. This study investigated how mobile technologies could strengthen delivery of distance-based CME courses and improve national CME program administration.

METHODS

A literature and policy review was conducted. Qualitative methods were employed to collect and analyze key informant interviews of 52 global and Vietnamese experts, including selected policy makers. Interviews were supplemented by six focus group discussions with Vietnamese physicians, nurses, midwives and physician assistants.

Transcripts were analyzed using an inductive coding methodology. A framework was developed to organize and present results for government consumption.

RESULTS

Globally, examples and supporting evidence related to mobile technologies for CME were limited. Experts reported three main use cases for using mobile technology for CME in Vietnam: 1) delivery of CME courses (N=34; 65%); 2) registration and tracking of CME credits (n=28; 54%); and 3) sending alerts and reminders on CME opportunities (n=23; 44%). The national CME policy environment in Vietnam was supportive of introducing mobile technologies within the eLearning network. However, there was a widespread lack of awareness and capacity to design and deliver distance-based CME courses. Mobile phone ownership was high and health workers reported interest in acquiring CME credits via mobile. Financing options to develop and implement distance-based CME courses were limited.

CONCLUSION

Despite the paucity of evidence related to mobile technologies for learning, there is potential to innovate and strengthen the evidence base using these technologies for CME in Vietnam. Introducing mobile technologies within the national eLearning network would improve clinicians' access to CME, particularly in rural areas, and can strengthen national CME program administration. Key recommendations were developed to provide the government with concrete steps for national level adoption.

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LIST OF ABBREVIATIONS

BUSPH..... Boston University School of Public Health

CME..... Continuing Medical Education

DrPH ..... Doctor of Public Health

FGD..... Focus Group Discussion

HAIVN..... Partnership for Health Advancement in Vietnam

HIV .....Human Immunodeficiency Virus

ICT .....Information and Communication Technology

IT..... Information Technology

LET .....Law on Examination and Treatment

LMS ..... Learning Management System

MOH .....Ministry of Health

NGO..... Non-Government Organization

RCT..... Randomized Controlled Trial

SMS.....Short Message Service

WHO .....World Health Organization

CHAPTER ONE: OVERVIEW OF DISSERTATION

In 2009, the Government of the Republic of Vietnam passed a law requiring all clinicians in the country to be licensed and to complete continuing medical education (CME) to maintain licensure. Since 2010, the Ministry of Health (MOH) and the Ministry of Education and Technology designed policies, standards, and guidance for the national CME program. Through the support of the Asian Development Bank, the country has also started to build the capacity of medical and nursing universities and schools to introduce electronic learning (eLearning) courses for pre-service education and CME. eLearning is defined as: *an approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways of understanding and developing learning.*(Al-Shorbaji et al. 2015) While experiences related to eLearning for medical and nursing education are still nascent in Vietnam, there is interest and potential new funding available to continue to build capacity.

Traditionally, eLearning or other distance-based teaching methods usually require access to the Internet via a desktop or laptop computer. But with the increasing adoption of mobile technology adoption in the last decade, there is the potential to leverage these tools within the national CME program. In 2015, the Boston University School of Public Health (BUSPH) and Pathfinder Vietnam, with funding from the National Institutes for Health, conducted a randomized controlled trial (RCT) assessing the use of short message

service (SMS) as a mechanism to deliver health content and stimulate self-study to physician assistants in Thai Nguyen Province. As a result of this RCT, the Vietnamese MOH and provincial health departments have expressed interest in learning how mobile technologies can be used to deliver CME content and provide administrative support to the national CME program.

Dissertation Overview

The goal of this Doctor of Public Health (DrPH) dissertation is to present evidence-informed recommendations for the Vietnam MOH to consider when introducing mobile technologies into the national CME program. In order to achieve the goal, the aims of this dissertation are to:

1. Determine clinician-level (physician, nurses, midwives and physician assistant) practices related to accessing CME credits, needs related to accessing CME, and preferences for how mobile technologies can be used to support CME credit acquisition;
2. Identify appropriate "use cases" where mobile technology can deliver CME or support administration of the national CME program based on local and international best practices; and
3. Provide policy and implementation recommendations for introducing the identified use cases within the national CME program by populating an programmatic framework based on international best practices.

The main methods used in this dissertation included a literature review, focus group discussions (FGD), and key informant interviews. These data were analyzed in order to meet the primary goal and research aims. First, this dissertation discusses the state of health and health worker education in Vietnam. Next, it covers the state of CME and eLearning policy, capacity, and infrastructure in Vietnam, termed as the "enabling environment". Global evidence for mobile technology for learning and CME is then presented and followed by identified "use cases" where mobile technology can be used in Vietnam. Mobile "use cases" refers to the different ways that mobile technology can be used for the national program. Examples include using text messages to send reminders, mobile applications to deliver CME content, etc. The selected use cases are then further examined to understand the key action steps necessary to introduce mobile technologies. Activities and recommendations are populated onto a programmatic framework designed specifically to guide policy makers. The final chapter presents recommendations for the MOH to consider when adopting mobile technologies within the national CME program.

Relevance to Improving the Health of the Public

Vietnam has advanced new policies to ensure that its medical personnel are up to date on clinical guidelines and practices by requiring clinician licensure and renewals. Efforts to increase the use of information and communication technologies (ICT) in medical and nursing education and for CME in Vietnam are ongoing. However, these efforts are new and, given the demand for CME courses, there is a need to identify innovative ways of

ensuring CME content is more widely available, particularly for clinicians in remote areas.

Vietnam has strong mobile network coverage and mobile phone ownership is widespread. This allows the MOH and other CME stakeholders to leverage these tools for mobile learning and to strengthen the overall CME program (International Telecommunications Union 2014). However, there is a lack of experience in designing and delivering mobile phone-supported projects at a national scale in Vietnam, and principally within the MOH. As of March 2016, the MOH was planning the implementation of a World Bank loan (over US$100 million) from 2015 – 2020, aimed at supporting human resources for health, including strengthening the use of eLearning as an educational tool. Incorporating mobile technologies within eLearning programs has the potential to transform how CME is delivered, reaching more clinicians than the status quo, and improve efficiencies in administration of the national program. The recommendations presented in this dissertation are meant to serve as a discussion springboard for the MOH as it considers adopting mobile technologies for CME.

CHAPTER TWO: DISSERTATION METHODS

This dissertation uses a qualitative research design collecting primary data through key informant interviews and focus group discussions. This is supported by secondary research data collected from a thorough review of the existing peer-reviewed literature on the use of mobile technologies for CME. Each research aim and its associated methods are described below.

Research Methods by Aim

Aim 1: Determine clinician-level (physician, nurses, midwives and physician assistant) practices related to accessing CME credits, needs related to accessing CME, and preferences for how mobile technologies can be used to support CME credit acquisition.

Methods:

Focus group discussions were used to gather information from health workers in Thai Nguyen Province on their current knowledge and practices related to CME and interests learning via mobile technologies. A FGD guide was created to gather information on:

- Knowledge of licensure and CME requirements and current barriers and facilitators related to accessing CME
- Mobile phone ownership among health workers and how they typically use their phones (calling, texting, social media email, Internet searches, etc.)
- Preferences for receiving CME content via mobile devices, eLearning or in-person courses

- Willingness to pay for accessing CME through mobile devices

A local Vietnamese researcher conducted six FGDs in Vietnamese in August 2015. Two FGDs were conducted with physicians; two with nurses and midwives, and two with physician assistants. Half of the FGDs included rural clinicians and the other half included urban clinicians. Each session included both men and women. Verbal consent was obtained from participants prior to conducting FGDs. The sessions were audio recorded in Vietnamese, transcribed, and translated into English in Vietnam by the local researcher. English transcripts were emailed to the doctoral student who conducted the analysis. The FGD guides can be found in Appendix 1.

Analysis

English-language FGD transcripts were reviewed and coded by the doctoral student using an inductive coding methodology in the Impact Mapper Software© (Thomas 2006). First the transcripts were reviewed and coded thematically around the topics raised during the FGDs. Once main topics were identified from the first round of coding, sub-themes were developed and responses coded in more detail. The results of the FGDs are presented throughout the rest of the document in relevant chapters using the citation "(McNabb Interviews 2015)".

***Aim 2*:** Identify appropriate "use cases" where mobile technology can deliver CME or support administration of the national CME program based on local and international best practices.

Methods: Two distinct methods were used to address this research aim: 1) a comprehensive literature review; and 2) structured key informant interviews.

Comprehensive Literature Review

A comprehensive literature review was conducted to understand the current evidence-based practices for using mobile technologies for CME content delivery and program administration. Vietnamese legislative documents related to national health policy, CME and integration of ICTs for the health sector were examined to identify gaps.

Key Informant Interviews

Two sets of key informant interviews were conducted, one each with: 1) global ICT for health and training experts, donors/multi-laterals and academics; and 2) Vietnamese MOH and provincial government stakeholders, implementing partners, and academics. Global experts were selected on the basis of their leadership and experience integrating mobile technologies for health or learning based on the doctoral students understanding of the field. Global experts were classified into one of four categories: technology related, academic, implementing partners, and donor/multi-lateral. Vietnamese experts were identified by the Pathfinder Vietnam country representative and were selected based on

their knowledge or experience with CME or eLearning, their role in the government, or their academic setting. Vietnam experts were categorized as: government, implementing partner, and academic.

Key Informant Interviews with Global Experts

A structured guide was developed for global interviews. In all, 30 experts working in a variety of settings worldwide were interviewed in English by the doctoral student via Skype. Each interview lasted approximately one hour. Interviews were audio recorded, and then transcribed for analysis. Key topics covered during the interviews included:

- Global examples and key considerations introducing mobile technologies for CME in Vietnam
- Opportunities and challenges introducing mobile technologies in CME delivery and program administration
- Vision of how mobile technologies can be used for CME in the next five years

Key Informant Interviews with Vietnamese Experts:

Another structured guide was developed for interviews with experts in Vietnam to gain a better understanding of the local environment. Key topics covered during interviews focused on:

- Understanding the status of CME implementation and the regulatory environment
- Learning the interests in integrating mobile technologies for CME
- Documenting eLearning initiatives in Vietnam and lessons learned

A total of 22 interviews with key government officials and other stakeholders were held. If local Vietnamese stakeholders could speak English, the interviews were conducted by the doctoral student in English via Skype. All other interviews of non-English speakers were conducted by a local researcher. All interviews conducted by the local researcher in Vietnamese were recorded and transcribed in Vietnamese and then translated into English. The English transcripts were emailed to the doctoral student for analysis.

Analysis: Interview transcripts were coded thematically using Impact Mapper © software and the qualitative inductive coding method (Thomas 2006). After initial coding was done to understand frequencies, further analysis was performed for each interview to extract key themes and recommendations. Additional analysis produced frequencies of the top "use cases" reported by global and Vietnam experts. Given the relevance of the findings to many parts of this dissertation, the resulting data are presented in various sections as aggregate summaries, quotes, lessons learned, and suggestions for each area. While this represents a somewhat unorthodox approach, the advantages of using these data in various places, rather than limiting them to a single section labeled "interview results" allow a richer and more comprehensive analysis of the situation in Vietnam. This is particularly true since there is so little relevant background information available.

***Aim 3*:** Provide policy and implementation recommendations for introducing the identified use cases within the national CME program by populating a programmatic framework based on international best practices.

Methods:

As noted earlier, the goal of this dissertation is to present evidence-based recommendations for the Vietnam MOH to consider when introducing mobile technologies into the national CME program. In order to structure the final recommendations, a programmatic framework was developed to present results from interviews and FGDs in a user-friendly manner. The World Health Organization (WHO) mHealth assessment and planning for scale tool (published in November 2015) was selected and adapted for this purpose (World Health Organization 2015).

The resulting planning framework was designed to support policy-makers and programmatic staff plan in their efforts to scale-up and sustain a mobile technology solution focusing on learning. Mobile-supported learning is nascent in Vietnam. Therefore, the framework developed for this dissertation covers major programmatic activities related to introducing a technology and learning project.

The planning framework has six axes: groundwork, partnerships, mobile CME (mCME) content, financial health, technology, and monitoring and evaluation. Within each axis are domains and sub-domains that cover specific topics related to the overarching axis.

Data from interviews and FGDs were thematically coded to relate to each of the axes and frequencies for common themes were generated to populate the planning framework. This information was further distilled into a list of concrete recommendations for the MOH to consider when introducing mobile technologies for CME delivery and administrative support.

Ethical Considerations

The Boston University Medical Center ethical review board approved this research on July 16, 2015 as an amendment to the approved IRB protocol for the mCME RCT (H-33241). Ethical clearance was also gained on August 11, 2015 from the Hanoi School of Public Health (014-286/DD-YTCC).

Comments on the Integration of Primary Data in this Dissertation:

The results from the FGDs and the interviews are the key source of primary data in this dissertation and could have been presented within a single chapter. However, upon reviewing the transcripts, it became apparent that they were highly relevant for establishing the context of the dissertation in the opening chapters. In light of this, a decision was made to intersperse these findings at many points in the document. These are denoted using the generic citation, "(McNabb Interviews 2015)". The table below details the demographics of the health workers who participated in the FGDs.

Cadre	**Work Location**	**Number**
Physicians (n=20)	Provincial Hospital	10
	District Health Center	5
	District Hospital	3
	Commune Health Center	2
Nurses/Midwives (n=19)	District Health Center	5
	Commune Health Center	6
	Urban Clinic	3
	District Hospital`	3
	Commune Health Station	2
Physician Assistants (n=20)	Ward Health Center	5
	Preventive Medicine Center	2
	City Health Center	4
	Commune Health Center	5
	District Health Center	4

Table 1: FGD participant demographics, Thai Nguyen Province

A total of 52 key informant interviews were conducted, including 22 experts in Vietnam and 30 global experts. The table below indicates the sectors and areas of expertise of participating stakeholders. A list of experts that were interviewed can be found in Appendix two.

Type of Expert	**Global Number Interviewed**	**Vietnam Number Interviewed**
Academic	3	3
NGO/implementing partner	11	11
Technology firm	9	-
Multi-Lateral or Donor	7	-
Government Representative	-	8
Total	**30**	**22**

Table 2: Type of Key Informant Interviewees

CHAPTER THREE: VIETNAM OVERVIEW

This chapter provides an overview of the health status of the people Vietnam, how the healthcare system is structured, and the state of Vietnam's human resources for health. This information is useful to understand the context in which CME is being implemented in the country.

Vietnam Demographics and Health

Vietnam is a Socialist Republic located in South East Asia and borders China, Cambodia and Laos. Vietnam has a population of over 90 million people, a life expectancy of 76 years, and 23% of the population is below the age of 15 years (World Health Organization 2015). Nearly 32% of the population lives in urban areas, with the remainder of the population living in rural and remote mountainous areas (World Health Organization 2015). There are 54 ethnic groups in Vietnam, of which the Kinh group comprises 86% of the ethnic population (World Health Organization and Ministry of Health Viet Nam 2012).

The Vietnamese national economy has grown significantly over the last few decades, with poverty levels falling from 58% in the 1990s to 14.5% in 2008 (Global Finance 2014). As a result, Vietnam was classified as a lower middle income country in 2010 (World Bank 2013). The majority of those who remain impoverished are Vietnam's ethnic minority populations, who make up only 15% of the country population but are nearly 50% of those living below the poverty line (World Bank 2014).

Life expectancy has increased from 66 to 75 years in the last decade, in large part due to substantial gains in infant and maternal mortality rates. In 2015, the infant mortality rate was 17 per 1000 live births, an improvement from 23 per 1000 live births in 2005 (World Bank 2015). Additionally, maternal mortality declined from 61 per 100,000 live births in 2005 to 54 per 100,000 live births in 2015 (World Bank 2015). The prevalence of communicable diseases has also declined from 56% in 1976 to 25% in 2008. However, the burden of non-communicable diseases (NCD) has risen from 43% in 1976 to 63% in 2008, consistent with the typical pattern of developing countries (Vietnam Ministry of Health 2011).

With the growth of the economy over the last 20 years, Vietnam has focused on poverty reduction strategies and ensuring universal health coverage for all citizens. The 1992 Constitution states that every citizen is entitled to benefit from health protection and the 1998 law on people's health protection and care reaffirms that every citizen is entitled to basic health protection, preventative and curative care (World Health Organization and Ministry of Health Viet Nam 2012). The "Master Plan on Vietnam Health System Development to 2010, Vision 2020" also outlines strategies to promote socio-economic development while ensuring healthcare access for all (World Health Organization and Ministry of Health Viet Nam 2012). In 2008, a law on health insurance was passed that sets goals and plans to achieve universal health insurance coverage for all citizens (World Health Organization and Ministry of Health Viet Nam 2012). By 2011, 64% of the population was covered under the national health insurance scheme (World Bank 2014).

With the rise in an aging population and NCD morbidity, coupled with increasing demand for better quality medical care and treatment services, the government of Vietnam is critically analyzing healthcare delivery and financing schemes. As of 2014, strategies to further decentralize healthcare and improve the quality of care at commune- and district-level health centers was being implemented to prevent overcrowding in higher level health facilities (World Bank 2014). These strategies also focus on increasing the health workforce in underserved areas and strengthening medical education to ensure quality healthcare access is available at all healthcare levels (World Bank 2014).

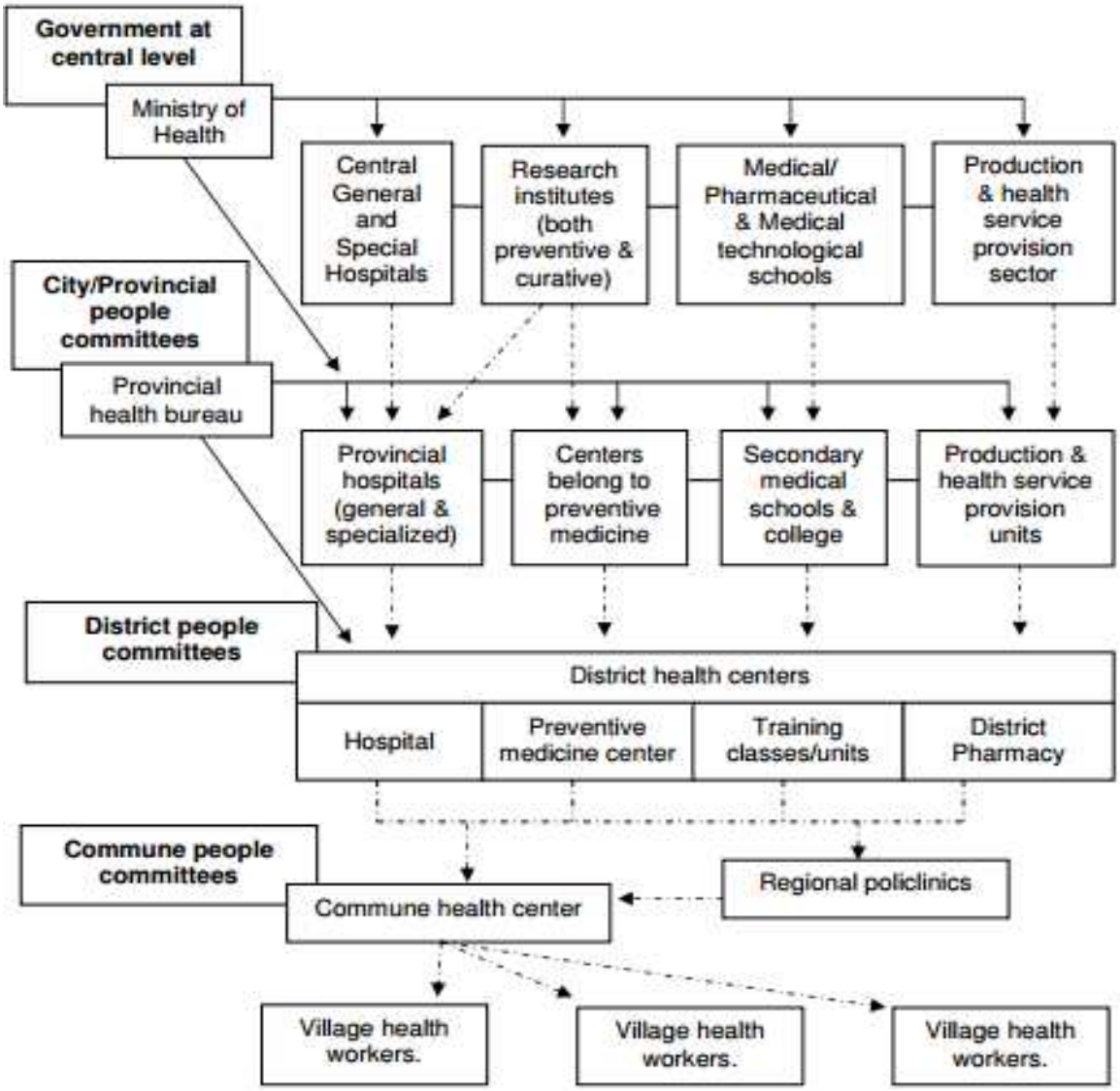
Vietnamese Healthcare Structure

Vietnam is administratively divided into 63 provinces, of which there are five municipalities (cities at central level). The country is further sub-divided into townships and counties with nearly 10,000 communes (Encyclopedia Britannica 2015). In the late 1980s, Vietnam underwent health care reform and decentralized the management the public health system to the province level and introduced a fee for service scheme. The reforms were designed to increase the national budget for health, while simultaneously engaging the private sector. Despite great efforts, coverage of health services is still low, particularly among marginalized populations and ethnic minorities. Out of pocket payments for health services, low quality health services, and a lack of clinicians to meet district and commune health demands were noted as major challenges to accessing health care during an annual health review in Vietnam (World Bank 2014).

Within each province, there is typically one provincial general hospital, and several specialized provincial hospitals, usually staffed by physicians, nurses, and other medical personnel. In each district, there is a district hospital and a district health center, usually staffed by physicians and/or physician assistants, with the district bureau responsible for state management of health care. Primary care is provided mainly by regional polyclinics, commune health centers, village health workers, and private clinics. Commune health centers provide the lowest level of primary care services and are often staffed by mid-level providers (nurses, midwives, and physician assistants). Traditional medicine is widely used in Vietnam, primarily due to the lower cost for traditional medicine as compared to public or private healthcare. As a result, in 2012, 79% of commune health centers also offered traditional medicine services (World Health Organization and Ministry of Health Viet Nam 2012).

More detail on structure of the health system can be found in figure one below (Ministry of Health 2012). Additionally, table three describes the level and type of health services provided in Vietnam (World Health Organization and Ministry of Health Viet Nam 2012).

Figure 1: Structure of the Vietnam Health System



Level of Service	Type of Service and Number	Characteristics	Comments
Commune	Commune Health Centers: 10,926	Deliver most primary care services, especially in rural and mountainous areas. Outreach with Village Health workers (VHW) based in villages	99% of communes have a health center, of which 79% of villages have active VHWs
Inter-communal/ regional level (under specific local conditions)	Regional Poly Clinics: 686	Deliver some higher level primary care services, satellite facility for some district hospitals	
District	Hospitals: 615	Basic inpatient treatment, emergency care and treatment of common diseases. Often connect to Regional Poly Clinics to prevent hospital patient overload or help clients not to travel to far for district hospitals	
	Maternity Homes: 18	Basic prenatal and delivery services	
Provincial	Hospitals: 376 Traditional Medicine Hospitals: 53	General and Specialized hospitals, each province has at least one hospital	
	Specialty Clinics: 47	Specialized outpatient services	
National	Hospitals: 44	Curative care, often with specialties and provide services to lower levels and conduct research	
Sectoral	Hospitals: 44	Basic and specialized curative care	
	Clinics: 759	Polyclinics and health stations of other sectors including military, police and transportation	
Private Sector	Hospitals: 102	Provide general and specialized curative care, primarily located in urban areas. Some joint public private ventures	
	Clinics	Most private services offered here.	

