M-health in harm reduction strategies for people who use drugs
A qualitative study

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<th>Description</th>
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<tbody>
<tr>
<td>ART</td>
<td>Antiretroviral Therapy</td>
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<tr>
<td>BIS</td>
<td>Biometric Identification Systems</td>
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<tr>
<td>GPS</td>
<td>Global Positioning System</td>
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<tr>
<td>HCV</td>
<td>Hepatitis C Virus</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<td>HR</td>
<td>Harm Reduction</td>
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<td>IHRA</td>
<td>International Harm Reduction Association</td>
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<tr>
<td>IT</td>
<td>Information Technology</td>
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<td>LMIC</td>
<td>Low- and Middle Income Country</td>
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<tr>
<td>M&amp;E</td>
<td>Monitoring &amp; Evaluation</td>
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<td>M-health</td>
<td>Mobile Health</td>
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<td>MT</td>
<td>Mobile Technology</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
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<td>NSP</td>
<td>Needle and Syringe Program</td>
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<tr>
<td>OST</td>
<td>Opioid Substitution Therapy</td>
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<td>PWID</td>
<td>People Who Inject Drugs</td>
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<td>PWUD</td>
<td>People Who Use Drugs</td>
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<tr>
<td>SMS</td>
<td>Short Message Service</td>
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<tr>
<td>STI</td>
<td>Sexually Transmitted Infection</td>
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<tr>
<td>TB</td>
<td>Tuberculosis</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Abstract

Introduction: the harm reduction strategy is a health program for people who use drugs (PWUD) with the primary aim to reduce adverse health consequences of the use of drugs. It has been found that especially in low-and middle-income countries, the access to harm reduction services and adherence to treatment form a problem for PWUD. Several studies show the contribution of the use of technology to access and adherence in health care. Especially M-health, the use of mobile technology in health care, is recommended to improve communication and information provision between health care programs and patients. This research aims to find out how the implementation of M-health technology could contribute to improving access to harm reduction services and adherence to treatment for people who use drugs in low- and middle-income countries.

Methods: in this explorative, qualitative research, the data was collected through semi-structured one-person interviews with a total of thirteen participants. The interview participants consisted of mobile technology experts or harm reduction experts, which were recruited via purposive sampling. Out of the thirteen participants seven were based in low-and middle-income countries and six of them in the Netherlands. The interview topic guides were developed according to the three central concepts of this research: ‘implementation of M-health’, ‘Access’ and ‘Adherence’ to care. The transcribed interviews were processed using the Theme Analyzing method, thereafter a detailed analysis is described in the results section according to the conceptual model of the study and the new themes that have been raised during the interviews.

Results: all interview participants recognized the added value of M-health to the harm reduction program. The interviews showed that the use of smartphones was preferred for the implementation of M-health as it provides a variety of information updates, language options and communication services that could all be presented to the PWUD in one smartphone application. The M-health functions of text and voice messages to remind and inform PWUD on harm reduction treatment as well as phone calls from service providers, were considered most valuable by participants. The implementation of M-health in harm reduction programs was highly influenced by the contextual characteristics according to the participants, specifically the insecure lifestyle of PWUD and the lack of technological development conditions in low- and middle-income countries. According to the participants, the most beneficial contribution of M-health for access to harm reduction was the increased outreach of the services and the increase in contact moments between service providers and PWUD. Furthermore, according to mobile technology participants, the harm reduction services would become more personalized for PWUD. The option of monitoring & evaluation through M-health technology has been proposed by participants as an additional advantage for harm reduction programs.

Discussion: the contextual factors of PWUD living in low- and middle-income countries form an important influence on the implementation of M-health in harm reduction programs. Therefore, the M-health should be adapted to the local language and the mobile technology or network that is already in place. In this study, M-health showed merely contributions to access to harm reduction programs but few for adherence to treatment. Further tailored
interventions should be designed to improve therapy adherence among PWUD. The function of monitoring & evaluation through M-health in the harm reduction programs could become a valuable data collection method to evaluate the program and to measure the contribution of M-health to harm reduction services. The implementation of M-health in harm reduction programs would lead to more accessible information and more frequent and individual harm reduction services through mobile phones for PWUD. If M-health is included in a context appropriate manner, it is expected to be an added value to harm reduction programs in low- and middle-income countries. For further research, the inclusion of the PWUD perspective and the focus on one specific country context before the implementation of M-health is recommended.