Table 3: Level and Type of Key Health Services in Vietnam

Human Resources for Health in Vietnam

Vietnam's health workforce consists of physicians, nurses, midwives, pharmacists, physician assistants, and village health workers. The Vietnam 2010–2015 health sector development plan sets a target of 8 physicians per 10,000 persons, aiming to have 80% of communes staffed with a physician and more than 95% of communes with a midwife by 2015 (Vietnam Ministry of Health 2011; World Health Organization and Ministry of Health Viet Nam 2012). Table 4 below details the number of health workers in Vietnam as of 2013 and the ratio per 10,000 persons from 2010 (World Health Organization and Ministry of Health Viet Nam 2012; Government of Vietnam 2015).

Cadre	**Numbers of workers (2013 data)**	**Ratio per 10,000 population (2010)**
Physicians	68,600	7.6
Physician Assistants	57,100	6.3
Nurses	98,300	14.1 (combined nurse/midwife)
Midwives	29,000	14.1(combined nurse/midwife)

Table 4: Number of health workers by cadre in Vietnam, 2013

As of 2014, less than eighteen percent of the total workforce was working at the commune level, and a third of commune health centers did not have a physician (World Bank 2014). Although the number of health workers in Vietnam has increased since 2005 to meet national health sector goals, the distribution of workers is still uneven, particularly an issue in rural and hard-to-reach areas (Vietnam Ministry of Health 2011). The majority of specialty health workers who have higher qualifications reside in more urban areas, affecting the ability to attract and retain highly skilled workers in rural and hard to reach places (Vietnam Ministry of Health 2011).

Healthcare workers report that lack of basic infrastructure and supplies in health facilities is a strong de-motivator for performing their job duties and makes retaining workforces in the public sector difficult (Vietnam Ministry of Health 2011). The Vietnamese government has responded by focusing on training and upgrading hospitals to improve the quality of health services delivered in the country. Although various technical standards and quality improvement systems have been developed, widespread compliance with these standards is still weak. Additionally, the lower levels, including commune health centers where much of the health worker attrition is occurring, are not receiving the same quality improvement and renovation support (World Health Organization and Ministry of Health Viet Nam 2012).

Another major challenge retaining health workforce in Vietnam is related to deployment and remuneration of health workers (World Health Organization and Ministry of Health Viet Nam 2012). In response, the government developed specific measures to attract and retain health workforce at lower levels and in disadvantaged areas. In 2011, policies were developed and activities designed to support supplemental training and provide subsistence allowance for health workers in rural areas (Vietnam Ministry of Health 2011). Little evaluation data are available so the degree to which these efforts have been successful is unknown.

Chapter Three Conclusion

Vietnam's health workforce remains insufficient to deal with the health service demand at the primary care level. There is still a large un-insured population preventing the MOH from reaching universal coverage of health services. The majority of services at the primary care level are offered by physician assistants, nurses, and midwives. Attracting and retaining health workers in rural and mountains areas is a challenge. However, the MOH is committed to improving working conditions, incentives, and career development opportunities for professionals in these areas (World Health Organization and Ministry of Health Viet Nam 2012). Ensuring that clinicians have up-to-date clinical knowledge and skills can support the development of high quality primary healthcare at the community level. With changing disease burdens in the country, there is a clear role for CME at multiple levels.

CHAPTER FOUR: MEDICAL EDUCATION AND STATUS OF CME IN VIETNAM

This chapter will cover the situation of medical education and CME roll out in Vietnam as of March 2016. It utilizes data gathered primarily from the literature search as well as information gleaned from the key informant interviews and FGDs described above. During key informant interviews with Vietnam experts, additional questions were asked to fill in gaps where literature and references were unavailable. Participants' responses are embedded in this section to provide a comprehensive overview of the national CME program policies, enabling environment, and CME courses available at the time of writing.

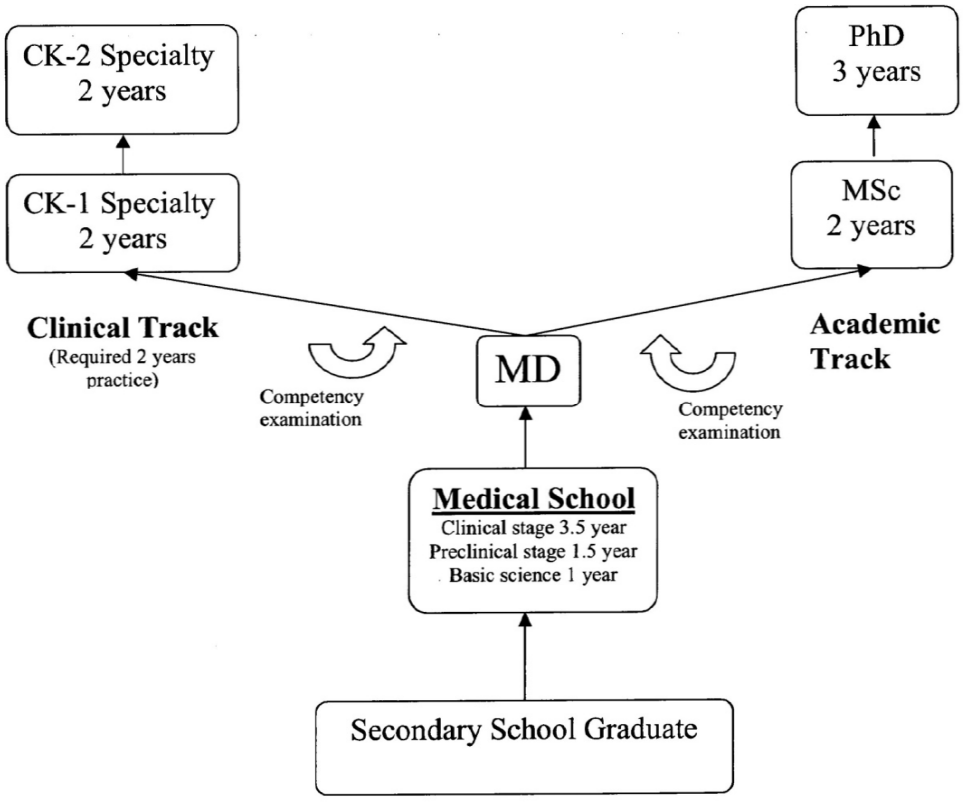
Medical Education in Vietnam

Over the last decade, the government has invested in improving the medical, nursing, and midwifery education in the country and increasing the numbers of health workers trained in order to meet national targets. Since 2006, the number of physician graduates increased by 60%, producing 2,450 graduates in 2012 from 14 medical schools (World Bank 2014). As of 2014, there were 14 undergraduate nursing programs (four-year training) and 29 nursing colleges (three-year training) in Vietnam (World Bank 2014).

Medical training for physicians lasts six years in Vietnam, with hospital-based clinical practice rotations during the last two years (World Bank 2014). The six-year program trains physicians to become specialists while the four-year program trains general level

physicians (Fan et al. 2012). There are three ways to obtain post-graduate medical training in Vietnam: academic, clinical and residency tracks. In the clinical track, medical graduates study an additional two years in a chosen specialty, called the CK1 track (chuyen khoa 1- specialty). The CK2 track requires an additional two years of study beyond the CK1 track and focuses on training those interested in conducting research. The CK1 track can be considered equivalent to a Master's Degree and the CK2 to a PhD (Tran and Pretorius 2007). Figure two below provides more details (Tran and Pretorius 2007).

Figure 2: Structure of Medical and Post-Graduate Education in Vietnam



With the need to shift medical education towards primary healthcare services, the MOH is developing a new training program that allows physicians to continue working while

receiving distance-based family medicine training. Through technical assistance from Boston University's School of Medicine, faculty at Hue University were trained in Family Medicine and are working to expand the CK1 track in family medicine nationally (Boston University 2015).

Medical Education and Curricula Development

Medical curricula are developed at the university level in Vietnam. The Ministry of Education and Training developed a framework to guide universities when they develop and revise medical curricula (Fan et al. 2012). In 2005, the Ministry introduced 10 standards and 61 criteria for accrediting higher education institutions. By the end of 2010 all medical and nursing schools were assessed and waiting for external review (World Bank2014). Given the diversity of medical curricula in the country, the Administration of Science, Technology and Training at the MOH is also developing standards for medical and nursing education that aim to standardize clinical education nationwide (World Bank 2014).

As of 2015, there was no national examination for physicians, nurses, midwives or physician assistants in Vietnam. Instead, students pass university-specific graduation examinations (World Bank 2014). Standards detailing core competencies for nurses and physicians have been developed to support the introduction of a national standardized examination system for the country, but these have not yet been implemented (World Bank 2014). There are no national or independent accredited examination authorities in

the country, therefore making it difficult to standardize competencies across universities (Fan et al. 2012).

Teaching methodologies used in medical and nursing education are also outdated (World Bank 2014). Students are typically taught using theoretical classroom based teaching methods and are typically assessed by essay or multiple-choice exams. Adoption of case and problem-based learning methods, which are promoted globally for medical and nursing education, has been slow (Ministry of Health 2013). Over the last few years, several international organizations have worked with select Vietnamese universities to adopt newer teaching methods, including the objective structured clinical examination, which is designed to assess student clinical skills. However, these innovations have been limited to only a few universities in the country (World Bank 2014).

Continuing Medical Education (CME) in Vietnam

In 2009, the government of Vietnam passed the law on examination and treatment (LET), which calls for one-time revocable licenses to be issued to all healthcare providers by 2016. The law also requires clinicians to complete CME credits to maintain licensure (van der Velden et al. 2010). In 2013, the Administration of Science, Technology and Training under the MOH issued circular 22 (22/2013/TT-BYT) to guide the organization of the national CME program. Circular 22 states that physicians must complete at least 48 course hours within two consecutive years and that other professionals (nurses, midwives

and physician assistants) need to complete 120 hours every five years (Government of Vietnam 2013).

According to Circular 22, CME is defined as: short-term courses designed to update the knowledge, skills, and attitudes of clinicians or re-training to transfer medical knowledge and skills that were not included in the current medical and nursing curricula (Government of Vietnam 2013). Circular 22 states that a clinician can obtain CME credits by: (Government of Vietnam 2013)

- *Participating and receiving a certificate for attending in-service training, practical courses or refresher trainings on a short-term basis, either domestically or abroad and either in-person or via eLearning*
- *Participating in domestic and overseas science seminars, conferences or health related discussions and being certified by the unit presiding over the organization*
- *Performing scientific research, guiding dissertations or theses or writing scientific articles*

In response to the need to increase the number of CME training opportunities as well as strengthen the overall human resources for health gaps in the country, the Asian Development Bank funded the "Health Human Resources Sector Development Program" from 2011–2015. The project had three main goals: (Asian Development Bank 2013)

1. Improve the planning and management of human resources for health
2. Introduce high quality and innovative training for medical and nursing education

3. Improve the management and use of health information systems

Through this project, significant work was completed to set up the national CME program. This work included developing appropriate policies and establishing a national electronic learning (eLearning) network. Despite great gains during the project, in 2015 many gaps related to implementing a nation-wide CME program remained.

In April 2014, the World Bank approved a loan to the government of Vietnam of USD $106 million in order to implement the "Health Professionals Education and Training for Health Systems Reform" project from 2015–2020 (World Bank 2014). This project's goal is to continue strengthening the health workforce in Vietnam, with an emphasis on ensuring adequate coverage of primary health care services (World Bank 2014). The project aims to improve coverage by: 1) improving basic health professional education, 2) improving the capacity of health managers, and 3) training primary health care teams at the grassroots level through long and short-term modular courses and CME (World Bank 2014).

The first component of the project focuses on improving the quality of health professional education by introducing standards for health professional education, including instituting a national exam system for physicians and nurses. The second component focuses on supporting the Hanoi School of Public Health and the Ho Chi Minh City Institute of Public Health to strengthen their capacity to deliver health

manager training and roll-out the CK1 Family Medicine track nationally (World Bank 2014). The third component aims to strengthen the national CME program and continue integrating eLearning training methodologies (World Bank 2014).

National CME Program

Since 2010, several governance and administration structures have been put into place to roll out the national CME program. In 2011, the government issued decree No 87/2011 that interprets the articles in the LET for implementation. This decree states that the MOH is responsible for national CME program and the Administration of Science, Technology and Training of the MOH was assigned to be the lead. Under this administration, an education bureau was established to govern the national CME program, develop guidance for accrediting CME courses, and manage clinician licensure at a national level (Asian Development Bank 2013).

While the MOH is tasked with developing frameworks, guidance, and processes governing the national CME program, the management and implementation lies with the provincial health departments. As such, these departments are ultimately responsible for guiding and approving CME courses and ensuring clinician compliance with CME regulations and licensure in their respective provinces (McNabb Interview 2015a). According to Circular 22, each province must develop an annual plan and budget to support CME (Government of Vietnam 2013). Provincial health department responsibilities include (Government of Vietnam 2013):

- Assigning lower level administrative units to manage CME in sub-localities
- Overseeing and managing codes issued to training facilities to offer CME courses
- Managing CME programs and documents for all approved CME training institutions in their respective provinces
- Managing province-level CME course lists and issue CME certificates to clinicians
- Developing a province-level database to track clinician licensure and CME compliance for re-licensure that reports to the national database managed by the MOH
- Implementing quality management activities for CME programs evaluated by the MOH every five years.

Accreditation of CME Training Institutions and Courses

Circular 22 also assigned the Administration of Science, Technology and Training at the MOH responsibility to accredit training institutions to deliver CME courses (Asian Development Bank 2013). In order for an organization to be eligible to develop and offer CME courses, it must apply for a code from the MOH. There are three types of institutions that can apply for this code: 1) medical universities, medical vocational schools, and other health-related schools; 2) hospitals, central-level research institutions, nationwide professional associations, and centers for training human resources for health; and 3) provincial health departments and related health departments under the jurisdiction of the MOH (Government of Vietnam 2013). Once a training institution has been granted

the code, the responsibility for approving CME course content is de-centralized to the provincial health department and/or training institution (McNabb Interview 2015e; Government of Vietnam 2013). Circular 22 also states that training institutions are obliged to do the following (Government of Vietnam 2013):

- Ensure a focal person for CME is in place to manage all activities
- Deliver CME courses
- Manage lists of course and advertise for learners
- Issue certificates to learners certifying CME completion

As of December 2015, the Administration for Science, Technology and Training at the MOH reported 48 departments of health, 66 units under the MOH, and 102 medical universities and other training institutions (medical colleges and secondary medical schools) were granted CME education codes (McNabb Interview 2015e; McNabb Interview 2015f).

As mentioned above, while the MOH ultimately determines which teaching institution is approved to develop CME content, the province is responsible for approving the CME courses that are developed specifically for their respective provinces (McNabb Interview 2015a). However, at the present time, there is no national standard or guidance for provinces to assign CME hours to approved courses. This means that a course can be approved at the national, province or institutional level as CME. However, to date only a few courses have been assigned CME hours for clinicians to receive credits.

For provincial management of CME, the directors of provincial health departments are mandated to establish a CME council with representatives from the heads of universities, colleges, and medical secondary schools in their respective provinces (Government of Vietnam 2013). However, if the CME course is to be offered in multiple provinces, the Administration for Science Technology and Training in the MOH must approve the course (Government of Vietnam 2013).

In order to offer approved CME credit courses, training institutions must develop a detailed overview of the course, including information on objectives, a syllabus, teaching methods, standards for the instructors, course assessments, and certificates, and then be given approval by the provincial health department (Government of Vietnam 2013). National policy also allows clinicians to receive credit from international CME courses if approved through the same mechanism as routine course development described above (McNabb Interview 2015b; Government of Vietnam 2013).

CME training institutions, when ready to offer a CME course, publicly advertise their courses. They then must report all clinicians who complete CME credits to the province health department, which enters their names into a provincial-level database (Government of Vietnam 2013). However, at the time of writing, there was no database in place to register and track clinician compliance at the national or province level. As of December 2015, some CME course materials had been developed and approved at the

provincial and national level, though only some of these courses had been assigned CME hours (McNabb Interview 2015g).

Clinician Certification and Licensure Tracking

In 2011, the MOH published circular No. 41/2011 mandating the MOH to establish a national advisory council to guide CME registration and licensing matters. In 2013, the council, chaired by the Vice Minister for Health, was convened and included representatives from teaching institutions, professional associations, various MOH departments, CME consumers, and a legal advisor (Asian Development Bank 2013). The council leads the national registration and licensing office tasked with inspecting provincial compliance to the LET (Asian Development Bank 2013). From 2013–2015, the MOH, under the plan 1439/KH BYT, conducted training for health worker licensing and relicensing for provincial staff to screen and process clinician licenses (Asian Development Bank 2013).

Certifying that a worker has completed CME credits can take two forms: 1) the training institution (with a MOH CME code) issues a certificate of CME completion or 2) other entities at the national level, including professional associations with a CME code, issue a certificate (Government of Vietnam 2013). The MOH and provincial health departments have the authority to recognize a certificate of CME from a foreign training institution if the learner is under their management (Government of Vietnam 2013). As of 2013, 5,500

out of 33,780 professionals in 63 facilities had been licensed (Asian Development Bank 2013). Therefore, as of 2013, only 2.2% of all clinicians in the country had been licensed.

CME tracking and information systems are critical to document and track clinician compliance. Under the MOH instruction letter (letter 1356/BYT) dated March 2013, the Administration of Science, Technology and Training at the MOH was tasked with developing a national database to track clinician licensure and CME compliance (Government of Vietnam 2013; McNabb Interview 2015a). This department was also charged with keeping a national record and database of all approved CME programs in the country, including materials and documents for each training (Government of Vietnam 2013). As of 2013, the online national database was tested and operational but provincial-level implementation was lagging (Asian Development Bank 2013). This delay prevented enforcing CME compliance among health workers (Asian Development Bank 2013).

CME Financing

According to Circular 22, the budget for developing and offering CME should come from: 1) learners through course fees; 2) government budgets, primarily the provincial department budget; or 3) by other means such as hospital revenue. At a national level, the MOH is also expected to reserve funds to support CME, but at the time of writing, no funds had been allocated at the national level (McNabb Interview 2015e).

Vietnam CME Implementation Experience

A mentioned above, as of 2015, national-level guidance for assigned hours to approved CME courses was still lacking. However, through online searches and interviews with Vietnamese stakeholders, it was possible to identify several relevant examples of short-term trainings and CME courses in place in Vietnam. The examples presented below are illustrative and should not be considered a comprehensive landscape analysis of all short-term and CME courses offered to date.

Thai Nguyen University

In Thai Nguyen province, three general hospitals have been accredited to deliver CME courses. The provincial health department manages the selection of short-term training topics and instructs institutions to create courses (McNabb Interview 2015g). The Thai Nguyen provincial health department will then advertise the time, place, and content for CME courses and has the mandate to supervise course implementation (McNabb Interview 2015g).

Thai Nguyen University is one of the training institutions approved to deliver CME courses in the province. The university uses the Ministry of Education and Training standards and regulations as the basis for designing CME courses. Through Asian Development Bank support, these standards were adapted for the university-specific CME course offerings (McNabb Interview 2015b). University departments are assigned to develop the content, theoretical, and practical learning hours, detailed subject planning,

and syllabus for courses for provincial health department approval (McNabb Interview 2015b). Thai Nguyen University has implemented X-Ray and ultrasound courses and has provided technical assistance to other provinces to offer CME. However, the university's experience is still nascent and it is still developing plans for how to offer CME courses at scale in order to meet demand (McNabb Interview 2015b).

Hanoi School of Public Health

The Hanoi School of Public Health also has experience in designing and implementing CME courses. In 2014, the school established the Institute of Health Manager Training and began supporting other universities in northern Vietnam (McNabb Interview 2015c). Several CME courses have been developed, but not limited to, topics on public health, epidemiology, and health statistics. Courses are offered on an annual basis and are funded by both the government and foreign implementing partners (McNabb Interview 2015c). Most courses are offered in-person at the Hanoi School of Public Health, but some courses targeting rural providers are organized in-person at lower levels (McNabb Interview 2015c).

Ho Chi Minh City University of Medicine and Pharmacy (UMP)

Through support from the Japan International Cooperation Agency, the Ho Chi Minh City University of Medicine and Pharmacy and the Fukushima Medical University developed and implemented three in-person nationally-approved CME courses, allowing them to be offered in multiple provinces. A total of 260 clinicians attended the courses

from 2010–2013 (Nga et al. 2014). An evaluation of student perceptions about the course revealed that over 80% of physician assistants found the course content to be useful and would be interested in attending another course in the future (Nga et al. 2014). Recommendations from this experience noted the need to continue to: 1) build the capacity of local university faculty members to incorporate more problem-based teaching methodologies; 2) match physician assistants with the teaching content they are interested in; 3) expand the courses geographically; and 4) improve the evaluation of CME courses (Nga et al. 2014).

Hue University

Hue University has a mandate to train health providers for provinces in the central region of Vietnam. The university organizes CME through in-person courses developed by respective departments and faculties (e.g. pediatrics, internal medicine, cardiology, and obstetrics). Course topics depend on demand and the resources available. The university has collaborated with other international agencies to develop CME courses addressing: advanced nursing protocols for nurses, Hepatitis C (with support of Nagoya Medical University and private sector partners), and integrated management of child illnesses. Courses are typically offered in-person, with trainees invited from targeted health clinics chosen by the university.

Vietnam Nurses Association (VNA)

As of December 2015, the Vietnam Nursing Association had developed and implemented

eight CME courses for nurses, targeting students mainly at the provincial level. CME courses are offered in-person and course topics include: nurses management and leadership, safety for caring for patients, infection control, prevention and care for people living with HIV, and communications skills training (McNabb Interview 2015l). The association reported a general lack of courses available for lower levels of the health system or in rural areas (McNabb Interview 2015l).

Clinician Knowledge, Awareness and Access to CME

As noted above, the LET has been in place since 2009, yet it is not enforced and guidance on assigning CME hours to approved courses is still weak. As a result, clinician awareness of licensure requirements also remains low. Among 20 physicians in Thai Nguyen province, all had heard about the LET, but none had acquired official CME credits. Among 19 nurses in Thai Nguyen province, only two had heard about the LET and none had received CME credits. Among 20 physician assistants in the same province, none knew about the LET or licensure requirements (McNabb Interviews 2015).

Despite the lack of awareness about the LET among clinicians, physicians in Thai Nguyen reported receiving some short-term training in the past. Physicians were typically financially sponsored by provinces, Hanoi Medical School, or an international implementing partner. Physicians mentioned that traveling long distances for courses was a challenge, with rural physicians often leaving health centers unstaffed to attend trainings (McNabb Interviews 2015).

Nurses and physician assistants in Thai Nguyen also attended numerous short-term trainings organized either by the provincial health department, district, or commune health centers. They mentioned being assigned to attend trainings by their supervisors and often did not have a choice on the topics covered by trainings. None of the nurses had completed an official CME accredited course. The short duration of in-service trainings, oftentimes irrelevant course topics, the need to travel long distances, and lack of financial sponsorship for course fees were reported as challenges (McNabb Interviews 2015).

Chapter Four Conclusion

In 2009, the government passed a law requiring all clinicians to complete CME credits to maintain licensure. A significant amount of work was done from 2010-2015 to set up the national program, though key policies and guidelines were still not in place at the national level as of 2016. Currently, there is no national-level guidance on assigning credit hours for CME courses. The national and provincial level database for registering and tracking clinician compliance with CME credits is also lagging. There is also no national system to store and provide access to CME and other in-person course materials developed by various universities. These gaps are preventing the wide-scale roll out of the LET in Vietnam. Clinicians in one province, Thai Nguyen, are still generally unaware of the CME and licensure requirements, which us likely typical of clinicians nationwide.

CHAPTER FIVE: INFORMATION AND COMMUNICATION TECHNOLOGIES TO SUPPORT CME

This chapter describes current best practices for delivering CME content to clinicians. Following this, eLearning is broadly defined and global evidence of how mobile technologies are used for CME program is presented. Finally, cutting-edge mobile tools used for training health workers globally are detailed, highlighting considerations for adoption within the national CME program.

Global Best Practices for Delivering CME

There are a variety of methodologies that are used to deliver CME to support both knowledge acquisition and clinical skills building (Ahmed et al. 2013). Typical methods used to deliver CME include: live in-person, internet/computer based, video, audio, handheld materials, and educational printed materials (Ahmed et al. 2013). In 2014, a synthesis of systematic reviews examining the impact of CME on providers' knowledge and behavior found that CME leads to greater provider performance and patient health if it is interactive, uses multiple methods, has multiple exposures embedded, and is focused on learning outcomes considered important by physicians (Cervero and Gaines 2014). In terms of clinical skills, CME methods can be effective in teaching basic clinical skills for primary care clinicians, but there is limited evidence of CME supporting advanced skills-building for medical specialists (Ahmed et al. 2013). Globally, CME is offered by several types of organizations, including medical and nursing societies, medical institutions, professional clinical bodies, academic centers, and private companies (Ahmed et al.

2013). Of these, the pharmaceutical sector is by far the largest sponsor of CME, which has the potential for bias and conflict of interest (Ahmed et al. 2013).

While there is some evidence that CME can improve knowledge and skills of providers, there is a lack of peer-reviewed evidence on the validity, reliability, efficacy, and cost effectiveness of the various methods to deliver CME (Ahmed et al. 2013). As such, researchers are calling for providers to design CME courses that further emphasize actual clinical performance and are correlated with clinical outcomes (Ahmed et al. 2013). This is shifting CME instructional design beyond the didactic based lecture format towards more interactive and problem-based learning approaches (Ahmed et al. 2013).

ICTs for Health Worker Training and CME

The global rise in information and communication technologies (ICT) over the last few decades has shifted the way healthcare is structured and delivered. The use of ICTs within the health sector is typically termed electronic health, or eHealth. The World Health Organization defines eHealth as (World Health Organization 2016):

The transfer of health resources and health care by electronic means. This encompasses three main areas:

1. *Delivering health information, for health professionals and health consumers through the Internet and telecommunications.*
2. *Using the power of information technologies (IT) and e-commerce to improve public health services, e.g. through the education and training of health workers.*

3. *Using e-commerce and e-business practices in health systems management.*

In 2005, the World Health Assembly published a resolution calling for WHO member states to adopt eHealth solutions to strengthen national health programs. Of note, the resolution stressed that eHealth is a "cost-effective and secure use of ICTs in support of health and health-related fields, including health-care services, health surveillance, health literature and health education, knowledge and research" (World Health Assembly 2005). The word 'eHealth' is an umbrella term covering a variety of sub-fields, including: health informatics, digital health, tele-health, telemedicine, eLearning, and mobile health (mHealth) (World Health Organization 2013).

Over the last 20 years, using ICTs for learning, or "eLearning", has also transformed the way that health education can be delivered (Shorbaji 2013). eLearning can be defined as an: *approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways of understanding and developing learning* (Al-Shorbaji et al. 2015).

In 2015, a systematic review of eLearning approaches for undergraduate medical education in low and middle income countries was published by the WHO (Al-Shorbaji et al. 2015). The review noted that eLearning solutions can help reduce the costs of delivering educational content, break down geographical and temporal barriers to

accessing educational content, and facilitate scaling educational interventions. eLearning also allows for personalization of the learning experience based on learner behaviors (Al-Shorbaji et al. 2015). The review also noted that eLearning can facilitate "immersive learning" through augmented reality and 3D learning environments, and promote "ubiquitous learning" through mobile and cloud learning environments (Al-Shorbaji et al. 2015).

After mapping 209 peer-reviewed studies on eLearning for undergraduate medical education, the authors found that computer-based or web-based eLearning is no better or worse than traditional learning in relation to knowledge and skills acquisition. The most commonly reported advantages for educational providers included: monetary savings, scalability of educational materials, freeing up instructor time to allow more complex subjects to be offered in person, ease of updating and pushing out new content to learners, portability, and enabling students to practice skills prior to experiences with real patients (Al-Shorbaji et al. 2015). Learners generally reported advantages of eLearning including: ease of access, flexibility, improved student-teacher contact and discussions, and more exchange with peers (Al-Shorbaji et al. 2015). Common disadvantages mentioned were: more time-consuming to develop courses, lack of student teacher interaction and tutor support, feelings of isolation, being unable to clarify doubts with a tutor, and lack of in-depth group discussions (Al-Shorbaji et al. 2015).

There are many ways that eLearning courses can be implemented using different technologies. Educators may consider adopting the use of ICTs in health worker training in order to facilitate: (Shorbaji 2013)

- Delivering a full course curriculum virtually
- Using video conferencing, webcasting or tele-medicine
- Developing clinical decision support tools and knowledge resources used at the point-of-care
- Quizzing or knowledge checks after pre-service or in-service training
- Implementing clinical case sharing or informal learning groups connected virtually
- Implementing interactive training technologies that incorporate gaming and adaptive learning principles

Adopting eLearning requires a paradigm shift that requires faculty to introduce methods that engage students virtually. Extensive resources are available online, and often for free, to support faculty to learn distance-based pedagogy that encompasses key adult and virtual learning principles.

Learning management systems (LMS) are software platforms that have built-in course authoring tools that allow educators to build courses for distance-based teaching. A LMS can be defined as: *a software application that automates the administration, tracking, and reporting of training events* (Ellis 2010). However, it is recommended that a LMS

extend beyond just housing digital materials to allow: (Ellis 2010)

- Centralizing and automating administration of courses
- Using self-service and self-guided services
- Assembling and delivering learning content virtually and rapidly
- Consolidating training initiatives on a scalable web-based platform
- Supporting portability and standards
- Personalizing content for individual learning

Many LMS platforms are available in the market, ranging from proprietary enterprise-wide systems such as Blackboard, that require licensure and fees, to other open source software systems such as Moodle, which have no license or support fees. Moodle is widely used around the world, and as a result of a vibrant open-source community, technical support is also often provided for free (Moodle 2016). There are also several publicly-available guides and training materials for educators to learn how to develop eLearning courses in Moodle (Moodle 2016).

There are many examples using eLearning within medical or CME training globally. Courses can either be delivered solely online through an LMS or through a blended learning approach that combines online and face-to-face teaching (Al-Shorbaji et al. 2015). For the purposes of CME, however, delivering content solely through a LMS online without an in-person training component can suffice for a CME course offering.

This is true particularly if the CME course is focused on knowledge gain and/or limited skills acquisition (Al-Shorbaji et al. 2015).

Globally, CME is increasingly being offered online in order to reach a larger audience with lower costs. Accessing CME online is rising. For instance, in 2010, 40% of CME courses for US clinicians were accessed online. In 2012, a survey of US clinicians found that 84% preferred to learn online because of the ability to view the content on demand without having to travel (AmedNews.com 2016). There are several online CME courses that are accredited in the US and other countries that are freely available for any clinician globally to access: http://www.cmelist.com/default.htm.

Introducing Mobile Technologies into eLearning

Over the past fifteen years, mobile phone ownership has risen dramatically around the world. In 2015, there were more than seven billion mobile cellular subscriptions. This corresponds to a global mobile phone penetration rate of 97%, while only 43% of the global population had access to a computer and Internet connection (International Telecommunications Union 2015a). This is largely due to the lower costs of mobile devices and increasing availability of more advanced smartphones and tablets (Pew Research Center 2015).

Global adoption of smartphones has skyrocketed over the last few years. In 2015, a survey of 21 low and middle-income countries, including Vietnam, found that 37% of mobile phone users owned smartphones, rising from only 21% in 2013 (Pew Research

Center 2016). Globally, younger generations are the fastest adopters of smartphones and gender gaps related to owning a mobile phone starkly favor men over women (Pew Research Center 2016).

Due to the sharp rise in mobile phone ownership, the field of mobile learning has emerged as an extension of the eLearning field. Similar to other ICTs, mobile devices can have a major impact on overall health system strengthening as well as health worker training. Mobile learning can be defined as: *learning across multiple contexts through social and content interactions, using personal portable electronic devices* (Crompton 2013).

Mobile technologies and applications or "apps" designed to deliver educational content are rapidly emerging on the market. In terms of health provider training and education, mobile tools are often used in tandem with other eLearning applications and often require the same backbone infrastructure and support to implement. Stakeholders do not need to set up additional servers or IT infrastructure to add mobile technologies into existing eLearning solutions, thus promoting cost savings and building on investments.

Evidence of augmenting eLearning with Mobile Tools

Extending learning opportunities from the desktop to mobile devices expands the reach of how, when, and where clinicians can access information at the point-of-care and help them to stay abreast of medical advances (Guze 2015). Through mobile phones, health

workers even in the most remote and rural regions can be reached and their work supported through multimedia training programs and clinical decision support tools (Shorbaji 2013). The portability of mobile devices can also facilitate peer-to-peer learning, joint problem solving and community discussions, and extend the reach of information farther than computer-based eLearning can do alone (Shorbaji 2013).

Augmenting eLearning programs with mobile tools is a relatively new phenomenon globally since mobile technologies have increasingly been adopted over the last decade. As a result, there is little published evidence about the impact of their use on learning outcomes and improved clinical performance (Lumsden et al. 2015; Sandars 2012). A 2014 systematic review of the literature on using mobile technology for health workers in low-income countries found a paucity of evidence related to the effectiveness of mobile learning solutions on educational outcomes. The review included studies from 2007 – 2014 and of the 583 studies, only seven pertained to medical education and technology in low-income settings. The majority of studies concluded that mobile technology was a promising tool for training health workers but none provided definitive evidence of effectiveness (O'Donovan 2014). The authors highlight that the "evidence appears to suggest potential rather than achievement" and call for more large scale implementations and rigorous studies to assess impact (O'Donovan 2014). Another literature review of effective in-service training design and delivery approaches published in 2013 only found one example of using mobile devices to deliver CME content (Bluestone et al. 2013). More recently, one study on mobile technologies for learning noted that providing access

to CME content through mobile devices had a positive educational impact among medical school faculty, residents, and students (Ventola 2014).

The lack of evidence related to the impact of using mobile devices for learning and CME is not surprising due to the recent advances in mobile technology and adoption of mobile devices globally. However, many studies are currently underway. For example, a search of the NIH clinical trials.gov database using the search term "mobile technology and training" revealed 29 clinical trials with 15 studies actively being implemented as of January 2016. It is reasonable to anticipate that the evidence base in this area will increase substantially in coming years.

Ways Mobile Technologies can be used for eLearning

There are several ways that mobile technologies can support eLearning or CME programming. Many eLearning LMS platforms and CME providers globally have the ability to push content directly to a mobile device and have developed apps, by which clinicians can access content, quizzes, and other learning opportunities' via smartphone or tablet. At the time of writing, there were several lists online documenting LMS platforms available in the market, including those that also have mobile applications to deliver courses. One such example can be found here: http://www.trimeritus.com/vendors.pdf . The top three global CME providers with mobile applications found at the time of writing included: 1) Epocrates: acts as a clinical decision support tool at point-of-care, in addition to offering CME courses via a mobile

app; 2) QuantiaMD: allows learners to access CME courses through an app while promoting a global interactive CME community; and 3) QStream: has a mobile application to access CME courses and uses a spaced interval learning method to increase memory retention (Physicians Practice 2014; QStream 2015). Despite many mobile apps on the market, there is still limited evidence on the impact of using these mobile applications as compared to traditional computer-based eLearning programs.

Apart from proprietary mobile apps, there are open-source mobile applications that can offer full CME courses though a mobile device. Educators can build CME content using a LMS course authoring tool and then "push" courses though the mobile network to a mobile application. The most common open-source learning management platform (meaning no licensure or fees are associated with using it) is Moodle (Moodle 2016). Moodle is the world's largest free learning platform and is used by millions of learners around the world; it has been translated in over 100 languages (Moodle 2016). The open-source software development community is actively contributing to the development of mobile applications that can integrate with Moodle. Digital Campus, a global leader in using technology for training health workers in low and middle income countries, developed an open source mobile application called OppiaMobile. OppiaMobile uses Moodle course authoring tools and allows learners to access course content through the web or the mobile application (Digital Campus 2015).

Mobile Learning Design Considerations

There are several design considerations that course developers should be aware of while adapting content for delivery through a mobile app. For example, viewing learning content or videos on a mobile device can be a different experience than viewing content on a computer. Some other key design considerations include (Buff 2013):

1. Present content in smaller chunks: Simplify text for more bite sized presentation of content.
2. Ensure a blended learning approach is used: Develop the right mix of learning on the go and supplemented with computer based eLearning or in-person trainings.
3. Be cognizant of file size: Educators might often expect workers to use their own devices to access learning content. Large file sizes might require using personal data to download content in the absence of wi-fi connections. The storage capacity of smartphones can vary. It is important to reduce file sizes and build apps that allow content to be available on and offline in cases where there is a lack of network.
4. Support adopting mobile applications that are open source and can integrate with learning management systems. Ensuring that learning systems and tools are integrated can simplify the core management of a course and allow learners to choose to access content via a computer or mobile device.
5. Consider device orientation: consider whether content should be landscape and/or portrait orientation to fit how devices are configured.

The cost of developing mobile apps that can house learning content can vary widely, depending on the functionality that is desired. Variable costs are associated with how much content the app will contain, which operating systems (Android or iPhone) the app will run on, and license fees for the platform. At the time of writing, it is estimated that an average eLearning app can cost US $8,000–$50,000 to develop. This includes the application architecture, but not the content development. Once the app prototype is built however, the costs for updating and adding additional content can reduce over time (Pakala 2013). However, these costs are quite variable and detailed costing should be done with specific content and lesson plans for reasonably accurate cost estimates.

Cutting-Edge Mobile Tools to capitalize on eLearning Functionality

With the rise in the sophistication of mobile devices, there are more tools that educators can use to reach learners. This section highlights the most relevant newer digital tools for the CME program in Vietnam, with examples of how they have been used for health worker education. Notably, not all of these digital tools are limited to just mobile phones, but can also be accessed through a desktop or laptop computer. Some common technologies that can be leveraged for CME include:

- mLearning apps (medical references, curriculum delivered via mobile devices, etc.)
- Data collection apps (data reporting, GIS etc.)
- Standard voice calls
- Interactive voice response (IVR) or “Robo calls”

- SMS (or text messages) or other data based text apps (i.e., What'sApp or Viber)
- Phone camera and video
- Social media apps
- Gaming apps
- Virtual simulation apps

Virtual Simulations

Advances in virtual simulation and higher-level technologies have opened medical education to new learning possibilities. For example 3-D viewing technologies can reconstruct anatomy that transforms the learning experience compared to 2-D images found in textbooks (Farooq and White 2014). Several anatomy 3-D applications developed also have a range of associated media, such as interactive quizzing and instructional videos (Lewis et al. 2014). Virtual simulations or mobile-augmented reality applications for medical training are used to imitate real patients and mirror real life circumstances (Guze 2015). These applications have been found to be particularly important for skills training, especially when medical ethical circumstances prevent clinicians from practicing skills on real clients (Albrecht et al. 2013). Many leading CME providers in the United States primarily use virtual simulations for CME training. For example, WebMD uses MedSims ®, which incorporates simulations, as its leading CME training approach and platform (Medscape 2015).

Despite their recent introduction into medical education, simulated anatomical models, virtual reality, 3-D visualizations, and online virtual worlds have all been shown to support medical knowledge and skills acquisition (Guze 2015). A recent systematic review of simulation technologies for medical education found that high-fidelity medical simulations facilitate better provision of feedback, repetitive practice, curriculum integration, and multiple learning strategies, and also promote individualized learning. Overall, simulations have been shown to compliment medical education in patient care settings (Guze 2015).

Gaming Technology

Digital games are highly attractive ways to teach health workers as they promote a high degree of interactivity, which can be entertaining and facilitate the delivery of personalized learning content. One RCT conducted in Germany found that game-based eLearning was more effective for medical education than traditional instructional methodologies (Boeker et al. 2013). Digital games for medical education are also often used to train surgeons to support hand eye coordination and reflex times (Guze 2015). While the evidence of using games as an approach for CME is still nascent, some studies report higher satisfaction with gaming as a learning experience (Telner et al. 2010).

Social Media

Utilizing social media channels such as Facebook, Twitter, and Instagram can also promote interactive learning environments and create learning communities to share

experiences (Shorbaji 2013). A systematic review of social media use in medical education revealed that most interventions using social media tools were associated with improved knowledge (e.g. exam scores), attitudes, and skills. Most common opportunities using social media tools were promoting learning engagement (71% of studies), feedback (57% of studies), and collaboration and professional development (36% of studies) (Cheston, Flickinger, and Chisolm 2013). Facebook groups can also be created to share information and updates about CME events or launch discussion boards for peer-to-peer learning exchanges. However, using social media interventions can pose privacy and security concerns that should be considered during the planning phase.

SMS for Medical Education

SMS has also been used to deliver health education content to health workers, particularly for workers who do not own smartphones. A typical SMS message can contain 160 characters and only displays text, unless the phone has multi-media message capacity (typically not found in simple feature phones). This small character count severely limits the amount of information that can be shared. Some use cases for SMS identified in the literature include (Broom, Adamson, and Draper 2014):

- One way texting of factual information to serve as a quick reference for clinicians
- Interactive 2-way texting for quizzing or discussion
- Linking clinicians to other eLearning modules or start online discussion forums
- Delivering educational content on a weekly basis to clinicians

There is mixed evidence regarding the effectiveness of SMS interventions to deliver CME content. Therefore, it is more important to examine "how" SMS is used (actively, passively, in what intervals, etc…) and the relevance of the content delivered through SMS than assessing the SMS technology itself. One study in Canada found that using SMS in the healthcare setting led to oversimplification of clinical messages and depersonalized communication, possibly leading to negative impacts in professional work relationships and patient care (Wu et al. 2014).

In terms of CME, the evidence suggests that using mobile phones, in particular the use of text messages (or SMS) has an impact on continued training and education for health professionals (Diedhiou et al. 2015). In China, sending clinical updates via SMS led to a statistically significant improvement in knowledge retention as compared to in-person CME courses (Chen et al. 2014). In Iran, Gynecology residents were put into groups to test SMS vs. paper-based learning. One group was sent SMS messages about breast cancer screening, while the other group was asked to study a pamphlet that covered the same information. At the end of the study, the SMS group had significantly better learning outcomes than the group that used traditional methods and demonstrated more interest in the subject (Alipour et al. 2012). Another study enrolled nurses to either receive SMS about breast cancer screening, or to engage in traditional paper-based training. Baseline and end of study knowledge tests were used to assess knowledge gain. The SMS group had a higher improvement in retention of information, but there was no difference in post-test scores between the groups (Alipour, Jannat, and Hosseini 2014).

Finally, in Botswana, a SMS program allowing access to clinical guidelines and PubMed abstract searches found significant initial interest, but use of the service dropped off dramatically over the 4-week intervention period (Armstrong et al. 2012).

Chapter Five Conclusion

Globally, mobile phone ownership is much higher than computer or Internet access. Thus, leveraging the reach of mobile devices by offering educational content through applications can have an important impact on the quantity of learners reached, and generally at lower cost. However there is very little evidence in the peer-reviewed literature that mobile technologies facilitate better learning outcomes. Despite this paucity of data, there is room to innovate and contribute to the implementation experiences and evidence base. The section below summarizes the advantages and disadvantages for using mobile technologies within eLearning that were presented in the chapter. This is designed to provide a summary of the design considerations for integrating mobile learning for educators. Advantages to introducing mobile technologies include:

1. Ability to integrate with an eLearning program already in place: If content is already presented in a digital format, there are many course authoring tools that facilitate revising content for mobile devices that often do not require computer programming expertise.

2. Capacity to reach more learners with content: Extending the learning to mobile devices can reach more learners on their own time with their own personal devices.
3. Exploiting more advanced mobile technologies can promote deeper problem based learning and skills development: Virtual simulations and gaming allow health workers to practice clinical skills prior to working with actual clients, thereby improving the process of skill acquisition.
4. Using social media can facilitate content access and promote peer to peer learning: Social media use is growing around the world and can be used to send or "push" content to learners as well as create groups for peers to communicate and dialogue for learning.
5. Using smartphones can extend the richness of learning content. Smartphone functionality allows the use of multi-media, repeated exposure of content, and multiple methods to assess and promote knowledge retention. Additionally, content can be accessed repeatedly, providing reference materials available at the point-of-care after training.

There are other important considerations that educators should be aware of when considering use of mobile technologies within larger eLearning programs and for CME in Vietnam. These include:

1. Faculty resistance to replace traditional training methodologies: Within the larger eLearning capacity building plan, mobile learning considerations can easily be

added to extend eLearning to mobile devices. Designing incentives or working with younger faculty can support faculty to learn new teaching pedagogy.

2. Device ownership, literacy and multiple operating systems: It is more costly to develop mobile solutions for multiple types of phones (feature phones, smartphones, iPhones, Androids etc.). Carefully reviewing the most commonly used phones among health workers can help with choosing the right operating system and optimal mobile learning application design. Additionally, stakeholders should recognize that not all workers will have high digital literacy or smartphones, so there is a need to offer multiple ways health workers can access CME.
3. Small screen sizes: Smartphones and tablets have smaller screen sizes. Therefore, the amount of content and visualizations that can be included might be limited and potentially complex to design. There are documents that detail best practices for designing content for mobile devices that can be included in overall eLearning capacity building activities with faculty. Poor vision among health workers, age, and general comfort level reading on small screens should also be considered.
4. Electricity and mobile network access: There is a need for physical power infrastructure for charging phones that might be lacking in very rural and remote areas. Additionally, network coverage typically is weaker in rural, mountainous, and sparsely populated geographic areas. Advocating for stronger network coverage, providing wi-fi hotspots, and building mobile applications that can run

offline can help offset spotty network access. Additionally, lean content should be designed to not require a lot of bandwidth for downloads.

5. High SIM card turn-over among health workers: Frequent changing of phone numbers or mobile network carriers can be an issue in ensuring, that health workers can be reached at the registered SIM card. Mechanisms for health workers to update their phone numbers centrally can also help keep them in the system if they move locations.