Keywords: harm reduction, People Who Use Drugs, M-health, access, adherence, Low- and Middle-Income Countries
1. Introduction

Health care programs for people who use drugs (PWUD) often find that it is hard to reach this population and to provide them with access to these services that can range from services that reduce drug use related health harms to HIV treatment. Moreover, PWUD show low adherence rates to treatment. This qualitative research aims to explore if the implementation of mobile technology could provide a solution to these specific problems. This section firstly explains the health care challenges of ‘people who use drugs’. Secondly, the ‘harm reduction strategy’, which is the central health care program of this research dealing with these challenges, is further explained and specified to the context in which the study takes place. Followed by ‘technological opportunities’ and ‘M-health technology’ as a possible opportunity to optimize the access to harm reduction services and adherence to treatment for PWUD. Finally, Mainline is introduced as a harm reduction organization and initiator of this qualitative study.

1.1 PWUD health care challenges

PWUD face many drug use related health harms, for instance the high prevalence of human immunodeficiency virus (HIV) among injecting drug users which represents a substantial global health challenge (WHO, 2009). The Hepatitis C virus (HCV) is also considered a public health risk and the prevalence of HCV among people who inject drugs (PWID) ranges between 40% and 90% with the highest incidence rates in low- and middle-income countries (Hagan, Pouget & Des Jarlais, 2011). Specifically in low- and middle-income countries, the harm reduction programs have shown certain challenges with respect to health care access and treatment adherence (IHRA, 2014). For instance, PWUD form two third of the HIV infected community in low- and middle-income countries but only 25% of them has access to proper medical treatment (Wolfe, Carrieri & Shepard, 2010). Oliver and Mossialos (2004) define access to health care as: “entailing the ability to secure a specified set of healthcare services, at a specified level of quality, subject to a specified maximum level of personal inconvenience and cost, while in possession of a specified amount of information” (p. 656). The most familiar barriers to care as experienced by PWUD are: a lack of awareness and information on when and where to seek care, the persistent experience of stigma and financial incapability to gain health insurance or out of pocket payments in the health system (Thomas & McCarty, 2004; Iguchi et al., 2002). The PWUD who are in need of health treatment are often disproportionally marginalized in health care facilities and denied the universal right to the highest attainable standard of health as every other human being (Room, 2005; UDHR, 1948).

The adherence to treatment is intrinsically linked to the access to care for patients, as patients need to have regular and reliable access to take the care as prescribed (Mukherjee et al., 2007). According to Sayles et al. (2009) this forms a common issue in minority groups who experience stigma. Long-term medical treatment adherence is defined by the World Health Organization (WHO) in their 2003 adherence-report as: “the extent to which a person’s behaviour – taking medication, following a diet, and/or executing lifestyle changes - corresponds with agreed recommendations from a health care provider” (p. 13). Adherence is considered one of the most critical factors for successful medical treatment (WHO, 2003). When compared with people who do not use drugs, PWUD are four times more likely to show
suboptimal levels of medical treatment adherence (Hinkin et al., 2007; Edlin, 2002). Therefore, adherence to HIV or HCV treatment by PWUD forms a priority in public health efforts including harm reduction services (Chaiyachati et al., 2014).

1.2 Harm reduction program

The harm reduction strategy is introduced by the Netherlands in 1984 and internationally recognized ever since (WHO, 2014). The four main goals of the strategy are to reduce sharing of needle equipment, reduce intravenous drug use, reduce drug use and increase abstinence if possible (Andréo et al., 2013). Firmly rooted in both the human rights- as well as in the public health approach, the harm reduction strategy consists of policies, programs and practices according to the following building blocks as shown in figure 1, with the primary aim to reduce adverse health consequences of the use of drugs (WHO, 2014; UDHR, 1948):

| 1. Needle and syringe programs (NSPs) |
| 2. Opioid substitution therapy (OST) and other evidence-based drug dependence treatment |
| 3. HIV testing and counselling (HTC) |
| 4. Antiretroviral therapy (ART) |
| 5. Prevention and treatment of sexually transmitted infections (STIs) |
| 6. Condom programs for people who inject drugs and their sexual partners |
| 7. Targeted information, education and communication for PWUD and their sexual partners |
| 8. Prevention, vaccination, diagnosis and treatment for viral hepatitis |
| 9. Prevention, diagnosis and treatment of tuberculosis (TB) |
| 10. Prevention of overdoses |

Figure 1: the building blocks of the harm reduction strategy (IHRA, 2014)

As part of harm reduction as a broader approach, it not only protects people from preventable health hazards and death related to drug use but it also links PWUD minority groups to specified health services, such as clean needles and essential HIV/TB/HCV treatment (IHRA, 2014; Andréo et al., 2013). Harm reduction is nowadays a mainstream health method in many parts of the world, as it has been accepted by almost all UN bodies and the International Red Cross (Andréo et al., 2013).