CHAPTER SIX: E-LEARNING AND MOBILE TECHNOLOGY FOR CME IN VIETNAM

This chapter first presents a review of the national policies and plans for integrating ICT solutions for the health sector in Vietnam and then the state of eLearning implementation for clinical education and CME in Vietnam. Next, Vietnam's current mobile network coverage and mobile phone ownership is discussed. The chapter ends with a review of the current use of mobile technologies for learning in Vietnam and recommendations for the MOH to consider when introducing mobile technologies within the national eLearning network.

Vietnam's Health IT Enabling Environment

The Ministry of Information and Communications plays a leading role in designing implementation plans to operationalize the strategies set in 2010 to "Transform Vietnam into an advanced ICT country by 2020". The Ministry plans to do so by improving infrastructure, access and human resources related to ICT (Information and Communication Publishing House 2011). The Ministry of Information and Communication is responsible for drafting laws, regulations and strategies related to ICT infrastructure. The Ministry also provides guidance on national plans to extend telecommunications and regulate licensure for mobile network operators (Information and Communication Publishing House 2011).

Despite an advanced ICT infrastructure in Vietnam, access to the Internet remains low in the country. As of 2015, 50% of the Vietnamese population had access to the Internet.

Younger people are faster adopters of technology in Vietnam. This can be seen in the data on Internet users: 81% of those aged 18-35 years are Internet users, compared to only 25% among those aged 35 years and above (Pew Research Center 2016).

The Government of Vietnam has also committed to introducing ICT interventions within the health sector. As of 2010, all ministries in the country had a functioning IT unit, including the provincial level ministry offices (Information and Communication Publishing House 2011). A national plan for supporting eHealth was developed from 2011–2015 with the main objectives to: ensure the availability of infrastructure, develop health management information systems and support health administrative processes (Ministry of Health 2011). This plan also included creating a national eHealth architecture to serve the country's needs, including systems to manage human resource for health (Ministry of Health 2011).

However, there are major gaps in the national policy and enabling environment for introducing ICTs into the health sector. There is no national eHealth strategy or guidance in place to govern the standardization and development of eHealth applications and programs (McNabb Interview 2015h). Despite the government's commitment to a national standard eHealth architecture and data interoperability standards, these guidelines are not yet in place (McNabb Interview 2015h).

Specifically within the MOH, the Center for Population Research, Information and Databases was established to coordinate MOH ICT-related efforts. The Center is also tasked with developing software platforms and applications for health, statistics and national support. As of late 2015, this center was in the process of designing a national health information system to aggregate and report on all national reportable health indicators using District Health Information System 2 (DHIS2), open source software platform. Further, the center was in the process of defining health ICT data standards and adapting internationally recommended coding and terminology to the local context (McNabb Interview 2015h).

The MOH national strategy for integrating ICT into the health sector from 2014 – 2020 includes provisions for using eLearning for healthcare worker training (McNabb Interview 2015i). The national policy document "decision No 317" calls for strengthening the health development of more remote areas from 2015 – 2020 and emphasizes the role of eHealth and eLearning applications (McNabb Interview 2015i). National CME policies, including Circular 22 passed in 2013, support the use of eLearning as an acceptable methodology for CME courses (Government of Vietnam 2013).

eLearning Experience in Vietnam

eLearning has a long history in Vietnam, primarily focusing on secondary and university level education. In 2004, the Ministry of Education and Training launched the national eLearning portal, which is translated into Vietnamese and housed on the Moodle LMS

(Ministry of Education and Training 2005). There is also a Vietnamese specific online Moodle developer group to share lessons learned in country (Moodle 2016).

In 2014, Vietnam was considered by eLearning experts as one of the fastest growing commercial eLearning markets in the world, even providing eLearning services to neighboring countries (Pappas 2013). To date, eLearning companies in Vietnam mainly provide support to the commercial and education sector. eLearning commercial entities in Vietnam have their own LMS platforms available in Vietnamese and have developed some mobile applications for learners to access content via mobile devices. The GK Corporation, founded in 2007, has what is called "VietnamLearning", an online Vietnamese LMS with a mobile application to access course content. The company also has a number of online eBooks, testing services and eLearning training courses targeting the corporate sector (GK Corp 2016). TOPICA, Cleverlearn, VGN and BEA are other corporate eLearning software platforms with mobile applications integrated that were developed in Vietnam (Vietnamnet 2016).

While the introduction of eLearning within the general education and corporate education sectors has boomed, the medical education field has also advanced in adopting eLearning solutions. In 2010, the Asian Development Bank funded the establishment of a national eLearning network aiming to build the capacity of 17 universities and medical colleges to design and deliver distance-based pre-service and CME courses. As of 2015, university centers of excellence and hubs were being established, using a model where one higher-

level university provides technical assistance to five or six surrounding universities and medical colleges to design and deliver eLearning courses. Two universities were identified as centers of excellence in eLearning: Hanoi Medical University and the learning resource center at Hue University (Churton 2011).

Each university-based center of excellence has a designated coordinator to oversee the development and management of eLearning related activities (McNabb Interview 2015a; McNabb Interview 2015j). In order to standardize and support cross-university eLearning exchanges, the project selected Moodle to serve as the standard platform for developing, managing and delivering eLearning courses in the network (McNabb Interview 2015j). Hanoi Medical University has trained key staff eLearning network universities on Moodle course authoring tools (Churton 2011). As of 2015, the MOH was also developing a virtual medical training resources library to support universities (Asian Development Bank 2013). Despite substantial gains in setting up the overall eLearning network structure, the widespread implementation of eLearning has not yet been accomplished.

The Ministry of Education and Training has published general requirements for organizing, implementing and evaluating eLearning courses in Vietnam, but detailed guidance was lacking and some universities lack the infrastructure and capacity to deliver eLearning courses (McNabb Interview 2015j). Specific national level regulations, policies, and standards for accrediting eLearning based CME courses were also lacking.

eLearning Experience in Vietnam

Several universities and international partners have experience developing and piloting eLearning courses in Vietnam, some with a focus on pre-service education and others with a focus on short-term training courses or tele-consultation. This section describes several examples of eLearning for both pre-service education and short-term training in Vietnam. They are presented in order to better understand the successes and challenges implementing eLearning for medical and nursing education in Vietnam.

Hanoi Medical University

As a national eLearning center of excellence, Hanoi Medical University has important eLearning experience in Vietnam. The university provides coordination and technical assistance to other seven training institutions in northern Vietnam (McNabb Interview 2015j). As of 2015, the university had IT and eLearning instructional design experts on staff and the infrastructure (hardware, software, video conferencing technology, etc.) was in place (Churton 2011). eLearning courses use a variety of blended learning approaches and technologies including videoconferencing, webinars and case discussions (McNabb Interview 2015j). Since 2007, over 300 eLearning courses have been developed in different subjects using Moodle and were available free of charge (see: http://elearning.hmu.edu.vn/cme) (McNabb Interview 2015j). As of 2015, there was very low utilization of these eLearning courses; only 1,043 workers had completed a course with an average of 100 health workers in each course (McNabb Interview 2015j). Low utilization is due to a number of issues including a lack of capacity and infrastructure at

other universities to deliver eLearning courses and slow adoption of new teaching approaches (McNabb Interview 2015j; McNabb Interview 2015m).

Hue University

Hue University learning resource center is the other national center of excellence for the national eLearning network. The university's learning resource center was established in the mid-2000s and has two computer labs with over 500 computer workstations and an extensive paper-based and digital library (Churton 2011). As of 2015, the university had extensive experience using Moodle to author eLearning courses. The university has developed several eLearning courses and trained 10 university instructors on Moodle and eLearning pedagogy. The university also produced several manuals describing the process of developing eLearning courses and supported implementation of courses in two other universities (Churton 2011).

Hai Phong Medical University

In 2008, Hai Phong Medical University, under the support of the national MOH HIV/AIDS office and Pathfinder International, designed five eLearning courses specific to HIV/AIDS prevention, care and treatment (Vietnam KII 2015l; Vietnam KII 2015f; Vietnam KII 2015g; Vietnam KII 2015o). In this project, physicians were called for a one-day in-person orientation to the eLearning course and then completed the courses on their own time. The courses were not officially approved for CME credit. The university used Moodle for the eLearning platform and received support from Hue University to

implement the courses (Vietnam KII 2015j). To date, around 200 students from a variety of universities and provinces have participated (Vietnam KII 2015j). The project found that faculty members were resistant to learning new teaching methodologies, highlighting the need to strengthen faculty capacity and incentives for designing and facilitating eLearning courses. Students who attended the courses reported that they enjoyed the distance-learning approach, primarily because they did not have to leave their workplace to travel for in-person training (Vietnam KII 2015f).

Ho Chi Minh Medical University

Ho Chi Minh University, with financial and technical support from the Partnership for Health Advancement in Vietnam (HAIVN), has a long running video conference-based eLearning program to support HIV clinicians in Vietnam. Virtual learning sessions are organized at specific days and times and discussions focus on unique HIV clinical cases. Case discussions are primarily meant to be knowledge updates; they are not officially approved as CME (Vietnam KII 2015k). The university uses the Zoom software as an eLearning platform, which allows for organized group calls and asynchronous communication (Vietnam KII 2015k). Participating clinicians reported satisfaction with the learning methods, primarily because they don't have to travel, they receive real time feedback from their peers, and they have access to specialists for advice (Vietnam KII 2015k).

Thai Nguyen University

Thai Nguyen University received some support through the eLearning network to establish IT and eLearning capacity, but as of 2015, the physical infrastructure was not in place to support a university-wide eLearning program (McNabb Interview 2015b). Several faculty members were trained in eLearning methodologies. While there was general interest to develop eLearning capacity, the university was focused on designing pre-service eLearning courses rather than for CME (McNabb Interview 2015b). The university has a plan to strengthen the IT department and develop video conferencing, telemedicine capacity, and pilot eLearning courses in select subjects to evaluate approaches for potential for university-wide scale-up (McNabb Interview 2015b). Poor physical infrastructure and faculty resistance to delivering eLearning courses were gaps reported by university faculty (McNabb Interview 2015b).

Hanoi School of Public Health

The Hanoi School of Public Health does not yet have experience offering eLearning courses to students for pre-service or CME, though, the physical infrastructure to do so is in place (McNabb Interview 2015c). The university received support in early 2016 from GIZ, a German Development NGO, to pilot eLearning courses focused on quality management and improvement, epidemiology and statistics (McNabb Interview 2015c). In order to prepare for the pilot in January 2016, the university was focusing on building the capacity of younger faculty and had sent faculty members abroad to learn eLearning methodologies.

Future eLearning Plans in Vietnam

As mentioned earlier, the World Bank has made a large loan to the Government of Vietnam to strengthen human resources for health in the country from 2015 – 2020 (World Bank 2014). One of the key components of this project is to further strengthen the medical, nursing and other health professional education in 31 colleges and universities nationwide (World Bank 2014). This project calls for and is a great opportunity for Vietnam to further strengthen the role of eLearning within the larger pre-service education environment as well as for CME. With this new World Bank funding, there is an opportunity to invest strategically in building eLearning capacity to advance pre-service education and CME goals. Given past funding patterns, other donors such as the Asia Development Bank also might be interested in supporting new innovations for CME.

Offering distance –based eLearning CME options is one way to reach more learners with CME content at a reduced cost. Extending eLearning to allow accessing content via mobile can offer more opportunities for clinicians to access CME content.

Mobile Technology Globally and in Vietnam

Vietnam has a very high mobile phone penetration rate with over 143 million active mobile subscriptions, corresponding to a population penetration rate of 1.5 subscriptions per person (We Are Social 2015; International Telecommunications Union 2015a). A mobile subscription refers to a mobile SIM card, with a unique phone number tied to a

particular mobile network operator. In many countries, including Vietnam, customers have more than one mobile subscription as there is poor mobile network coverage in some areas; or many also have separate phone numbers for personal and work use (International Telecommunications Union 2015b). While the national mobile subscription rate is 1.5 subscriptions per person, 93% of the population owns any type of mobile device (We Are Social 2016).

At the time of writing, mobile phone ownership in Vietnam was much higher than population access to the Internet. In 2016, there were nearly three times more mobile subscriptions than active Internet users in the country. There were only 47 million Internet users compared to 143 million active mobile subscriptions (We Are Social 2016).

Mobile network coverage in Vietnam is relatively strong, with various 3G networks widely available in the country. In 2015, out of all mobile subscriptions, 89% of them were pre-paid and 26% were broadband connections, accessing 3G and 4G data services (We Are Social 2015). There are several mobile telecommunication companies in Vietnam, with many launching their own texting and gaming applications and platforms. The country's telecommunications market grew nearly 16% from 2014 to 2015 with five licensed mobile network operators in the country (VinaPhone, MobiFone, Viettel, Vietnammobile and GMobile). Nearly 90% of the market share is divided by Viettel Mobile, MobiFone and Vinaphone companies (US Commercial Service 2014). As of

2015, the country successfully launched a national 3G network, however only 16% of mobile traffic used 3G. Viettel, the state owned telecommunications company, has the largest number of 3G users (70% of these 3G users have Android phones) followed by Mobiphone and Vinaphone (Appota 2015).

Feature phones have basic dialing and texting functionality, and often access to data services, but are not as advanced as smartphones which have more advanced computing power (Tech In Asia 2014). With the rise of the telecommunications industry in Vietnam and the growth of mobile phone adoption, the sophistication of market mobile devices is also increasing. In 2016, around 55% of the population was estimated to own a smartphone in Vietnam, and 97% of smartphone owners actively use their device to search for information on the Internet (We Are Social 2016; tuoitrenews 2015).

In Vietnam young people aged 16–24 are the fastest adopters of smartphones accounting for 58% of all smartphone owners in the country (tuoitrenews 2015). In 2014, among 40 countries surveyed, Vietnam had the highest age gap between younger and older people in Internet and smartphone access. There was a 56 percentage point gap in access to Internet or smartphones between 18–35 year olds (81%) and those above the age of 35 (25%) (Pew Research Center 2016). Additionally, there is a gender gap in access to the Internet and smartphones in Vietnam. In 2014, among those who reported owning a smartphone, only 44% of women reported access compared to 57% of men (Pew Research Center 2016). Given the growth over the last few years and the reduction in the

cost of smartphones, it is reasonable to expect more smartphone purchases rather than feature phone purchases in the future (We Are Social 2016).

In order to design effective and engaging mobile learning solutions, it is important to understand how people use their phones on a daily basis or for personal reasons. This information can help to identify potential ways to work "within" the ways the people identify and regularly use their mobile devices. Social media channels such as Twitter, Facebook and Instagram are an increasingly popular way for people around the world to connect socially or professionally using mobile phones. This situation is no different in Vietnam, where the use of social media increased by 40% in just one year (2014 – 2015) with 35 million people (37% of the population) having active social media accounts in 2016. Among those using social media, nearly all use a mobile device to access accounts (We Are Social 2015).

The most common global social media and chat applications accessed in Vietnam are Facebook (21%), Facebook messenger (14%), Google+ (13%), Skype (12%), and Viber (9%) (We Are Social 2015). Interestingly, Vietnam mobile phone users spend on average of 2 hours and 41 minutes surfing the Internet and 3 hours and 4 minutes on social media sites every day (We Are Social 2015). Locally developed mobile innovations are also flourishing. In 2009 Zing Me, a Vietnam specific social media site, was launched and nearly immediately had more than twice the number of users than Facebook in the country (Tech in Asia 2011). With one-third of the population, and particularly the

younger generation, accessing social media, this represents a great opportunity to utilize these channels for CME.

Mobile app developers are also on the rise in Vietnam, with 14,000 active developers in 2014 alone (Appota 2015). With more and more mobile app developers, there is an opportunity to use local developers to design mobile learning applications. App downloads are also increasing yearly, with over 15,000 apps downloaded in 2014 alone (56% iPhone apps, 44% Android apps) (Appota 2015). Many in Vietnam play mobile phone-based games. In 2014, out of all the apps downloaded, 58% were games, 15% were entertainment related and 27% were other types of apps (Appota 2015). In 2014, onClan, the first Vietnamese social network for mobile gaming, was launched and its first online mobile game was released globally (Appota 2015). As mentioned in the previous chapter, the use of gaming approaches for medical training is an exciting new innovation in medical education that could be adopted in Vietnam.

Mobile chatting applications that use data (which is much lower cost than SMS in Vietnam) are also becoming increasingly popular. Zalo is the most popular chat app in the country with over 22 million registered users by the end of 2014 (Appota 2015). The country's first Vietnamese specific chatting app called VietTalk was also launched in 2014 by Vinaphone (Appota 2015).

Mobile Ownership among Health Workers in Thai Nguyen Province

Understanding the mobile phone ownership among health workers and how they use their phones for their personal lives is important to understand when considering whether a mobile learning intervention is the right fit for the Vietnamese CME program.

Health workers were asked about their phone ownership and use during FGDs conducted in Thai Nguyen province as part of the data collected for this dissertation. During all FGD sessions, all health workers reported having mobile phones, but not all of them owned smartphones. Physicians were primarily the ones who owned smartphones. Urban physicians reported using their mobile phones mainly for phone calls and half used them for social media sites such as Facebook and chatting apps such as Zalo. Rural based physicians reported that older workers typically do not have a mobile phone and are not skilled in how to use smartphones. Among nurses and physician assistants, all have phones but mainly used them for SMS and calling. They reported only using the 3G network when necessary due to an unstable network and high personal cost. However all clinicians reported using publicly available wi-fi at the health centers. It should be noted that the availability of wi-fi is not widespread in Vietnam; it is likely more available in Thai Nguyen than in other province due to the province's relatively high socio-economic status and close proximity to Hanoi (McNabb Interviews 2015).

Results from the mCME RCT in Vietnam

Only one rigorous test of using mobile technology for CME has been conducted in Vietnam. In 2015, the Boston University School of Public Health (BUSPH) and

Pathfinder International in Vietnam conducted a RCT assessing the use of SMS as a mechanism to deliver health related content to community based physicians assistants in Thai Nguyen province. The trial had three arms: 1) Intervention group that received content in the form of interactive health-related questions, requiring and answer; 2) Intervention group that received standard fact-based health messages, requiring a response that the message was received; and 3) Control group that received inspiring messages via SMS but with no substantive health-related related content and required no response. The content of the SMS messages was carefully crafted in English by physicians and then translated into Vietnamese using 160 character count limits. The content of the messages was developed using the physician assistant core curriculum as a basis for identifying general medicine facts that physician assistants are expected to know. The Center for Population, Health and Research, under the MOH, designed the custom SMS software and facilitated the technical implementation of the study. Study participants (N=638) were enrolled to receive the messages for six months. A baseline and end-line knowledge survey was used to assess changes in health-related knowledge. Baseline and end-line user surveys also collected information about the users' satisfaction as it related to receiving health content via SMS, how physician assistants access CME content, and mobile-related preferences for receiving content.

Study results found very high participation rates with >95% of participants in both intervention groups responding to most or all of the daily messages. Additionally, more than 80% of all participants reported that mCME was favorable and greater than 90%

reported that the message content was relevant or highly relevant to their work. However, there was no statistically significant change in knowledge from baseline to end-line and no change in the time participants used for self-study (Gill 2016). Overall, the study participants liked the intervention, preferred the interactive approach and were interested in learning with SMS. A number of key lessons were learned including: content should be relevant to all users, messages in Vietnamese characters should contain the tones, and linking SMS to online or other eLearning resources might increase actual self-study (Gill 2016).

Chapter Six Conclusion

Vietnam has made steps to introduce new distance-based teaching methodologies in 17 universities in the country. The mCME RCT provides insight into how mobile technologies can be used for CME in Vietnam. The literature documents other key use cases for how mobile technologies can be leveraged. With high mobile phone ownership in the country, there is room to consider additional use cases for introducing mobile technologies. This can support enhancing the eLearning network by extending the reach of CME opportunities in Vietnam, potentially realized through the new World Bank project and potentially other funders.

CHAPTER SEVEN: CONSIDERATIONS FOR MOBILE TECHNOLOGIES FOR CME IN VIETNAM

Background

One of the core aims of this dissertation is to provide recommendations to the MOH regarding how mobile technology can be leveraged to support the national CME program. In order to achieve this aim, a full review of the current state of the CME program roll out in the country was conducted through searches of the peer reviewed and gray literature, supplemented by data collected through interviews with key stakeholders in Vietnam. The results, outlined in chapter four, are complimented by a description of the efforts MOH has done to introduce eLearning. Chapter five described how mobile technologies can further support the eLearning network in Vietnam. In order to identify the various ways that mobile tools can be used for CME, a literature review was undertaken to understand international experiences, best practices and recommendations. This produced little global evidence related to mobile technology and CME but did reveal a number of pilot mobile CME programs.

Focus group discussions with physicians, nurses and physician assistants in Thai Nguyen province helped provide clarity on their current CME practices (which is currently very limited) and mobile phone use (which is high and increasing). Interviews conducted with global mHealth and mobile learning experts, academics and donors shed light on how mobile technologies could be incorporated locally. Vietnam expert interviews also provided lessons learned from eLearning programs.

The goal of this chapter is to synthesize the literature review and the FGDs and key informant interview findings by organizing them within a programmatic framework. This was done in order to produce a user friendly "guide" of recommendations for the MOH. The first part of this chapter focuses on "use cases", meaning different settings in which mobile technologies could be used to deliver and/or support CME activities. These were selected from among those most commonly mentioned during interviews as being beneficial for supporting the national CME program. Part two of this chapter is focused on the operationalization of these use cases. It further describes broad planning and operational considerations for adopting mobile technologies. A final list of recommendations is provided.

Part 1: Use Cases for CME in Vietnam

There are many ways that mobile technologies can be used within a health system. In 2013, a useful framework was published to define common use cases for health system strengthening (figure 2) (Labrique 2013).

Figure 2: 12 Common Applications of mHealth as Health System Strengthening Innovations

As seen in figure two, mobile technologies can be used to support a variety of functions, some focusing on administrative tasks and others directly impacting service delivery, client knowledge or provider training. According to this framework, and specifically in relation to a national CME program in Vietnam, mobile technologies can be applied to the following use cases:

1) CME program administration:
    - #3: Registries
    - #4: Data collection and reporting
    - #10: Human resource management
2) Delivering or linking to distance-based CME content
    - #9: Provider training and education

Using the use cases as a guide, global and local experts were asked to give their opinions on which mobile technology solutions might be useful in a national CME program for operational support and content delivery. It is important to note that among the Vietnam stakeholders interviewed, 50% reported a widespread lack of awareness about the potential of integrating mobile technologies. Therefore, the majority of responses for use cases came from global technology and implementation experts. The table below describes the number of times a particular use case was mentioned by interviewer type and location.

Mobile Technology Use Case	Global Stakeholders (n=30)				Global Total n (%)	Vietnam-based Stakeholders (n=22)			VN Total n (%)	Total N (%)
	Tech (n=9)	NGO (n=11)	Multi-lateral or Donor (n=7)	Academic (n=3)		Govt (n=8)	Academic (n=3)	NGO (n=11)		
Deliver CME Courses	6	6	5	3	**20 (67)**	4	3	7	**14 (64)**	**34 (65)**
Registration and Tracking CME credits	3	6	6	4	**19 (63)**	3	2	4	**9 (41)**	**28 (54)**
Clinician Alerts, Reminders, Updates	3	7	5	3	**18 (60)**	2	2	1	**5 (23)**	**23 (44)**
Link to EMR or Decision Support	5	4	2	4	**16 (53)**	0	1	3	**4 (18)**	**20 (38)**
Mobile Consultation with Senior staff	5	5	3	1	**14 (47)**	1	2	5	**8 (36)**	**22 (42)**
Extension of current eLearning platforms	2	4	2	1	**9 (30)**	3	2	3	**8 (36)**	**17 (33)**
Point of Care Tools	2	3	2	3	**10 (33)**	0	1	1	**2 (9)**	**12 (23)**
Quizzing, delivering content before and after in-person training	0	4	3	1	**8 (27)**	0	2	0	**2 (9)**	**10 (19)**

Table 5: Frequency of Use Case Mentions by Type of Interviewee (N=52)

Top Mentioned Use Cases by Experts

Among all stakeholders, the top three most commonly mentioned use cases for mobile technology were: 1) delivering a curriculum or other learning program via a mobile device (65% n=34); 2) registration and tracking of CME credits (54%, n=28); and 3) CME clinician alerts and reminders (44% n=23). Global and Vietnamese interviewees generally agreed with these top three. However, more global experts suggested clinician alerts, reminders and updates compared to Vietnamese interviewees.

In order to organize the eight use cases mentioned by interviewees, three categories were developed and each are described in detail below:

1. Deliver CME courses through mobile devices
2. Amplify CME activities through point-of-care reference and educational materials
3. Support CME program administration

Category 1: Deliver CME course through mobile devices

Delivering an actual CME course through a mobile application was the most frequently mentioned use case. It was noted by 65% (n=34) of those interviewed. Since the national eLearning network has chosen to use Moodle as their eLearning platform, this opens up possibilities of adding on a mobile learning app within the existing infrastructure. However, using a mobile app would require the learner to own a smartphone to access content. Thirty percent of global and thirty-six percent of Vietnamese stakeholders mentioned integrating a mobile component into already existing eLearning to offer

options to access content on the go. Some mobile medical applications commercially available in the market (ePocrates, The Sanford Guide and others) were mentioned by global experts to also have CME apps where clinicians can access actual CME courses. However, these apps have licensing fees that would need to be purchased. A smartphone is not essential to be able to provide CME content to health workers. As demonstrated in the mCME RCT, simple feature phones can also be used for learning via voice calls or SMS. However, smartphone applications can provide much more information and storage of key documents on the device itself. More information on action steps and recommendations for adopting this approach is found later in this chapter.

Category 2: Amplify CME activities through point-of-care reference and educational materials

Mobile technologies and applications can also be used to support a CME program by linking to service delivery data and provide clinicians with point-of-care tools. Using point-of-care tools to document actual client cases and then embed some learning content within actual case delivery can be a good example of how to use these tools for CME credits. Integrating mobile learning solutions within existing electronic medical record (EMR) or clinical decision support tools was mentioned by 53% (n=16) of global interviewees and 18% (n=4) of Vietnam interviewees as an important innovation that can help to link CME content with actual client health outcome indicators. Additionally, 47% of global interviewees and 36% of Vietnamese interviewee's suggested that mobile

technologies be used to connect learners with senior staff for consultations, virtual grand rounds, or other case conferencing for CME credit.

Point of care tools such as mobile reference, drug-drug interactions, or other medical reference applications were mentioned by 33% of global and 9% of Vietnamese interviewees. These tools are often meant to serve the "just-in-time" information needs of clinicians and might not serve well for formal CME credit acquisition. However, they are also available to support improving the quality of care and adherence to medical and clinical guidelines.

Finally, mobile apps, SMS, IVR and other VoIP technologies were mentioned by 27% of global and 9% of Vietnamese interviewees as good ways to reach learners with content, quizzes, or other learning tools. They can be used either before or after and in-service training to save time, reduce the costs of in-person training, and promote continued and sustained knowledge retention.

Category 3: Support CME Program Administration

Mobile technologies can also be used to support CME program administration. These operational use cases can greatly impact the cost and efficiency of the national program. Two key use cases were included in the top three mentioned: 1) registration/tracking CME credits, and 2) clinician CME alerts and reminders. Several other uses case mentioned by experts included:

- Paying for courses or other services through mobile money
- Developing a supervisor app for mentoring and coaching to support learning
- Alerting health workers of courses that are available for CME credit
- Allowing clients to check if a healthcare provider has a valid license to practice
- Blending entertainment applications with health worker learning apps
- Engaging clients to give feedback on clinician performance or service quality
- Allowing instructors to submit health worker information about completion of CME credits to a central database
- Negotiating closed user groups with mobile operators for free voice calls for clinicians with mobile network operators

Registration and Tracking of CME Credits

Among all interviewed 54% (41% Vietnam, 63% global) suggested that mobile technologies could be used to register or track clinician CME credits or compliance. The current method of recruiting clinicians for short-courses or CME was reported as a challenge by several stakeholders. In the FGDs, physicians reported autonomy in selecting their own CME courses, but nurses and physician assistants reported always being assigned by supervisors to attend CME courses, and that not all were able to have the opportunity to attend such courses. Clinicians also reported having to keep track of their own CME compliance and complained that systems for documenting compliance at the province level are still paper based, and thus inefficient. In the US, there is no central repository or tracking CME credit compliance system in place. The MOH in Vietnam,

however, expressed interest in tracking individual licensure compliance. Considering how mobile technologies can be integrated into the national CME database can offer administrative support and improve efficiencies in registration and tracking clinicians.

In order to address these issues, global experts suggested the following use cases related to registration and tracking as opportunities for using mobile technology:

- Facilitating CME registration and reminder functions within the national database
- Checking on registration and CME compliance (by clinicians)
- Providing automatic reminders for clinicians to know compliance status
- Alerting provinces and MOH information systems of completion of CME credits by individual providers (by CME instructors)
- Checking whether health providers clients are being seen by are licensed providers
- Alerting clinicians to CME courses that are available for credit in their localities

Mobile technologies such as mobile apps, SMS, social media, VoIP applications and phone calls or other app blasts were reported as potential tools for CME registration and tracking. SMS can be used to send reminders for health workers or as a two-way system for clinicians via SMS to assess compliance status. Over 24% of the population in Vietnam uses social media frequently on their mobile device, so setting up a Facebook page where clinicians can find course announcements could be a low cost intervention. Additionally, the most popular data based texting app in Vietnam is Zalo with over 22

million users. Since Zalo is low cost and widely available, this could be used as a tool to connect clinicians to provincial or MOH databases to check on CME compliance but also serve as a real time communication tool that has question and answer functions to connect workers to CME administrators.

Currently, a national database for tracking credits is under development, but actual implementation is lagging. Additionally, there is no central source where clinician phone numbers are registered. However, one Vietnam implementer suggested using the nursing association registry or other informal peer networks to connect clinicians through mobile phones. One key consideration is that the health workers phone numbers change rapidly, so any registration and tracking system should be designed to allow clinicians to update their phone numbers on a regular basis.

With the absence of a national health workforce registry in the country, there is a need to consider information systems that can connect to the mobile tools mentioned above for more automated tracking and reaching clinicians and educators. All global experts interviewed recommended using the world's most widely adopted open source human resources information system called iHRIS. iHRIS (http://www.ihris.org/) is an open source software supported by Intrahealth International that designed to be interoperable with other open source information systems such as DHIS2 and Moodle, both of which are chosen information system platforms in use in Vietnam. iHRIS was developed in 2009 and, to date, 19 countries have adopted it as their national health worker registry

database, with translations in 14 languages.

iHRIS has two main features: ‘iHRIS manage’ and ‘iHRIS qualify’. iHRIS manage allows countries to collect, manage and analyze detailed information about health workers in the country. It can be used at any level from the MOH, district, province or health facility and can be customized to any context. Human resource information can be entered via a computer but can also be customized to work with mobile applications. iHRIS qualify is a health professional registration, licensing and certification application to support tracking clinician licensure. iHRIS qualify can be used by the MOH or professional associations to ensure that clinicians are up to date with licensure requirements (IntraHealth International 2015). Although iHRIS is not specifically a mobile application, it can use mobile tools for various CME program supportive functions. Data captured in iHRIS qualify can help to: (IntraHealth International 2015)

- Enforce minimum qualifications for students
- Administer national level qualifying examinations
- Verify CME requirements have been completed
- Issue private practice licenses
- Verify qualifications of foreign-trained workers applying to work in a country or internal health workers applying for international posts

Key features in iHRIS qualify include: records management, pre-service training tacking, examination management, registration and licensing, and reporting. There is also a robust

international open-source community of iHRIS developers that provides often free technical support (IntraHealth International 2015). Health professional councils in Nigeria and Uganda have adopted iHRIS qualify for their licensing needs (Intrahealth International 2015). An implementation toolkit has been developed to help countries assess, plan, deploy, scale, and sustain the system at national or provincial levels (http://www.ihris.org/toolkit-new/).

More recently, iHRIS was enhanced to allow for integration with other mobile technologies to reach clinicians directly for better management and communication. In 2014, as a response to the Ebola epidemic in West Africa, a consortium led by Intrahealth was developed to extend the functionality of iHRIS to the health worker themselves through what is called mHERO (http://www.mhero.org/mHero/). mHERO integrates mobile technologies such as SMS or Interactive Voice Response into the software platform so that ministries can communicate with health workers in real time. This can add great value and improve efficiency of the national CME program. The MOH has started to design a national database that would allow provinces to update information on clinicians in their geographic area, but it might consider switching to the iHRIS platform and additional mobile application features.

Clinician CME Alerts, Updates, and Reminders

The third most commonly mentioned use case, one recommended by 60% (n=18) of global and 23% (n=5) of Vietnamese interviewees, related to using mobile technologies

for sending alerts, updates and CME reminders to health workers. Common examples mentioned include:

- Sending helpful tips or educational messages to health workers
- Alerting health workers of new CME courses or other national level CME policies
- Notifying clinicians in the event of an outbreak or natural disaster and quickly send information about clinical and preventive care
- Creating social media pages using Facebook or other platforms to post content or create networks of professionals to share updates or clinical experiences (considering ethical and privacy concerns)
- Using Voice over IP or other applications to connect learners to share information or do group discussions about particular topics

Part 2: Planning Framework for Integration of Mobile Technologies for CME

In part two of this chapter, the aim is to describe the necessary programmatic and operational steps the MOH can take to adopt mobile technologies for CME. The "use cases" described in part one of this chapter have similar underlying enabling environment, policy and financial considerations. Therefore, this section will provide recommendations that apply to all use cases identified.

As mentioned earlier, the WHO developed mHealth assessment and planning for scale tool to help program managers and governments plan to scale a mobile-supported health intervention. This tool was used as a basis for creating the planning framework used to

present the key informant interview and FGD results (World Health Organization 2015). The planning framework is useful in that it describes key programmatic and operational considerations necessary for designing and implementing mobile solutions for CME. The framework is organized into six axes that are further divided into domains and sub-domains. Each axis is presented sequentially and ends with axis-specific recommendations for the MOH. The figure below describes the framework in further detail.

Axis 1: Groundwork	**Axis 2: Partnerships**	**Axis 3: Mobile CME Content**	**Axis 4: Financial Health**	**Axis 5: Technology**	**Axis 6: Monitoring and Evaluation**
Domain 1: Contextual Environment	*Domain 3: Strategic Engagement*	*Domain 5: mCME Content*	*Domain 8: Financial Management*	*Domain 10: Data*	*No domains or sub-domains*
1.1 Policy environment 1.2 Technical environment	3.1 Identification of partners 3.2 Fostering buy-in	5.1 mCME pedagogy 5.2 mCME tools 5.3 mCME content	8.1 Program cost 8.2 End user cost 8.3 Health system cost 8.4 Forecasting	10.1 Data access and security 10.2 Data transmission and storage	
Domain 2: Scientific Basis	*Domain 4: Partnership Sustainability*	*Domain 6: Mobile Learner*	*Domain 9: Financial Model*	*Domain 11: Interoperability*	
No sub-domains	4.1 Champions 4.2 Governance	6.1 Target audience 6.2 Clinician preferences	9.1 Business plan	11.1 Systems integration 11.2 Data standards	
		Domain7: Faculty Development			
		No sub-domains			

Table 5: Planning Framework Axes and Domains

Axis 1: Groundwork

This axis refers to "the initial steps of specifying key components of the projects approach to scaling up, assessing relevant contextual influences, and taking stock of the scientific basis for the product" (World Health Organization 2015). There are three domains within this axis: parameters of scale, contextual environment and scientific basis. The table below describes the domains for axis one in further detail.

Axis 1: Groundwork
Domain 1: Contextual Environment 1.1 Policy Environment 1.2 IT Environment
Domain 2: Scientific Basis 2.1 Existing Evidence 2.2 Local Validation

Domain 1: Contextual Environment

This domain refers to the need to conduct a thorough assessment of the contextual elements that are necessary related to mobile interventions. Two main areas are included in this domain: 1) Policy environment and 2) IT environment.

Sub-Domain 2.1: Policy environment

Through interviews, three levels of policy were identified as critically important for integrating mobile technology into the national CME program: national CME, national eHealth, and university policies. The table below summarizes interview findings in relation to policy considerations related to integrating mobile technology for the national CME program.

Policy	Global (n=30)				*Global Total n (%)*	Vietnam (n=22)			*VN Total n (%)*	Total n (%)
	Techno-logist (n=9)	**NGO (n=11)**	**Multi-lateral/ Donor (n=7)**	**Aca-demic (n=3)**		**Govern-ment (n=8)**	**Aca-demic (n=3)**	**NGO (n=11)**		
Need to revise or create new national policies	4	3	3	1	***11 (37)***	7	1	8	***16 (73)***	**27 (52)**
Need to create governance and regulatory structures	2	2	0	1	***5 (17)***	2	0	3	***5 (23)***	**10 (19)**
Need to enforce current CME-related policies	1	1	0	1	***3 (10)***	1	1	2	***4 (18)***	**7 (13)**
Need to ensure that government CME policies are conducive for mobile	0	0	0	0	***0***	5	0	0	***5 (23)***	**5 (10)**
Need to develop sub-national policies	0	0	0	0	***0***	1		3	***4 (18)***	**4 (8)**

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Table 6: Domain 2: Contextual Environment, Sub-Domain 2.1: Policy Interview Results

National Policies

Nearly one quarter (23%) of government stakeholders reported that the current CME policies would be supportive of introducing mobile technologies. The LET and circular 22 published for CME guidance are also both supportive of utilizing online and Internet-based teaching methodologies to deliver CME content. While national guidance was in place, 73% (n=16) of Vietnamese stakeholders (87% from the government) mentioned the need to revise, enforce, or create new national policies related to the CME program. Key national level policy revisions recommended by Vietnam interviewees included:

- Develop a national CME course accreditation system that also includes eLearning standards
- Design one national database that provinces can access to register clinicians and monitor CME compliance. Consider using the same database to document and house course materials.
- Prepare detailed guidance for financially supporting the development of CME courses by faculty and training institutions
- Develop a national eHealth strategy to promote interoperability of health information systems and databases and guide mobile application development
- Advocate for a decentralized accreditation process from the national to the provincial level

While the LET and Circular 22 are in place at the national level, 18% (n=4) of Vietnam interviewees stated that the law is not strictly enforced, resulting in poor clinician

compliance to maintain licensure (McNabb Interview 2015d; McNabb Interview 2015m). To date, there is no national accreditation process in place for general CME courses. However, guidelines were under development and are expected to be completed in 2016 (McNabb Interview 2015n; McNabb Interview 2015m). One MOH stakeholder suggested that since the law stipulates that CME courses should be at the provincial level, it would be challenging to have one coordinated national program.

Further, there were no specific guidelines for accrediting eLearning or mLearning courses. This includes developing standards for designing eLearning or mobile learning courses, credit hours and accreditation criteria (McNabb Interview 2015m). Circular 22 mentions distance-based learning and eLearning mechanisms; however, mobile technology is not mentioned as an option (McNabb Interview 2015k; McNabb Interview 2015m).

Currently, there is no centralized mechanism to issue certificates based on eLearning CME courses to learners (McNabb Interview 2015o; McNabb Interview 2015j). In addition, no national registration system is fully in place to monitor individual worker compliance with CME credits for re-licensure (McNabb Interview 2015n). The MOH, however, has identified the development and roll out of the national database to track clinician compliance with CME requirements for licensure as a priority activity (McNabb Interview 2015f).

International stakeholders recommended ensuring that the licensure identification is linked to national ID systems to streamline tracking across provinces. However, it is still unclear how the national registry will be stored or housed. International experts pointed to the WHO minimum data set for health workforce registries, a set of international data standards, that could be adopted (found here: http://www.who.int/hrh/statistics/minimun_data_set/en/). All international experts also suggested the need establish governance and regulatory structures to ensure that clinicians complete CME credits to avoid gaming and provide guidance on access to data related to CME and licensure.

One local implementer suggested that the national government design a comprehensive eLearning roll out and capacity building plan. The MOH has developed a strategy for rolling out CME from 2010–2030, and is the process, through World Bank funding, to further design implementation strategies (McNabb Interview 2015f; McNabb Interview 2015p). The MOH's first priority is setting up the full network for eLearning including identifying the roles of all stakeholders, procuring equipment and ensuring the necessary infrastructure is in place. It also plans to train faculty on eLearning methodologies (McNabb Interview 2015f). Secondly, the MOH plans to conduct faculty training and then support trainers to develop and roll out CME courses with a quality assurance mechanism in place (McNabb Interview 2015f). Given potential usefulness of introducing mobile technologies, including in the national level plan for capacity building on eLearning could be a strategic use of resources.

While the government is supportive of including mobile technologies and other information and communication technologies in the health sector, there is no national eHealth strategy or specific guidelines on implementation (McNabb Interview 2015h). However, the MOH general strategy on development of a national health management information system 2014–2020 does mention eLearning as a strategy (McNabb Interview 2015i). The 2012 Master plan and strategic framework for integrating the use eHealth tools does not cover the use of mobile tools for human resources for health or learning, but is mainly concerned with data standards for health information sharing along with other considerations for adopting ICT and mobile tools for health (ECISM Conferences 2015; McNabb Interview 2015h).

University Policies

As noted in earlier chapters, once a university or training institution has received a code from the MOH, they are authorized to design, deliver, and certify clinicians as compliant for re-licensure by the province. One Vietnam government and 100% of academic interviewees mentioned the need to develop university specific policies related to CME or eLearning, particularly related to faculty support for CME course development and design standards for eLearning and CME courses.

While formal hubs and networks for eLearning were reported to be established under the Asia Development Bank project, two academic interviewees reported that there are no formal mechanisms in place for universities to share experiences and lessons learned

introducing eLearning approaches (McNabb Interview 2015c). Hue University and Hanoi Medical School have provided some support to other universities to develop eLearning courses; however, these are not fully institutionalized as a support mechanism. HAIVN is also supporting Ho Chi Minh University to develop an eLearning capacity building model that they hope can be scaled to other universities (McNabb Interview 2015n).

As mentioned, courses are usually developed at the province-level, and by regulation, if approved at this level, they cannot be offered across provinces. However, courses developed may be applicable to all provinces. The MOH could consider developing a national database and a process for reviewing of courses that have been developed, with consideration of what might be offered to clinicians nationally. This can help with cost-savings, national level coordination and allow a central nation-wide database that provinces could have access to.

Sub-Domain 2.2 - IT Environment

Introducing mobile technologies can leverage existing eLearning IT infrastructure, but mobile tools do not require such intensive physical resources as do traditional eLearning programs. Simple mobile learning solutions might only require a server, mobile application platform and software and mobile data access. The MOH or universities can consider purchasing mobile devices for learning, as seen in some global examples in high-income settings. However, several global interviewees indicated that “bring your own device” is more cost effective when workers purchase and use their personal

devices. However, not all health workers have smartphones. They use a variety of operating systems (Apple vs. Android), which could be problematic given that some mobile learning applications use only one operating system.

Overall, there is strong mobile network coverage in Vietnam so interviewees did not perceive a lack of coverage as a barrier to mLearning adoption. However, coverage in more rural and mountainous areas is not as strong as in urban centers. Wi-fi access has also been set up by many telecom providers in the country, facilitating easy access to the Internet if 3G services are not available, though. However, this access might not be available everywhere in the country. There are global examples of bringing wi-fi hotspots around health centers or other education institutions to allow health workers to download content or synchronize applications to continue working offline.

In terms of physical equipment necessary to implement eLearning courses, 41% of Vietnamese interviewees reported this as a challenge to designing and delivering eLearning courses. While some support was provided through the Asian Development Bank project, many universities in the eLearning network, including Thai Nguyen University, have not yet been upgraded with full video conferencing, recording, and computer labs to-date, nor have the IT support staff available. However, some schools such as the Hanoi Medical School and Hue University have technical infrastructure and knowledge to implement eLearning approaches.

Centrally, the MOH has IT capacity for eLearning and for designing mobile applications. The MOH was the lead mobile application designer of the mCME RCT described above. One Vietnamese interviewee suggested that due to the high costs of setting up the technology necessary for eLearning in all institutions, it might be advisable to centrally design and administer CME courses using eLearning or mobile learning and provide access to interested institutions.

Domain 2: Scientific Basis

This domain refers to the need to have scientific evidence of the effect of the mLearning solution on outcomes. There are 4 stages of evaluation of mobile technology solutions found in the literature: 1) functionality: does the technology work as intended?; 2) usability: can the technology solution be effectively used by the end user?; 3) efficacy: does the technology solution demonstrate the intended effect in a controlled setting?; and 4) effectiveness: does the technology solution demonstrate the effect in a non-controlled setting? (World Health Organization 2015).

As presented in chapter five, there is limited evidence globally related to the efficacy or effectiveness of delivering CME through mobile technology. However, several studies have shown that mobile tools can be used to support learning, are feasible, and are acceptable to health workers. There is a major opportunity in Vietnam to conduct further research to test different approaches for using mobile technologies for learning. The mCME RCT results showed limited impact on increased knowledge, though.

A related sub-study is underway to focus on HIV CME and to link clinicians to full eLearning courses content. This revision in the approach is supported by expert opinions gathered in this research and the literature. It is expected that this second study will provide additional evidence on the feasibility and efficacy of using SMS for CME in Vietnam.

While there is strong interest in introducing mobile tools for learning, 45% of all Vietnam interviewees (n=10) and 75% of government staff explained that there is a need to pilot different approaches locally and to generate evidence for the MOH to consider widespread adoption. Among global respondents, 42% stressed the importance of testing approaches and adopting evidence-based best practices.

Axis 1: Recommendations

1. Revise and enforce policies related to CME to facilitate course development. A number of policies were mentioned by stakeholders as needing to be revised or enforced in order to expand CME opportunities in the country.
2. Raise clinician awareness of the LET and licensure requirements. Results from the FGDs and interviewees indicate that knowledge about the general CME requirements was very low among clinicians, limiting the demand for CME courses. Identifying ways to raise awareness and enforce the LET will be an important initial strategy and can support tracking compliance.