1.3 Technological opportunities

Technological solutions could play a role in interventions for PWUD in order to cope with these challenges of inaccessibility and non-adherence to care, and create more outreach with the currently existing harm reduction programs (Bates, 2002). Emerging technology based interventions such as tele-monitoring systems, E-health and automatic electronic reminders have already resulted in improvements to treatment accessibility and adherence for patients in health care programs (Bates, 2002; Granger & Bosworth, 2011). Accordingly, an example that is already implemented in some harm reduction programs is the Biometric Identification System (BIS). This system is developed to improve the patient identification in health care systems with the aim to increase the access of minority groups to appropriate health care (Wall et al., 2015; Ewijk, 2015).

1.4 M-health technology

In line with this technological development in health care, mobile-health (M-health) plays an increasingly important role in health care services (WHO, 2011). M-health is defined as: “the use of portable electronic devices for mobile voice or data communication over a cellular or
other wireless network of base stations to provide health information” (Kahn, Yang & Kahn, 2010, p. 255). It is considered a component of E-health and used globally for medical public health services supported by mobile technology, such as mobile phones, patient monitoring devices and other wireless equipment. Although the most common effectively used M-health method is text-messaging, health information and intervention apps have become increasingly popular as well due to the increasing use and development of smartphones (Kahn et al., 2010; Kliner et al., 2013; WHO, 2013).

Marsch, Lord and Dallery (2014) have presented the following advantages of mobile technology-based interventions: the increasing reach and availability of treatment, the increasing affordability of treatment for patients and the increasing individuals’ sense of anonymity. The usage of M-health has shown to be beneficial in terms of awareness raising and accessibility of health services in multiple chronic diseases (Kamel Boulos et al., 2011). Moreover, in complex care such as HIV/AIDS treatment or health seeking behavior of risk groups, M-health has created improvements in treatment adherence and a decrease in patient no-shows (Lester et al., 2010; Chaiyachati et al., 2014). The WHO M-health report (2011) shows that mobile technology is already incorporated in public health programs in many low-income countries. The advance of mobile technology in combination with the increased ownership of mobile phones in low- and middle-income countries create opportunity to deliver health interventions to those individuals who have limited access to health programs (Cohn, Hunter-Reel, Hagman & Mitchell, 2011; WHO, 2011).

1.5 Mainline
The positive examples of M-health initiatives in health care systems show potential for improvements in harm reduction programs performed by international public health organizations. Mainline is such an independent foundation which strives for the improved health status and quality of life for people who use drugs. Their (inter)national harm reduction program leads to health education of people who use drugs, lobby and advocacy, research advice and trainings to service providers. The program is performed by Mainline in cooperation with its international partner organizations in Pakistan, Nepal, South Africa, Kenya, Indonesia and Georgia. Especially in these low- and middle-income countries, harm reduction foundations frequently experience the struggle of inaccessibility and lack of adherence to health services amongst PWUD, as previously explained. It is essential that new methods are developed to overcome this program gap (Joseph et al., 2015). Preliminary studies and small scale efforts on this topic are increasing, however the peer-reviewed literature and systematic empirical researches on the adoption of new technologies in alcohol and drug use treatment settings is limited and outdated (Chaiyachati et al., 2014; Thomas & McCarty, 2004). As international health organizations increasingly implement mobile technology in their strategies, further knowledge on the usability of M-health in this specific setting is desirable for the prospective development and possible implementation of M-health into the harm reduction program of Mainline (Lester et al., 2010; Chaiyachati et al., 2014).

This qualitative study is performed with the aim to contribute to optimizing harm reduction for people who use drugs by assessing the potential of M-health technology in low- and middle-income countries, at the request of the international department of Mainline. The main
research question is: how could the implementation of M-health technology contribute to improving access to harm reduction services and adherence to treatment for people who use drugs in low- and middle-income countries?
2. Theoretical background
In this theoretical background, the concepts that underlie the aim of the study are further described. Theories on the three main concepts of the research: access, adherence and M-health, are retrieved from related scientific studies and literature. These include the ‘ACCESS to Health Care Framework’, the ‘Adherence Framework’ and the ‘Triangle Model: adoption of innovative technologies’. The theories may be aimed at different target populations or in different contexts, but are applicable to the structure of this research as is explained in the following paragraphs.

2.1 The ACCESS to Health Care Framework
As described in the previous section, the lack of access to harm reduction services forms a problem for PWUD, especially in low- and middle-income countries. The ACCESS Framework provides an elaborate theory on the different influences on access to care (Obrist et al., 2007).