3. Finalize CME certification criteria, including eLearning CME. Many CME and eLearning courses have been developed but are not officially accredited. Finalizing this guidance will promote the development of courses and generate demand for CME credits.
4. Design strategies and policies to support faculty to develop CME and eLearning courses. University staff reported a lack of budget and policies for reimbursing faculty to develop eLearning CME courses. Financial incentives or revision of job descriptions to include CME course development can incentivize faculty.
5. Introduce mobile technologies within the current eLearning network and leverage IT infrastructure in place. Significant work has been done to establish the eLearning network. Adding mobile tools to existing initiatives requires adapting content to mobile viewing screens. The incremental cost of introducing mobile within the eLearning network can have great value. Revising capacity building approaches to include design and other considerations for mobile technologies into existing efforts can produce value for little cost. Hue University and Hanoi Medical school, two national centers of eLearning excellence, can be targeted first as those institutions have capacity to deliver distance-based courses.
6. Review results from the mCME trial to assess mobile CME efficacy in Vietnam. The results from the mCME trial conducted in Thai Nguyen province will provide useful information to those interested in developing SMS programs for CME in Vietnam. Establishing a research and learning agenda to continually produce and

review the evidence for mobile technology for CME can support the MOH to make informed decisions on mobile technology for learning.

7. Develop a research and implementation agenda that highlights evidence-generation. There is little peer-reviewed evidence on use of mobile technologies for CME. Vietnam is already a leader in producing such evidence given that the mCME RCT was recently conducted. Reviewing these findings and adjusting implementation approaches accordingly will support localization of mobile CME solutions. With World Bank funding and interest on the part of the government, there is an opportunity to design and evaluate solutions that contribute to the local and global evidence base.

Axis 2: Partnerships

This axis refers to the various partnerships and stakeholders that are necessary for introducing a mobile solution. There are two main domains in this axis: 1) strategic engagement and 2) partnership sustainability. The table below describes the areas included within the partnerships axis and domains.

Axis 2: Partnerships
Domain 3: Strategic engagement 3.1 Identification of partners 3.2 Fostering buy-in
Domain 4: Partnership sustainability

4.1 Champions
4.2 Governance

Domain 3: Strategic engagement

The strategic engagement domain refers to the need to ensure that all stakeholders involved in mobile learning approaches be engaged actively in planning and implementing programs. Within this domain, there are two main areas for consideration: 1) identification of partners and 2) fostering buy-in.

Sub-Domain 3.1: Identification of partners

There are many stakeholders who should be involved in a mobile technology-supported program. Interviewees stressed that ensuring that the right mix of government, private sector, and academic partners are included from the start of any project will support successful and inclusive planning. Of all interviewed, 17% of global and 18% of Vietnamese respondents mentioned the importance of having the right stakeholders involved. Interviewees mentioned including the following collaborators:

- Ministry of Health
- Ministry of Education and Training
- Ministry of Information and Communication
- Provincial health departments
- Professional medical and nursing associations
- Academics and university staff
- Health workers

- Local and international m/eLearning design experts
- Private sector health institutions
- Mobile network operators
- Local or international private sector technology firms
- Local or international private sector CME content developers and accreditation agencies

Stakeholders interviewed did not prioritize or rank the importance of each partner, or their potential role in introducing mobile technologies. However, most of the above stakeholders are already potentially included in the national eLearning network, with the exception of mobile network operators. Leveraging partnership structures already in place and establishing a national steering committee to prioritize mobile technology use cases for potential consideration is recommended.

Sub-Domain 3.2: Fostering buy-in

Since mobile learning for CME is new globally, it is not surprising that there is a general lack of awareness among Vietnamese stakeholders about how mobile technology can be used. Out of all government staff interviewed, 63% (n=5) reported they were unaware about different ways mobile technology can be used for CME. Fostering buy-in among stakeholders is an important task, along with ensuring that they all share a vision for introducing mobile technology and that each partner is aware of the "value proposition" and role in achieving the vision.

Interviewees also reported a lack of clinician awareness about CME with 23% (n=5) of Vietnamese stakeholders declaring that awareness is low among health workers. Despite low awareness, there is strong interest, as 86% (n=19) of Vietnamese stakeholders interviewed said that they do not have any mobile learning programs now, but are interested in learning about the potential.

In order to foster ownership at the national level, 45% of global implementers (n=5) stated that improving capacity of government staff is important. Interviewees also pointed to the variety of stakeholders, including the public and private sector partners, and the need to define the roles, and strengths, or contributions each partner brings to a mobile technology-supported implementation. As mentioned, forming a national steering committee or a community of practice that is guided by a terms of reference or other governance document can help establish a forum for communication, sharing lessons learned, and aligning partners roles and contributions to the national program.

Domain 4: Partnership sustainability

This domain refers to the mechanisms to support sustained partnerships over time and includes two sub-themes: 1) champions and 2) governance.

Sub-Domain 4.1 Champions

The importance of having champions in the MOH and universities was raised by three global experts. Champions were described as key staff members that have influence over

budget and policy changes. Experts noted that identifying champions and ensuring they are supported can help lead to larger partnerships designed to adopt mobile technology. Champions that are in the current eLearning network would be good candidates for initial capacity building to leverage existing investments. Identifying additional champions within the MOH and provincial health departments in addition to the eLearning university network will also be important to target.

Sub-Domain 4.2 Governance

In addition to champions, three international experts also pointed to the need to set up governance structures to ensure that partnerships are sustained over the long term. A national steering committee guided by an agreed upon terms of reference with deliverables was mentioned as a possible governance structure.

Axis 2 Recommendations:

1. Present the findings of this research to the MOH and chairs of national eLearning network to define next steps. There is an opportunity with new World Bank funding to expand the eLearning network. The MOH can also advocate with other donors such as the Asian Development Bank to support the national eLearning network. A steering committee made up of key stakeholders would be valuable.
2. Engage the Ministry of Information and Communications when considering adopting mobile technologies. This ministry is an important stakeholder for the national CME program, particularly for the purposes of advocating with mobile

network operators in the country to strengthen network coverage in rural and mountainous areas and potential public-private partnership moving forward.

3. Engage other private sector companies and mobile operators in the national level planning and implementation structures. Many eLearning private sector companies and local mobile application builders are available in Vietnam. Including mobile network operators in the larger eLearning network partnership structure can help align roles and potentially negotiate reduced mobile data costs. Engaging these stakeholders and mobile network operators from the start will increase the potential for reduced cost for services implemented at national scale.

4. Develop strategies to embed mobile technology partners into the eLearning network leadership and stakeholder groups, and include approaches for ensuring partnership sustainability. The national eLearning network can be leveraged to include additional partners to add mobile functionality into eLearning courses. Developing national governance structures including potentially a steering committee to govern partnerships will be useful.
5. Identify champions in the MOH, province health departments and universities to support introducing mobile technologies. A structure for developing eLearning capacity in the country was established. Embedding mobile technologies as a potential resource within the network can leverage investments. Targeted training of eLearning champions and experts can support integration.

Axis 3: Mobile CME Content

Three domains are included in this axis: 1) mobile CME content development; 2) mobile learner considerations and 3) faculty development.

Axis 3: Mobile CME content
Domain 5: Mobile CME content development 5.1 mCME pedagogy 5.2 mCME tools 5.3 mCME content
Domain 6: Mobile learner 6.1 Target audience 6.2 Clinician preferences
Domain 7: Faculty development 7.1 Capacity building

Domain 5: Mobile CME content development

This domain refers to the various approaches that can be used to deliver educational content through mobile tools. Three sub-themes are included: 1) mCME pedagogy; 2) mCME tools and 3) mCME content.

Sub-Domain 5.1 mCME pedagogy

Using mobile technology for learning has benefits similar to eLearning; namely, it allows the student to learn in his/her own location, while still being connected to faculty, other learners, and learning resources. Mobile learning, however, allows access to students who might not have a desktop computer or laptop, this facilitating learning 'on the go'.

It is important to note that 20% (n=6) of global experts and one Vietnamese expert claimed that mobile technology "won't fix everything" and that mobile learning should not replace in-person training or traditional skills related training. Granting the validity of this view, it is still important to understand how mobile technologies can be used. As one expert mentioned, "mobile technology adoption is increasing and it will be inevitable that mobile devices will be incorporated into routine medical education in the future".

Nearly two-thirds (63% (n=19)) of global experts and more than one-third (36% (n=8)) of Vietnamese experts recommended using a blended learning approach when designing CME courses that are mLearning based. As mentioned earlier, blended learning can be defined as: combining in-person classroom and online learning in order to achieve

learning objectives. There are many examples in the literature about the various ways educators can combine virtual and in-person training, from having students complete some assignments or tasks online and discussing them during in person trainings to using mobile technologies to quiz or poll students during an in-person training. Two Vietnamese experts were adamant that mobile learning should target knowledge and might not be good for skills building.

Learning via digital devices allows a wealth of data to be collected including information on learner performance, learning outcomes, and providing educators with information about when learner's access content or how long they take to respond to a learning task. This learning outcome and "meta-data" can then be used to adapt the way the content is delivered and tailor it to individual learner's needs. Among those interviewed, 40% of global experts (n=12) suggested that data collected through mobile and eLearning solutions can be used for "adaptive learning", such that the technology can adapt to learner performance and target content delivery to those areas in which the learner is weak. Using adaptive learning techniques can have a strong impact on addressing individual competencies, ultimately influencing knowledge retention and performance.

Peer-to-peer and case-based teaching via mobile devices is emerging as an effective way to support knowledge and skill transfer among health professionals. Among all interviewed, 17% reported (n=9) that mobile technologies can help facilitate better case-based or peer-to-peer learning. Examples of peer-to-peer learning include connecting the

learning directly to a clinician's actual practice. This could be achieved by introducing virtual grand rounds whereby pictures of cases can be taken on phones and shared among a group of clinicians to review and comment on via mobile technology applications, with CME credits issued for the number of cases on which a clinician consults. Another example mentioned was using a mobile app to link a group of learners who all work on the same assignment together, thus promoting dialogue and discussion among clinician peers as well as more senior clinicians.

Virtual simulations have also been shown to have a positive impact on skills and knowledge acquisition. Ten percent of global experts (n=3) interviewed suggested that the future of mobile learning will involve more virtual simulations mimicking clinician-participant encounters. The use of games is also being used increasingly for medical education. Nearly one-third (30%) of global experts (n=9) highlighted the value of considering game theory and the entertainment associated with learning through a game. This could be a particularly important strategy for Vietnam as there is a fast growing culture of gaming in the country.

Another important consideration mentioned by interviewees is the need for a high degree of interactivity when designing mobile solutions to maintain learner interest and connections to educators. Nearly one-third (30%) of global experts and 9% of Vietnamese experts mentioned that ensuring interactivity in mLearning is critical to engage learners for long-term knowledge retention. Another important factor for learner

motivation is ensuring that the content is relevant and interesting to the user. Of all interviewed, 17% of global and 41% of Vietnamese experts reported that motivating clinicians via mobile devices would require providing a choice of CME topics deemed relevant to clinician interests and work. For example, a physician in Hanoi might have very different learning needs as a specialist than a family medicine doctor practicing in rural areas. Having CME content and course options that are tailored to learners' needs, rather than being driven by donors or implementing partners was described by Vietnamese stakeholders as critical. Three Vietnamese experts also stated that mobile learning can save time and resources for the learner and educator as compared to in-person training. Experts also claimed that traditional eLearning approaches could integrate a mobile technology component as well to extend the learning environment.

Sub-Domain 5.2 mLearning Tools

In order to deliver a full CME course through a mobile device, educators need access to software platforms that allow them to build course content and facilitate mobile learning courses. As mentioned in chapter four, there are many open source and proprietary eLearning platforms with mobile applications that can deliver full course content. In Vietnam, the national eLearning network has chosen to use Moodle, while HAIVN is using the Zoom platform with their work.

Several global experts interviewed mentioned OppiaMobile, developed by Digital Campus, Inc., as a leading open source mobile application that is already integrated with

Moodle. The OppiaMobile application allows educators to build course content in Moodle and deliver the course either on the web or through a mobile application. OppiaMobile is an Android-based application allows learners to access educational content, activities, videos, text content, quizzes, and other features while in network or offline. Text-to-speech functionality allows for activities to be read aloud for lower literate populations. It also has a feature that allows automatic notifications of new courses added to a learner's library, with badges and points can be earned for completing activities. Because OppiaMobile is integrated with Moodle, there is no need for programmers or other IT specialists to be involved in maintaining or updating learning content. Any updates to course content can be pushed automatically to the learner's device when they are in network. Tutors and other educators can access student activity to see course completion, the selection of videos or materials viewed, etc.

As mentioned in chapter five, other mobile technologies such as SMS, social media, and VoIP can also be used to deliver educational content, but each have benefits and tradeoffs. In terms of using SMS to deliver educational content, 23% (n=5) of Vietnamese interviewees mentioned SMS character length limitations and suggested that SMS be used mainly for knowledge-related education and to provide links to other technologies and in-person trainings. Vietnamese interviewees also mentioned that many private sector companies use SMS for advertisements and other commercial purposes. Therefore, delivering health content via SMS might be confused as spam and health workers might disregard messages. Additionally, global experts pointed to the fact that

SMS has been shown to be an effective way to amplify an existing training, but suggested that a high degree of interactivity is essential and exploring how SMS can link learners to a more complete set of learning resources virtually or in-person is important to achieve learning objectives.

Sub-Domain 5.3 mCME Content

The advances made in designing eLearning courses in Vietnam over the last five years are not insignificant. Over 300 eLearning courses have been developed, but are not yet fully implemented in the country. The MOH HIV/AIDS office also has a large repository of HIV related digital resources that still need to be structured into eLearning courses. Additionally, many universities and professional associations have repositories of content that could be adapted for delivery via mobile devices. The MOH plans to use Moodle to develop future courses. The MOH also plans to develop a database of all CME courses that can be stored and accessible at the national level. Given these two priorities, selecting Moodle, iHRIS (mentioned earlier), and a mobile application that can be integrated with these two platforms can help meet the needs of the MOH. Cataloging local CME content developed for in-person distance-based learning can support selecting key core courses that can be adapted for mobile delivery. Additionally, it will be important to consider traditional medicine-focused CME courses as they are officially sanctioned by the MOH and traditional medicine services are offered in nearly all commune health centers in Vietnam.

The legislature in Vietnam allows for international CME courses or content to be used for official CME credit in country. However, the course or content still must be reviewed and approved locally. While there is a wealth of globally available open source health content available, stakeholders highlighted the need to ensure content is translated into Vietnamese to ensure all learners can access and digest the information.

While it is important for educators in the country to be trained on designing eLearning and mobile courses using evidence based methodologies, 40% of global experts and 9% of local experts recommended considering using globally available, free, and open source medical education content and CME courses. ORB is an online content platform that globally crowd sources health worker training content and vets the content through an expert medical review for clinical accuracy before publishing it online (mPowering Front Line Workers 2015).

Domain 6: Mobile Learner

This domain refers to key considerations related to mobile learners themselves, particularly on how clinicians in country prefer to use mobile for CME.

Sub-Domain 6.1 Target Audience

Using mobile tools for learning is not for everyone. That is, it is not a "'one size fits all" solution for every learner in need of CME credits in Vietnam. Moreover, not everyone is eager to change his/her ways of learning. Of those interviewed, 18% of Vietnamese stakeholders explained that there might be some general hesitation towards mobile learning as workers might be resistant to changing their learning behaviors to a digitally-based system. Additionally, delivering an entire course on a mobile device requires a smartphone to display videos and use advanced learning features. With the rise of smartphone ownership in the country, delivering a full curriculum for health professionals to view on their own device is feasible, but offering multiple learning opportunities for accessing CME will be important.

Addressing learner motivations was mentioned by 33% of global and 18% of Vietnamese stakeholders as critical to spur clinicians to adopt mobile learning for CME. Several types of motivations were mentioned during interviews. Ensuring that topics are relevant to learners' needs was mentioned by 17% of global and 41% of Vietnamese stakeholders. Additionally, 17% of global experts and 23% of Vietnamese experts stated that official approval of mobile learning CME would motivate learners to access such CME content.

One global expert suggested that combining educational and entertainment content has been shown to improve learner adoption. Since CME is a requirement for licensure now in Vietnam, this puts regulatory pressure on the health worker to complete credits. Two global experts suggested revising job descriptions to tie participation in CME to performance appraisals and job promotion.

Having content available on a mobile device allows flexibility for the health worker to learn anywhere, at any time. Ten percent of global experts and 18% of local experts noted that the expenses of traveling, accommodation, and food to participate in in-person training is a barrier to rolling out in-person CME widely throughout the country. Participants in the FGDs supported this claim. Interviewees described mobile learning as a good option to reach clinicians with a mechanism to earn credits on their own time and at their own pace. However, one global and one local interviewee did note that health workers can often change phone numbers or SIM cards, which could pose a problem for reaching learners and monitoring their use of mobile content.

Understanding learner preferences by worker cadre, age, and location can provide insight into which groups are best to target with mobile learning solutions. Twenty percent of global and 27% of Vietnamese interviewees stated that mobile learning options might be more attractive to young, lower level cadres who might not have access to computers. Three Vietnamese interviewees mentioned that targeting rural based clinicians with

mobile learning options will help to overcome distance and travel barriers associated with attending in-person CME courses.

Sub-Domain 6.2 Clinician preferences

Each cadre of health worker has a variety of learning needs. They also vary by income level, with nurses, midwives, and physician assistants earning less than doctors. These variations can impact the types of devices that clinicians own, how much money they spend on data and voice plans, and their willingness to use their own mobile device for learning. The preferences related to each cadre of health worker are presented below.

Physician Preferences

None of the physicians in the FGDs had ever taken an eLearning course, but all had heard of such courses. Additionally, none had ever used mobiles for learning, though, the physicians revealed interest in mobile learning and emphasized that mobile devices would be more convenient if wi-fi were available. During FGDs, physicians mentioned they might be willing to pay for mobile CME access if fees were modest (McNabb Interviews 2015). However, all cadres noted that using mobile learning approaches was best suited for knowledge transfer and that in-service training should focus more on acquiring clinical skills (McNabb Interviews 2015). They indicated that mLearning topics should be more general and focus on preventative medicine, since their specialties require more focused technical content (McNabb Interviews 2015). Additionally, they felt that

ensuring interaction and connections with teachers and peers would be essential for effective mobile learning (McNabb Interviews 2015).

All physicians felt that mobile learning should not replace traditional in-person trainings, particularly for clinical skills training, and that mobile learning might be better suited for younger physicians (McNabb Interviews 2015). However, using SMS to send updates or knowledge focused CME would be acceptable and welcomed. Participants also noted the usefulness of using social media or linking mobile learning to eLearning courses (McNabb Interviews 2015).

Nurse Preferences

Similar to the physicians, some nurses had heard of eLearning but none of them had ever completed an eLearning course, as many do not have personal computers or Internet connections at home (McNabb Interviews 2015). Most nurses reported being interested in mobile learning and suggested topics should be general, encompass preventative medicine, be knowledge focused and be relevant to their learning needs. Overall, nurses, similar to physicians, suggested the need for more interactivity with mobile learning and noted that incorporating more videos and other media would make mobile learning more interesting (McNabb Interviews 2015). Like doctors, nurses claimed that older workers might not be as keen to learn via mobile devices. Additionally, not all nurses had phones or smartphones, so a variety of CME options should be considered for this cadre (McNabb Interviews 2015). Despite recognizing that not all groups would make

appropriate target audiences for mobile learning, nurses generally preferred distance-based learning due to its greater convenience – they would not have to leave their homes and would have greater flexibility to learn on their own time (McNabb Interviews 2015).

Physician Assistant Preferences

Physician assistants who participated in the FGDs were all part of the mCME RCT research study described above. Overall they liked receiving information via SMS and usually worked together to find the correct answers. Additionally, they liked the flexibility of the timing to learn on mobile because they were usually tired at night and did not have access to Internet or computers at home (McNabb Interviews 2015). Similar to other cadres, they all agreed that mobile learning might be better suited for knowledge focused learning objectives and should be coupled with in-person trainings for clinical skills development. All preferred more interactive mobile learning approaches and felt it might not be a good approach for older learners (McNabb Interviews 2015). They cautioned about implementing mobile learning in mountainous areas that lack strong 3G coverage (McNabb Interviews 2015).

Domain 7: Faculty Development

This domain covers the needs related to building local faculty capacity to design and deliver mobile learning solutions. In Vietnam, work has been done to build the capacity of faculty to design and deliver eLearning courses. Interviewees emphasized the general lack of eLearning faculty capacity, with 32% of Vietnam and 27% of global experts

recommending further efforts to train faculty to design and deliver eLearning courses. Additionally 50% of Vietnamese experts claimed that faculty lack interest and time, as well as the IT knowledge to learn new online and mobile teaching methodologies. However, many experts mentioned that younger faculty are often more keen to adopt new teaching approaches. Incorporating some specific considerations within those initiatives can help educators in Vietnam begin to incorporate mobile tools.

Some universities have experience offering more interactive eLearning courses in Vietnam that also use media such as videos or blogs. Seventeen percent of global interviewees mentioned the importance of using different audio/visual teaching tools, including instructional videos for skills and knowledge building. However, developing locally appropriate videos and content remains a challenge in academic settings. When asked about developing eLearning courses that follow evidence based best practices, one university interviewee noted that while the faculty had been trained to develop educational videos, a notable challenge was that video equipment was outdated and hence inadequate; some instructors were also shy to record videos.

Lack of remuneration for faculty time spent developing CME, eLearning, or mLearning content was mentioned as a barrier to developing high quality CME courses. Two Vietnamese academics mentioned it was a challenge to design eLearning courses in their universities because of the amount of time it takes to learn eLearning pedagogy and to develop courses. A lack of budget at the university and national levels to pay faculty was

mentioned by three interviewees; one suggested that universities institute a policy allowing faculty to be reimbursed for their time. CME and medical education often requires utilizing content and learning resources that are protected and licensed, oftentimes with a high use fee. Thirteen percent of global and 9% of Vietnamese interviewees mentioned the need to also ensure that intellectual property laws are in place to protect videos and other content developed by faculty.

Axis 3 Recommendations

1. Review all digital materials available in country and abroad to strategically plan adapting eLearning and digital content for CME in Vietnam. Conducting a thorough review of all digital materials developed in Vietnam and internationally available free CME resources can support the MOH as it maps the content to be developed for mobile learning through Moodle and a mobile application to reach more learners.
2. Consider adapting globally-reviewed and appropriate online, open-source CME content to the local context. There are several online resources at a global level that have clinically-reviewed and openly available content for clinical education. One such example is Orb, which, houses educational content to train health workers. Reviewing and adapting these resources can save faculty time to develop new content and offer and opportunity to offer nation-wide CME courses to reach more learners.

3. Consider using mobile learning applications that can integrate with Moodle eLearning platform for nationally scalable approach. Since the national eLearning network has chosen Moodle, it will be cost effective and nationally scalable to select mobile technologies that can be integrated into this eLearning platform. Mobile apps such as Oppia mobile can connect with Moodle as well as to other mobile technologies and platforms such as SMS and iHRIS to develop one central resource for eLearning and CME content.
4. Integrate key considerations for developing mobile learning CME courses, with national guidance on accrediting eLearning CME courses and faculty capacity building plans. Developing guidance on key considerations for adapting content for viewing on mobile devices is feasible. Many resources are also available internationally that can be adapted to local contexts. Integrating this guidance into the eLearning network and capacity plans can be cost-effective and potentially reach more users.
5. Explore using other mobile technologies such as SMS, gamification, adaptive learning, peer-to-peer learning, virtual simulations, and social media as ways to improve the delivery of mobile learning and eLearning courses. These interactive tools and approaches were identified as novel and innovative distance-learning methodologies that can be used for CME delivery. Including these approaches can bolster the quality of teaching methods and promote interaction to reach learning objectives.

6. Develop strategies to introduce mobile technologies for CME that are age, geographic and cadre-specific. Mobile phone ownership is high in Vietnam and among clinicians. However, smartphone ownership differs among those in urban and rural settings and between health cadres. People under the age of 35 are the fastest adopters of Internet and mobile phones, including smartphones, in the country. Physicians might benefit from smartphone mobile learning applications as they have higher smartphone ownership compared to nurses or physician assistants. A thorough assessment of the different demographic groups can help frame strategic use cases for mobile learning for CME.

7. Ensure a mix of CME offerings from in-person to computer-based and mobile-based are available in country. There is no "one size fits all" approach to delivering CME that will meet all levels of clinicians in need of credits. Designing a plan that addresses the learning needs and access to technology resources by worker cadre and urban and rural can help target specific groups. Younger, more urban, and higher income? clinicians might have more access to technology and interest in learning via mobile devices. Consideration of smartphone ownership among clinicians will also be helpful to determine which types of mobile technologies might support their unique learning needs.
8. Review motivations and incentives, including intellectual property, for faculty to develop eLearning and mobile learning CME courses. Results from interviews indicate that many university faculty members were not motivated to learn new teaching methods and adopt eLearning teaching practices from the national

eLearning network experience. Developing financial incentives, policies, and requirements for faculty to develop CME and eLearning courses can motivate faculty.

Axis 4: Financial Health

This axis describes: "the projection of scale-up costs, and the development of a financial plan for securing and managing funds over the long term" (World Health Organization 2015). The axis has two domains: 1) financial management and 2) financial model. The table below describes the domains and sub-themes.

Axis 4: Financial Health
Domain 8: Financial Management 8.1 Program cost 8.2 End user cost 8.3 Health system cost 8.4 Forecasting
Domain 9: Financial Model 9.1 Business plan

Domain 8: Financial Management

This domain refers to understanding the costs of operating a technology solution and the forecasting future costs, and cost-savings, as a result of the intervention. There are 4 sub-themes identified: 1) program cost; 2) end user cost; 3) health system cost and 4) forecasting.

Sub-Domain 8.1 Program Cost

In terms of program costs, it is important to consider recurring fixed costs, variable costs, and capital costs necessary to implement mobile learning solutions. Some costs for introducing mobile technologies can be absorbed within the national eLearning program. However, a lack of funding available for the national CME program was reported by 53% of global and 56% of Vietnam interviewees.

Despite the national policies stating that the state would pay for CME, at the time of writing, the MOH had no budget in the coming year to support eLearning or general CME course development. Additionally, MOH interviewees explained that legislative documents need revision to stipulate where funding will come from in the future. There is an opportunity now, however, as the new World Bank project is being planned, for the MOH and other stakeholders to consider the potential addition of mobile technologies. While eLearning—and potentially mobile learning options—are more cost-effective than in-person trainings, the resources required to deliver eLearning options might have significant upfront costs.

One interviewee from a global non-profit claimed that in Nigeria, a mix of classroom, feature phone, and tablet blended learning training saved 42% compared to the cost of a classroom only model. One global interviewee also stated that using a blended learning approach for training community health workers, mixing eLearning with traditional didactic training, can provide a total cost savings of 42% and scaling the model to one

million community health workers would further reduce the total costs by 25%. Cost-savings were primarily due to decreased classroom time and thus reduced costs of travel, trainers, and renting classrooms. Overall, using a blended eLearning approach for community health worker training at a large scale reduced costs as much as 67% (Sissine et al. 2014).

Some key cost categories to consider include:

- Human resources including content experts, IT support staff and eLearning and mobile learning instructional design experts
- Mobile LMS or other software applications license and support fees
- Helpdesk for learners and educators
- IT servers to store applications and data
- Mobile devices (if provided by MOH or universities to students)
- SMS, mobile data and voice and short code fees

Sub-Domain 8.2 End User Costs

The cost to the end user can refer to technology costs (mobile device, airtime, SMS fees, etc.) in addition to the non-technology costs (course fees, value of time saved by learning through mobile devices, cost of materials and travel, etc.). Currently, the financial models for developing and delivering CME in Vietnam are varied. Some CME courses are offered at a fee to the students while other models in country are donor funded or government funded. Historically, in-person training comes with financial incentives, including per-diem for health workers to participate, and one Vietnam implementing

partner mentioned this might be a challenge when introducing mobile learning. If course fees are applied for clinicians to access content, thirteen percent of global experts suggested instituting tiered pricing based on health worker cadre to ensure affordability for clinicians at different pay grades.

However, 13% of global and 9% of Vietnam interviewees stated their belief that users being willing to pay for CME credits even at high cost if the content was interesting, high quality, and relevant to their work. There is no typical course fee, but local interviewees said that CME course fees can range from $20–100 USD per course. Three Vietnamese interviewees explained that they had participated in CME courses paid for directly by a donor or an NGO, and two described CME experiences in which the health worker had to pay some aspect of the fee, hotel, or meals while away from home. One interviewee mentioned that private sector providers often pay for their clinicians to receive CME, while usually public sector employees are sponsored to attend CME courses by the government (McNabb Interview 2015m).

During FGDs, all cadres of health workers described being sponsored to attend in-service trainings, as well as self-paying to attend trainings. Among physicians, participants said they were sponsored to attend specialty trainings according to their expertise by the province or through partner sponsorship. All physicians explained that they would be willing to pay to attend CME courses if they were mandatory and the course fee was less than 10 million Vietnamese Dong (approximately US$ 450). However, they cautioned

that more junior or newer graduates might not be willing to pay because of their lower salaries (McNabb Interviews 2015).

Nurses explained that they tended to be assigned to workshops by supervisors, with financial support for attendance. Some nurses described having to pay for course fees and travel costs for the training they chose to attend. Nurses said they would be willing to pay for CME courses on a mobile device, but only if it was mandated. Similar to the physicians, nurses believed newer graduates might have a harder time paying due to lower salaries (McNabb Interviews 2015).

Physician assistants said they are also typically sponsored financially to attend courses and that they were less likely to be able or willing to pay for their own courses due to low salaries. If they were mandated to attend, they were only willing to pay 10–20 thousand VND (approximately US $450-900) (McNabb Interviews 2015). Three global interviewees pointed to a project in India where community-level workers paid for learning content via mobile phones as a successful way to recoup some upfront development costs.

Sub-Domain 8.3: Health System Costs

The need to have accurate understanding of the costs and cost savings to the health system by introducing mobile learning was mentioned by 23% of global and 5% of local interviewees. Many interviewees also explained that in rural areas, there is often only one

clinician staffing a health facility. If required to travel, their absence could impact staffing at the health centers.

Sub-Domain 8.4 Forecasting

This theme refers to forecasting the costs and cost savings of investing in a technology for learning over time as a value proposition for scale and sustainability. This economic analysis could include developing a total cost of ownership model to predict future costs and cost savings. International experts pointed to many resources available for conducting these economic analyses.

1. Dimagi total cost of ownership model for decision support applications (https://confluence.dimagi.com/display/commcarepublic/Budgeting+for+a+Project)
2. mNutrition financial forecast model for SMS, IVR and USSD technology solutions developed by GSMA and Palladium (http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2015/09/GSMA-mHealth-Market-Report-Mozambique.pdf)
3. mHealth Solutions – What's the Cost? mPowering Frontline Workers meeting report June, 2014 (http://mpoweringhealth.org/wp-content/uploads/2015/05/141161218238894.pdf)
4. Costing mHealth strategies in maternal and child health (http://www.gfmer.ch/mhealth/coursefiles2013/Youngji-Jo-costing.pdf)

As mentioned, the only experience using mobile learning for CME in Vietnam is the BUSPH and Pathfinder International-supported clinical trial. Investigators are currently finalizing the data analysis from the trial and this will include a cost documentation component, though it is already clear that the upfront development costs were much higher than the costs of implementing the SMS-based learning intervention (Gill 2016). This information will be important for the government, but is limited to designing and implementing an SMS-based intervention. The documents above also outline cost components and elements necessary for other types of mobile learning interventions that can be used to plan for CME in Vietnam. Careful analysis of the mCME costing results compared with other mobile learning and eLearning costing scenarios can support thoughtful budgeting and planning of interventions.

Domain 9: Financial Model

This domain relates to developing financial models that help estimate the cost of investing in mobile technologies and of developing business models that can ensure the sustainability of funding over time. There are two sub-themes in this domain: 1) business plan, and 2) sustainability of funding.

Sub-Domain 9.1 Business Plan

Developing business models to ensure that mLearning can be introduced and sustained over time is an important undertaking in the design phase. Fifty percent of global interviewees stated that having a sound business model that takes advantage of user

willingness to pay, government funding and private sector potential funders is important for the design of any mobile learning project. Several models for covering costs were reported by global interviewees. Models suggested include:

1. Donor-funded
2. Government-funded
3. Public private partnership models

In Vietnam, interviewees indicated that the Asian Development Bank and the World Bank are the key groups interested in supporting the health workforce and roll out of CME and eLearning. All global donors interviewed stated that mobile learning for CME is not a global funding priority for many donors, including USAID and the Gates Foundation. However, at the time of writing, these donors have little presence in Vietnam. Donors might be best suited to provide the up-front capital necessary to develop infrastructure and workforce training, while long-term funding strategies are developed.

In terms of government-funded models, Vietnam stakeholders highlighted a lack of government resources for CME at both the national and provincial levels. However, as mentioned, the MOH now has an opportunity through the World Bank loan to invest in innovating and testing mobile learning solutions over the next five years.

Exploring public private partnership models was noted by 50% of global and 29% of Vietnamese interviewees. The use of mobile technology for learning requires investing in

mobile devices and data services, two highly profitable private sector areas. Many global interviewees did mention private sector companies, including mobile operators, which might have an interest in investing in solutions, if there appears to be a real financial return on the investment. Some examples of situations in which mobile operators would be willing to contribute resources were:

1. In exchange for customer loyalty. Mobile operators might "donate" free airtime or SMS or can leverage corporate social responsibility funds to support mLearning.
2. In situations where the program used the mobile operator proprietary mobile applications platforms. Some mobile operators have their own mobile applications or platforms that they want to promote. Utilizing these would add value to the mobile operator and provide low cost sustainable access to mobile technologies for learning.

Globally, pharmaceutical companies are the leading provider of CME courses and can be a good source of funding for CME course development. However, a number of global experts expressed concern that substantial conflicts of interest can arise from partnerships with pharmaceutical companies who may try to market their medications and other clinical practices inappropriately. Other private sector stakeholders mentioned were international CME and research clearinghouses that might be willing to offer discounted access to licensed or copyrighted medical education content to the MOH. Global experts noted that there are a few models in Kenya and India where private sector hospitals buy licenses to content, viewing this as a cost of routine business.

The cost of buying smartphones for an entire health workforce may not feasible for Vietnam. One global expert pointed to examples where the MOH or professional associations work with the Ministry of Finance and mobile device manufacturers to obtain discounts on bulk procurement of devices, and then subsidize health workers to purchase them through their monthly salary. Other suggestions included negotiating lower tax rates for mobile network operators in exchange for reduced costs or free support for the national CME program.

Many global interviewees reported that, globally, CME courses are often offered for free for users while others are tied to user fees. It is commonplace in many countries for clinicians to pay out of pocket to maintain their CME compliance status. Health workers in Vietnam revealed a high willingness to pay for CME (reported earlier in this chapter), particularly if they are mandated to do so, and if the CME course is interesting and the content is relevant. Integrating user-fees can also help to recoup the costs for the faculty to develop CME courses, a major deterrent for faculty noted during interviews.

Axis 4 Recommendations

1. Define strategies for using mobile technologies for CME and develop costing models. Globally, eLearning and mobile learning options have been found to be more cost-effective than in-person trainings. The mCME RCT conducted in Vietnam will produce a costing analysis in early 2016. Reviewing these findings and comparing with other costing tools can help the MOH plan for integrating

mobile approaches. This will also help the MOH plan for the new World Bank project activities and budgets.

2. Approach the World Bank and other donors in Vietnam that might have interest in supporting CME and eLearning in the country to assess interest in including mobile technologies. Leveraging the recent World Bank loan to the government of over US$100 million to augment approaches to distance-based CME with mobile technologies is feasible. Other donors with a track record of funding innovations in clinical education might also be interested.
3. Develop a detailed business model for the next five years to ensure sustainable funding for mobile learning for CME. Convening a group of Vietnamese government, donor, university staff, and other key stakeholders to discuss and review potential business models at the start of planning can identify potential revenue streams that can be designed and tested through the World Bank project. Engaging mobile operators and other key private sector partners early on in the planning process can help to identify possible discounts or other in-kind support for introducing mobile technologies for CME.

Axis 5: Technology

This axis refers to: "steps taken to optimize the mHealth product for scaling up based on its anticipated user base, purpose, integration with information systems, and compatibility with other components of the information systems architecture" (World Health

Organization 2015). This axis has two domains: 1) data, and 2) interoperability. The table below describes these domains and sub-domains.

Axis 5: Technology
Domain 10: Data 10.1 Data access and security 10.2 Data transmission and storage
Domain 11: Interoperability 11.1 Systems integration 11.2 Data standards

Domain 10: Data

This domain refers to ensuring that the data access, transmission, storage, and security measures are all accounted for when designing and scaling mHealth solutions.

Sub-Domain 10.1 Data access and Security

Large quantities of data can be collected by introducing mobile tools for CME. Data related to worker performance or compliance with CME requirements as well as data on how health workers interact with mobile tools (including time of day accessed, how many times accessed a video, etc.) can be collected. Global interviewees suggested many tools (mentioned earlier in the framework) for capturing these data and developing metrics and dashboards that can be developed to track CME.

Data privacy concerns were mentioned by one government stakeholder in Vietnam. Ensuring that data are only accessible by the right stakeholders is an important aspect of a mobile or eLearning program. Four global experts suggested developing security, privacy, and confidentiality guidelines regarding access to various data and protection of health workers' privacy. The Vietnam master plan for eHealth from 2011–2015 lays out a plan for a national data integration center as well as systems to be in place for complying with information privacy and protection laws (Vietnam Ministry of Health 2012). Additionally, the MOH strategic plan for health information systems calls for data protection and privacy laws, but this legislation on data protection is still in development, and there are no clear mechanisms for enforcement (World Health Organization 2012). Ensuring that this legislation also covers mobile specific considerations and privacy concerns is recommended.

Sub-Domain 10.2 Data transmission and storage

This refers to the need to ensure adequate bandwidth for transmitting and receiving data as well as enough server storage space to handle a nationally-implemented mobile learning solution. When introducing mobile learning and expanding eLearning, IT departments at the universities and the MOH should plan for increased usage and server storage needs. Additionally, guidelines for how data is stored and transmitted will be important to develop.

Domain 11: Interoperability

Interoperability of information systems refers to the ability of systems to freely exchange sets of data in an error-free manner with limited or no human interaction (Ministry of Health 2012). During interviews with global experts, 20% (n=6) stressed the need for any mLearning software or health worker registry to be designed in such a way that it is interoperable with other national information systems.

Sub-Domain 11.1: Systems Integration

As mentioned previously, the government is piloting the use of DHIS2 for the national health management information system. Additionally, Moodle was chosen as the national eLearning software platform to design and deliver eLearning courses. Both of these technologies are open source platforms, which means the "instructions" for pushing and pulling data and information between systems is publicly available. Interviewees also mentioned integrating mLearning solutions into electronic medical records to support adaptive learning and use of clinical data to structure learning needs based on client health profiles. Integrating these platforms can allow the MOH to easily report on CME indicators and link CME outputs to improvement in health outcomes or worker performance.

Sub-Domain 11.2 Data Standards

In 2007, the government issued a decision (number 64/2007/ND-CP) regarding IT applications in government organizations and called for them to set up information and

data in digital form, and to maintain standard criteria for managing and processing data. However, as of the date of writing, no such standards existed and there is no national eHealth strategy or architecture that defines standards for health data exchange in Vietnam, nor is there a national mechanism for governance or coordination of eHealth interventions. One representative of the MOH, however, stated that the government is currently in the process of defining an overall eHealth architecture that will provide guidance on setting up information systems and data exchange for health IT applications.

Additionally, as reported earlier, the WHO advocates for countries to adopt standard health workforce registry data standards when designing human resources for health tracking systems. The MOH can also consider working with the open health informatics exchange (OpenHIE) to access internationally suggested data standards that can be adopted. More information can be found here: https://ohie.org/.

Axis 5 Summary and Recommendations

1. Advocate for the fast tracking of an eHealth architecture and interoperability standards. At the time of writing, the national eHealth architecture was developed and approved. The MOH was developing a national health management information system database and CME registration and tracking database. National policies are supportive of eHealth and eLearning. Developing data standards and designing national eHealth architecture can facilitate interoperability of information systems including mobile software applications.

2. Establish data privacy protocols for accessing human resources and CME data. Developing a data access and privacy plan that is in line with national level policies will establish privacy standards and data access protocols.
3. Forecast additional data storage and server needs at universities prior to implementing mobile technology solutions. Introducing mobile technologies into existing eLearning plans and systems will require more data storage as more users will be accessing the system. This applies to universities that host and run eLearning courses as well as the MOH, which plans to store all clinician CME compliance data and to document all CME eLearning courses developed.
4. Choose mobile applications, platforms, and databases that are open source and can easily integrate connect to other national systems. Mobile applications or technologies that have already been demonstrated to integrate with Moodle, DHIS2, or iHRIS (if chosen) can reduce information system silos and improve efficiency of the national program.

Axis 6: Monitoring and Evaluation

This axis refers to "the decisions and activities that enable effective process monitoring and in-depth outcome evaluation based on project and stakeholder needs" (World Health Organization 2015). This axis has no sub-domains; it covers general recommendations for effective monitoring and evaluation.

There is a need to establish regular monitoring mechanisms for any mobile learning intervention to ensure that it is going on the right track. Careful consideration of how this

will link with the overall monitoring of the national CME program and roll out of eLearning will be important. While the evidence is still nascent in terms of mobile learning for CME globally and in Vietnam, pilot implementations should be designed with evaluation research in mind. Securing funding and research partners, such as local research firms, universities, or international institutions that are already involved in research in the country, including BUSPH, can be supportive to the national program.

Axis 6 Recommendations

1. Monitoring the implementation of a mobile learning solution for CME can be integrated into eLearning monitoring structures. If mobile learning tools are selected in country, integrating key process monitoring indicators into eLearning monitoring plans can save resources.
2. Designing evaluation research will have a major impact on understanding the values and costs savings for mobile CME in Vietnam and globally. The HIV sub-study of the mCME RCT currently underway will provide insights into how SMS can be used to link clinicians to more robust eLearning resources for CME. As the field is relatively new globally, there is room to design further evaluations of mobile applications within the national CME program.

CHAPTER EIGHT: CONCLUSION AND RECOMMENDATIONS

Overall, the research aims of this dissertation were to:

1. Determine clinician-level (physician, nurses, midwives and physician assistant) practices related to accessing CME credits, needs related to accessing CME, and preferences for how mobile technologies can be used to support CME credit acquisition;
2. Identify appropriate "use cases" where mobile technology can deliver or reinforce CME content delivery in Vietnam based on local and international best practices, an enabling environment, and possibilities for public-private partnerships; and
3. Provide policy and implementation recommendations for introducing the identified use cases within the national CME program by populating a programmatic framework based on international best practices.

A review of the peer-reviewed literature, FGDs with Vietnamese clinicians, and key informant interviews with global and Vietnamese experts were methods used in this dissertation. Key summary findings and final recommendations for each of the research aims are found the section below.

Research Aim 1 Conclusions

1. Determine clinician-level (physician, nurses, midwives and physician assistant) practices related to accessing CME credits, needs related to accessing CME, and

preferences for how mobile technologies can be used to support CME credit acquisition.

Overall, there is a general lack of awareness among clinicians about the new CME and licensure requirements. Through FGDs, doctors relayed having heard about the regulations, but nurses, midwives, and physician assistants lacked such awareness. The availability of CME courses varies widely by university and province, and the uptake of CME courses still remains low in the country. The national accreditation of CME courses remains to be finalized to assign hours for CME courses. Clinicians explained that if they are required to pay for CME credits to maintain licensure they would be willing to do so for a small fee. There was greater interest to pay if CME options could reduce incurring travelling costs. Many clinicians had heard of and were interested in eLearning courses, but none had participated in such courses. All clinicians were interested in trying mobile learning, yet believed that these options might be more relevant to younger clinicians generally.

Importantly, not all clinicians owned smartphones; smartphone ownership was highest among physicians. Some nurses and physician assistants owned smartphones, but most, particularly older workers, had simple basic feature phones. All clinicians preferred a high degree of interactivity if mobile learning was to be introduced, and most felt that it should still be combined with other eLearning or in-person training. Integrating more engaging teaching methodologies into mobile CME courses, such as gaming and social

media, will be a good option to explore with the rising gaming and social media culture in Vietnam.

Overall it appears that mobile learning options would be **acceptable** by health workers in Vietnam. However, smartphone ownership among clinicians is not widespread. Therefore, smartphone-based mobile learning applications should be designed for physicians, who are more likely to own smartphones. Nurses and physician assistants can benefit from SMS based mobile learning activities. Since smartphone ownership is rapidly increasing in Vietnam, it is reasonable to expect that lower-level healthcare workers in Vietnam might have access to these devices within the next five years.

The BUSPH and Pathfinder Vietnam-led RCT evaluating the use of SMS for CME found no improvement in knowledge as a result of the intervention. Key lessons included the need to link SMS content to more comprehensive eLearning courses. This is supported by global and local interviewees who recommend using mobile technologies to extend the reach of eLearning courses. The following are recommendations for moving forward for this research aim:

1. Design strategies and activities to increase awareness of licensure and CME requirements in Vietnam. Suggested activities include: working through professional associations to advertise the requirements, send alerts to clinicians about the requirements through SMS, etc.

2. Pilot test use of SMS and mobile applications for learning among various levels of healthcare workers, including urban and rural, and younger and older providers. Pilot testing these approaches can contribute to the evidence base and provide information on the best way to deliver content that can be scaled nationally.

Research Aim 2 Conclusions

2. Identify appropriate "use cases" where mobile technology can deliver or reinforce CME content delivery in Vietnam based on local and international best practices, an enabling environment, and possibilities for public-private partnerships.

Through expert interviews, three main use cases for integrating mobile technology for the national CME program operations and content delivery were generated. Use cases included: 1) delivering curricula via mobile devices (65%, n=34); 2) sending CME alerts and reminders for clinicians (54%, n=28); and 3) supporting registration and tracking of clinician compliance to CME requirements (44%, n=23). Each use case has its own unique advantages and disadvantages and can all be implemented independently or as a combined and coordinated set of use cases that can work to strengthen the overall delivery and management of the national CME program. The following general recommendations apply to all use cases:

1. Engage the MOH to review all use cases and prioritize implementation of any approach.

2. Engage mobile network operators and other local private sector partners early in the planning process and integrate within the national eLearning network.
3. Select 1-2 universities with existing eLearning infrastructure and experience to pilot test use cases. Hanoi Medical School and Hue University are plausible candidates for pilot testing mobile tools within eLearning course design and delivery.

Use Case 1: Delivering Content through Mobile Technologies

Several universities have adequate infrastructure to develop and deliver eLearning courses for CME credits. Augmenting the eLearning network and infrastructure to adding additional mobile functionality is **feasible** to pilot test within universities with strong infrastructure, such as Hanoi Medical School and Hue University. Recommended next steps include:

1. Introduce the results and options for using mobile learning into the eLearning network and plans.
2. Incorporate final recommendations listed in Axis 4: mCME content and design found in the table below.
3. Consider cataloging all eLearning courses already developed in country at the national level and allow all provinces to access these courses. Review potential courses that can be adapted for mobile learning.

Use case #2: Sending CME alerts and reminders for clinicians

Clinicians are generally unaware of CME requirements and courses that might potentially

be available for them to gain credits. SMS can easily be integrated to reach clinicians remotely and efficiently. The mCME RCT found that using SMS to reach clinicians is feasible and acceptable by health workers. Therefore it is **feasible** to integrate this use case within the national program and would be **acceptable** to clinicians. Recommended next steps include:

1. Explore associations and other professional bodies that might have active lists of health workers in the country and their phone numbers;
2. Consider a national level system that provinces and universities can access and use in order to reduce costs and promote national oversight of clinician compliance;
3. Conduct a design workshop with key stakeholders to develop a roadmap and plan for how this can be designed as well as costing implications.

Use case #3: Supporting registration and tracking of clinician compliance to CME requirements.

Guidance for accrediting CME courses with hours is underway. A national level database to register and track clinicians, where provinces can also access and report province-level clinician compliance, is still under development. Adopting a database and software platform such as iHRIS can integrate with Moodle and other mobile technologies in order to streamline investments and promote interoperability. SMS and other mobile applications can be used for teachers to report clinician completion of courses, allow clinicians to check their own compliance and remaining credits, as well as allow the public to see whether a clinician has been licensed or not. Findings from this research

indicate that this is a solution that could address a large gap in the CME program, clinicians would be interested in this opportunity, it is **feasible** to implement with feature phones reaching all clinicians, and this could reduce costs by automating tracking, removing a potentially cumbersome paper-based solution. Recommended next steps include:

1. Review the current state of the national database for registration and tracking. Consider adopting iHRIS at the national level.
2. Conduct a design workshop with key stakeholders to review options and prioritize strategies to potentially pilot test.

Research Aim 3 Conclusions

3. Provide policy and implementation recommendations for introducing the identified use cases within the national CME program by populating an international framework based on international best practices.

The final aim of this dissertation is to provide guidance to the MOH detailing the requirements, strategy, enabling environment, and governance and leadership structures necessary to introduce mobile tools to support the overall national CME strategy. These considerations were mapped using a program design framework. The summary findings are found in the table below with the final key recommendations for moving forward.

Axis	Key Recommendations
1. Groundwork	1. Revise and enforce policies related to CME to facilitate course development. 2. Raise clinician awareness of the LET and licensure requirements. 3. Finalize CME certification criteria, including eLearning CME. 4. Design strategies and policies to support faculty to develop CME and eLearning courses. 5. Introduce mobile technologies within the current eLearning network and leverage IT infrastructure in place. 6. Review results from the mCME trial to assess mobile CME efficacy in Vietnam. 7. Develop a research and implementation agenda that highlights evidence-generation.
Partnerships	1. Present the findings of this research to the MOH and chairs of national eLearning network to define next steps. 2. Engage the Ministry of Information and Communications when considering adopting mobile technologies. 3. Engage other private sector companies and mobile operators in the national level planning and implementation structures. 4. Develop strategies to embed mobile technology partners into the eLearning network leadership and stakeholder groups, and include approaches for ensuring partnership sustainability. 5. Identify champions in the MOH, province health departments and universities to support introducing mobile technologies.

Axis	Key Recommendations
Mobile CME considerations	1. Review all digital materials available in country and abroad to strategically plan adapting eLearning and digital content for CME in Vietnam. 2. Consider adapting globally-reviewed and appropriate online, open-source CME content to the local context. 3. Consider using mobile learning applications that can integrate with Moodle eLearning platform for nationally scalable approach. 4. Integrate key considerations for developing mobile learning CME courses, with national guidance on accrediting eLearning CME courses and faculty capacity building plans. 5. Explore using other mobile technologies such as SMS, gamification, adaptive learning, peer-to-peer learning, virtual simulations, and social media as ways to improve the delivery of mobile learning and eLearning courses. 6. Develop strategies to introduce mobile technologies for CME that are age, geographic and cadre-specific. 7. Ensure a mix of CME offerings from in-person to computer-based and mobile-based are available in country. 8. Review motivations and incentives, including intellectual property, for faculty to develop eLearning and mobile learning CME courses.
Financial Health	1. Define strategies for using mobile technologies for CME and develop costing models. 2. Approach the World Bank and other donors in Vietnam that might

Axis	Key Recommendations
	have interest in supporting CME and eLearning in the country to assess interest in including mobile technologies. 3. Develop a detailed business model for the next five years to ensure sustainable funding for mobile learning for CME.
Technology	1. Advocate for the fast tracking of an eHealth architecture and interoperability standards. 2. Establish data privacy protocols for accessing human resources and CME data. 3. Forecast additional data storage and server needs at universities prior to implementing mobile technology solutions. 4. Choose mobile applications, platforms, and databases that are open source and can easily integrate connect to other national systems.
Monitoring and Evaluation	1. Monitoring the implementation of a mobile learning solution for CME can be integrated into eLearning monitoring structures. 2. Designing evaluation research will have a major impact on understanding the values and costs savings for mobile CME in Vietnam and globally.

In conclusion, all three use cases for how mobile technologies can support the national CME program are: 1) **feasible** to implement in universities with strong eLearning infrastructure and at the MOH, which has a strong IT department and experience developing SMS solutions and 2) **acceptable** to clinicians. The mCME RCT found that using SMS to deliver content did not have a positive impact on knowledge outcomes.

However, the HIV sub-study that will be conducted will further link SMS based interventions to eLearning courses, which represents a **promising approach** that can be explored in Vietnam. Developing robust mobile applications that can deliver full CME courses through a smartphone or tablet **is recommended** to reach clinicians that may not have access to a computer and internet connection. Funding is potentially available to implement mobile technologies for CME delivery or program administration. Introducing these tools can produce **cost-savings**, while reaching more clinicians than eLearning or in-person courses can do alone. There is **interest** at the national and university-levels to explore options. Pilot testing different approaches of using mobile technologies for CME, while engaging mobile operators and other private sector partners, will support **evidence-generation** and **refined models** that can be scaled nationally.

APPENDIX

Appendix 1: FGD Guide

Focus Group Discussion Guide in Thai Nguyen Province– mCME Toolkit Research

Purpose: This focus group discussion guide is meant to gather information from healthcare providers in Vietnam about their current practices related to accessing continuing medical education (CME) content, ownership and use of mobile devices as well as preferences for receiving content or interacting with mobile phones related to CME credit acquisition.
Duration of each session: 1.5 hours
Key topics to be covered in the FGDs:

1. Are the participants aware of the national continuing medical education (CME) program and requirement to get CME credits to maintain licensure?
2. Do you know where to get CME credits and your status on how many credits you need to complete for maintaining your license?
3. How do you currently access CME and health education content, what are the major needs and barriers to accessing CME content?
4. Have you ever used computer based training to get health education? (eLearning courses)? Do they ever go to in-person trainings to get CME credits? Which type of training do they prefer (computer based or in-person and why?) *Note, if participants have not done computer training, explain to them what it is and what it be like if they did – i.e. be able to do the course on their own time, would need a computer or device to connect to the internet to access it, would not need to travel, etc)
5. Do they have to pay for CME credits now? Would they be wiling to pay for CME credits? If yes, why and if no, why not. If yes, what is the highest amount that they would be willing to pay?
6. How do the participants typically use their phones (calling, texting, social media, email, internet searches, etc)? What do they use their phone the most for? Work? Personal?
7. How do the participants think the government can use mobile phones to help them get access to CME content? Would having an online course on the phone be useful? Would they use it?
8. How would they prefer to get CME credits? In-person training, eLearning, using their cell phone? Why or why not for each type of educational delivery?
9. What ideas do the participants have about how mobile technology can be used for accessing CME program (probe with: accessing courses, finding out credits, getting registered into the program, contacting other clinicians etc)?
10. Would participants be interested in the following, and why or why not?
    a. CME course actually on their phone to complete
    b. SMS reminders about their CME status and where to access CME credits
    c. Using SMS to receive content on their phones
    d. Being connected to other clinicians via voice?
    e. Other ideas?

Appendix 2: List of Key Informant Interviews

List of Vietnamese Experts Interviewed				
	Name	**Organization**	**Background**	**Type**
1.	Dr. Hac Van Vinh	Thai Nguyen Medical University	Head of International Cooperation Dept	Academic
2.	Prof. Pham Viet Cuong	Hanoi School of Public Health	Head of Injury research center Former head of statistic and Informative Technology Dept	Academic
3.	Mr. Pham Duc Muc	Vietnam Nurse Association	Chairman	Implementer
4.	Mr. Nguyen Thanh Duc	Dept of technology, science and training – Ministry of Health	Officer – focal point of CME (currently)	Government
5.	Ms. Nguyen Thi Hai	Health Dept of Thai Nguyen province	Deputy Director	Government
6.	Mrs. Phi Nguyet Thanh	Dept of technology, science and training – Ministry of Health	Officer – who was focal point of CME previously	Government
7.	Mr. Khuong Anh Tuan	Institute of Health strategy and policy	Vice director	Government
8.	Prof. Nguyen Cong Khan	Dept of technology, science and training – Ministry of Health	Director	Government
9.	Ha Thai Son	Administration of Medical Service Management	Official	Government
10.	Ninh Tran	Vietnam Authority of HIV/AIDS Control	Officer, Training scientific research and International Cooperation	Government
11.	Le Ngoc Anh	Vietnam Authority of HIV/AIDS Control	Head of IT Department	Government
12.	Dr. Nguyen Van hung	Hai Phong Medical University	Head of Public Health Department	Academic
13.	Dr. Ngo Van Huu	Pathfinder Vietnam	Former Program Manager, Medical Education Team	Implementer
14.	Dorothy Leab	Agence de Medicine Preventive (AMP)	Former Country Director	Implementer
15.	Sang Dao	PHYSICIAN ASSISTANTTH Vietnam	Technical Advisor	Implementer
16.	Nguyen Quang Trung	HAIVN	Deputy Director	Implementer
17.	Nhung	HAIVN	Technical Officer	Implementer
18.	Maya	Boston University School of Medicine	Program Officer	Implementer

19.	Kristen Shaw	Boston University School of Medicine	Program Officer	Implementer
20.	Steve Cummings	Boston University School of Medicine	Senior Consultant	Implementer
21.	Robert Kamei	Duke	Principle Investigator	Implementer
22.	Ton Vandervelden	Consultant	Consultant	Implementer
Global Expert Interview List				
No.	**Name**	**Organization**	**Position**	**Type**
1.	Patty Mechael	Health Enabled	Principle Advisor	Multilateral
2.	Kunal Patel	iHeed	Technical Director	Technology
3.	Tom O'Callahan	iHeed	CEO	Technology
4.	Bob Bollinger	Center for Clinical Global Health and Education	Founding Director	Academic
5.	Dykki Settle	Deputy Director, Digital Health Solutions	PHYSICIAN ASSISTANTTH	Implementer
6.	James Bon Tempo	JHUCCP	Director, ICT and Innovations	Implementer
7.	Laura Raney	Jhpiego	Senior Advisor	Implementer
8.	Bobby Jefferson	Futures Group	Senior Advisor	Implementer
9.	Lesley-Anne Long	mPowering Frontline Workers	Director	Multi-Lateral
10.	Jodi Lis	Jhpiego	mLearning Advisor	Implementer
11.	Kate Tulenko	Intrahealth	Expert	Implementer
12.	Carl Leitner	Intrahealth	Director	Implementer
13.	Pam Riley	Abt Associates	Senior mHealth Advisor	Implementer
14.	Amanda Puckett	Intrahealth	Director	Implementer
15.	Aaron Schubert	USAID	Regional HIV/AIDS Lead Asia	Donor
16.	Peggy D'Adamo	USAID	KM/mHealth Advisor	Donor
17.	Tigest Tamrat	WHO	eHealth Program Advisor	Multi-Lateral
18.	Francis Gonzales	UN Foundation	Program Manager	Donor
19.	Alvin Marcello	Asia eHealth Informatics Network	Director	Technology
20.	Tim Woods	Gates Foundation	HRH Lead	Donor
21.	Marc Mitchell	D-Tree/Harvard	CEO/Faculty	Academic
22.	James Wolff	Boston University School of Public Health	Faculty	Academic
23.	Joanne Schaberick	ProPatient	Chief Operating Officer	Technology
24.	Will Green	Director	Tiger Mine Ventures	Technology
25.	Alex Little	Digital Campus	Technical Lead	Technology
26.	Jonathan Jackson	Dimagi	CEO	Technology
27.	Mohini Bhavsar	Dimagi	Program Manager	Technology
28.	Steve Ollis	D-Tree	Deputy Director	Implementer

29.	Karl Brown	Thoughtworks	Chief Technology Officer	Technology
30.	Sharon Kim	One Million CHW Campaign	Project Officer	Implementer

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CURRICULUM VITAE

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SUMMARY

Over 15 years of global public health experience in area of sexual and reproductive health and rights (SRHR), with 8 years living and working in Ethiopia. I am currently the Senior Technical Advisor for mHealth at Pathfinder International leading the design and integration of innovative mobile technology solutions within global SRHR programs. Lead designer and co-Instructor, MPH Course on mHealth in Global Settings at Boston University School of Public Health. Specialties: Technical and program leadership, management, design and evaluation of public health programs. Extensive experience in mHealth, grant writing, HIV/AIDS, Maternal Health, Contraception, TB and STIs; design and implementation of mHealth, eHealth and mobile learning programs in countries in Africa, Asia and the Caribbean. Quantitative and qualitative research experience.

EDUCATION

2010 – 2016 **Boston University School of Public Health;** Boston, MA
Doctorate of Public Health (DrPH) Candidate, International Health;
Dissertation Topic: Introducing mobile technologies to strengthen the national continuing medical education (CME) program in Vietnam.

2004 – 2008 **Johns Hopkins University, Bloomberg School of Public Health;** Baltimore, MD
Masters of Public Health, International Health
Thesis: Follow up of PEPFAR-trained Clinicians to Assess HIV/AIDS Working Status in Ethiopia

2000 – 2003 **St. Louis University;** St. Louis, MO
Bachelor of Arts**,** African/African-American Studies;
Magna Cum Laude, Most Outstanding Student Award
Capstone Project: History of Ethiopian Healthcare and the Evolving Response to HIV/AIDS

1998 – 1999 **Loyola University;** New Orleans, LA
Major: Biology

WORK EXPERIENCE

Senior Technical Advisor, mHealth: Pathfinder International; June 2012- Current

- Technical lead for mHealth related projects providing assistance in the design, implementation and evaluation of technology and health projects in 8 countries in Africa, Caribbean and Asia
- Lead the development of an organizational technical strategy for introducing mHealth in sexual and reproductive health and rights programs globally
- In Haiti, designing nationally scalable complex 10,000 community health worker (FP, maternal health, child health and HIV) home visit and referral system using CommCare as a mobile decision support platform
- Designed and technically advise maternal health, family planning, HIV and child health mHealth applications in Kenya, Nigeria, Tanzania, Mozambique and Haiti; Advised and led design of SMS behavior change projects for family planning in Mozambique and Ethiopia. Co-designed and led implementation of mobile SMS continuing medical education randomized control trial in Vietnam
- Leadership in global mHealth working groups: mPowering Frontline Health Workers, Advisory Board for Global mHealth Working Group

Instructor, Boston University School of Public Health; Boston, MA January 2013 - Current

- Designed and co-teach a 2 credit MPH course on mHealth for MPH students at BUSPH: Using mHealth to improve health outcomes in low and middle income countries.

Independent Consultant; Boston, MA June 2010 – 2012

- Grant writing support for international and Ethiopian organizations
- Editor of Dr. John G. Bartlett's Medical Management of HIV Infection Africa and Kenya Edition, 2012.

DGAP Program Manager, Boston University School of Public Health; CGHD; Sept 2011 – June 2012

- Led the development, design and implementation of a systematic literature review for 7 countries on the burden, programs, policies, and other related information regarding the country status of diarrheal diseases. Oversaw the development of 7 country case studies for the Diarrhea Global Action Plan (DGAP) project published in the Lancet

Doctoral Leadership Internship, Children's Hospital Boston, Intelligent Health Lab; Boston, MA June 2011 - Current

- Developed, deployed and analyzed 4 surveys in English and Spanish regarding adverse events with glucometers and insulin pumps. The surveys were administered to participants of two innovative social networking sites called TuDiabetes and EsTudiabetes. The survey design and tools were developed directly with the U.S. Food and Drug Administrations (FDA) national US adverse events reporting system.

Clinical Programs Manager/Research Associate: Johns Hopkins University, Bloomberg School of Public Health – Technical Support for the Ethiopian HIV/AIDS ART Initiative (TSEHAI); Addis Ababa, Ethiopia October 2008 – June 2010

- Program management support for HIV/AIDS care and treatment programs in an over $12 million dollar a year CDC funded PEPFAR grant operating in 4 regions of Ethiopia. Coordinate implementation of ART, TB/HIV, PMTCT, STI, Lab, Palliative care programs implemented in over 70 health facilities in Ethiopia providing technical, program management, budgeting and strategy development support. Telemedicine program support for HIV between Johns Hopkins and Addis Ababa University HIV clinicians.

Director, Global Health Initiatives TheraSim®, Inc.; Addis Ababa, Ethiopia, February 2008 – September 2008

- Expanded implementation of TheraSim® HIV/AIDS clinical simulation software designed to train HIV clinicians in advanced HIV care and treatment on a local computer in target hospitals beyond the pilot project phase to over 55 PEPFAR supported ART sites in Ethiopia; developed strategy for expansion; initiated new partnerships with international ART implementing organizations for site expansion; pursued direct funding from PEPFAR; explored opportunities for TheraSim implementation in other African countries

Program Officer, Ethiopia Country Program, Jhpiego, an affiliate of Johns Hopkins University; Baltimore, MD and Addis Ababa, Ethiopia, November 2006 – January 2008

- Program management support for HIV/AIDS program (PMTCT, HCT, eLearning) funded by CDC under PEPFAR; implemented in Ethiopia providing support to in country staff to develop and expand activities. Participated in development of program designs and proposals for funding opportunities in collaboration with other partners to expand activities in the Ethiopia program.
- Supported the design and implementation of technology based solutions including a Training Information Monitoring System tracking HIV/AIDS trained providers in Ethiopia. Supported the development of the HIV/AIDS eLearning modules for pre-service education.

Program Coordinator, Ethiopia Office; Jhpiego, an affiliate of Johns Hopkins University; Addis Ababa, Ethiopia; May 2004 – November 2006

- Worked with country director to establish Jhpiego Ethiopia country office and operations to implement CDC funded HIV/AIDS project addressing HIV counseling and testing, prevention of mother to child transmission of HIV and other related programs.

Public-Private Partnership and PMTCT/ARV Training Advisor U.S. Centers for Disease Control and Prevention; Addis Ababa, Ethiopia; August 2003 – May 2004

- Coordinated the implementation of ART and PMTCT trainings for service providers in Ethiopian hospitals, workshops, meetings; managed TA visits for partner organizations. Co-designed and coordinated a humanitarian flights project led by the US Ambassador designed to bring US medical donations to Ethiopia via Boeing/Ethiopian airlines partnership.

Nurse Assistant, Acute Care for Elderly (ACE) Unit St. Louis University Hospital - Tenet Corporation; St. Louis, MO USA; 2002 – 03

- Monitored patient vital signs, phlebotomy, patient hygiene, attended to dementia patients under nurse/MD supervision

Skills and Interests

- Information technology knowledge and skills for implementing electronic data collection systems and mobile phone applications for community health workers: CommCare, eMOCHA, Open Data Kit
- Proficient in Microsoft applications (Word, Excel, PowerPoint) and statistical analysis software (SPSS, InVivo, Epi Info)
- Extensive knowledge about mHealth interventions, HIV/AIDS Prevention, Care and Treatment programs, MNCH programs
- Extensive experience working with international funding agencies and mechanisms: PEPFAR, USAID and CDC
- Yoga, Pilates and jewelry making

Languages – English (Native); Amharic (National Ethiopian language)- proficient in reading/conversational speaking

Teaching Experience

- Spring 2013, 2014 and 2015; lead co-instructor for 2 credit MPH Course on mHealth in low resource settings.
- Summer, 2011 and 2012; Teaching Assistant for MPH class: IH715 Antiretroviral (ARV Program Management Issues In Low resources settings)
- Fall, 2011 and 2012; Applications and hands on learning on mHealth the use of Open Data Kit for 2 sessions for MPH students
- Fall 2011; Budgeting and Financial Management for DrPH students

Peer Reviewed Publications

M. McNabb, EC. Chukwu, O. Ojo, N. Shekar, C. Gill, H. Salami, F. Jega. Assessment of the Quality of Antenatal Care Services Provided by Health Workers Using a Mobile Phone Decision Support Application in Northern Nigeria: A Pre/Post Intervention Study. *PLoS One.* 2015

M. McNabb, E. Chukwu, H. Salami, O. Ojo, F. Jega. Assessing the feasibility and value of a pilot project using mobile applications and mobile money to enhance a maternal health conditional cash transfer program in Nigeria leading to the development of a costed business model for scale up. Annals of Global Health, 2015; 80(1): 193-194

L. Wissow, T. Tegegn, K. ASheber, **M. McNabb,** T. Weldegebreal, D. Jerene, A. Ruff. Collaboratively reframing mental health for integration of HIV care in Ethiopia. Health Policy and Planning, 2014.

K. Mandl, **M. McNabb,** N. Marks, E. Weitzman, S. Kelemen, E. Eggleston, M. Quinn. Participatory surveillance of diabetes device safety: a social media-based complement to traditional FDA reporting. Journal of the American Informatives Association. 2013

C. Gill, M. Young, K. Schroeder, L. Larvajal-Velez, **M. McNabb**, S. Abubaker, Z. Bhutta. Bottlenecks, barriers and solutions: results from multicountry consultations focused on reduction of childhood pneumonia and diarrhoea deaths. *Lancet,* 2013, 381 (9876) 1487-1498.

L. Hue, L Thanh, T. van der Velden, L. Bao, **M. McNabb.** mHealth: An Effective Education Channel for Hard-to-reach Ethnic Minority Populations in Vietnam. *Journal of Mobile Technology* 2012(1)4S

M. McNabb, C. Hiner, A. Pfitzer, Y. Abduljewad, M. Nadew, P. Faltamo, and J. Anderson; Tracking Working Status of HIV/AIDS Trained Service Providers by means of a Training Information Monitoring System in Ethiopia. *Human Resources for Health,* 2009*,* 7:29

National Guidelines Contributor

Contributing Author; Ethiopian National Guideline on HIV/AIDS Training Coordination, January 2009.

Book Contributor

Contributing editor; The Medical Management of HIV/AIDS: Africa Edition. Dr. John G. Bartlett and Joel E. Gallant, 2012

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Twitter: 23ME2; Tweets about public health, advancing technology and health, infectious diseases