The ACCESS Framework is presented to explore and improve access to health care for patient groups and provides an oversight for analysis and action to reach this goal (Oliver & Mossiales, 2004). Out of the three perspectives which form the base of this framework, the health-service perspective is the most important for this study.

- the health-seeking perspective, which is focused on the motives of patients to seek care. This model investigates the interaction between patients and the professional.
- the health-service perspective, which pays more attention to the supply side of health care and focuses on ‘5 A’s’ that determine access as a general concept.
- the livelihood perspective, which is an approach focused on assets that could increase the accessibility of care specifically in poor contexts, emphasizing solidarity and empowerment for the target population (Obrist et al., 2007).

The five A’s as of access, as described in the model, lead to the utilization and quality of care (Oliver & Mossiales, 2004; Obrist et al., 2007). All aspects of the framework are applicable on PWUD in low- and middle-income countries. However, for the focus of this study, specifically the five A’s of Access are further explained as this forms one of the main concepts of the study.
Figure 2: the ACCESS Framework (Obrist et al., 2007)

The five A’s of the Access Framework:

Accessibility: health care is considered accessible when all patients, not just certain groups, are able to obtain the health services they need. The location of health services should be in line with the location of patients. The geographical distance between the patients’ home and the service providers as well as the available transport options are part of Accessibility (Obrist et al., 2007). Poor roads and a lack of adequate communication services are often documented as barriers to reach health care services in low- and middle-income countries (Peters et al., 2008).

Availability: this is defined as ‘the appropriate health services create opportunity to be accessed when needed by patients’ (Obrist et al., 2007, p.1586). This includes skilled personnel, qualified organizations who provide the services and sufficient supplies. Impaired availability is often documented in low-income countries because of limited opening hours of health care centers, long waiting lists and impaired medicine stocks (Peters et al., 2008).

Affordability: this is defined as ‘the health service costs fit the patients’ ability to pay for care’. This includes the direct and indirect costs of care (Obrist et al., 2007, p.1586). Studies show that the introduction of user fees and the increase in prices of health care, lead to a decrease in health care utilization in low- and middle-income countries. Financial affordability of care is considered as one of the important aspects of access to care, and directly related to dimensions of marginalization and poverty (Peters et al., 2008).

Adequacy: this is defined as ‘the health services are provided in ways that meet the expectations of patients’ (Obrist, et al., 2007, p.1586). This includes the organization of services, the scheduling of services and the state of the facilities.
Acceptability: this is defined as ‘the characteristics of the service providers are in line with the expectations of the patients’ (Obrist, *et al.*, 2007, p.1586). This is especially focused on professional-patient communication and cross cultural patient-service provider relationships (Goodson, 2010). These vary per country and social/cultural values as the criteria for health care acceptability are highly linked to context of target populations. For instance, in marginalized communities the adjustment to social values and prevention of stigma and discrimination is measured (Peters *et al.*, 2008; Rooms *et al.*, 2009).

In their critical analysis of the theories of access in health care, Ricketts & Goldsmith (2005) encourage researchers to consider the dynamic aspects of access before applying a specific access framework to their study. For this research, the nature of the PWUD patient group and the low- and middle-income country context in which the harm reduction services take place, form the important dynamics who determine the applicability of a framework. This ACCESS Framework is mostly used in empirical social- or public health studies, focused in resource-poor countries. It is highly valued in scientific research purposes, especially for sustainable development, due to the combination of perspectives and expertise which leads to a more comprehensive and structured analysis of access to health care in resource-poor settings (Oliver & Mossiales, 2004; Mamdani & Bangser, 2004). Applied to this research, the three-perspectives look into the PWUD as a target group and their motivations to seek harm reduction services and health services or not. It focuses on the attitude and outreach of harm reduction services and related health care towards PWUD. Moreover, the assets to improve the livelihood conditions of PWUD in low- and middle-income contexts by increasing the mobilization of the PWUD community is taken into account as well.

Two other access frameworks have been taken into consideration for this study. Firstly, the well-tested Health Systems Framework of the WHO (2010) which is used in many studies and has a focus on access as an essential concept for a qualitative health care system. However, as the framework has a general approach to health systems and access is not the main concept, it is not the most suitable for this specific study. Moreover, the Aday & Anderson’s Framework for the study of access, is a traditional framework that explains the concept of access in health care (Aday & Anderson, 1974). Although this framework is highly comprehensive, it is not considered applicable to this study as it is not specified to patient groups, the context of patients or the different aspects that access includes.

The ACCESS Framework shows the desirable pathway from access to health care to significant health outcomes. The processes in this pathway are valuable to research, since they show the struggles with access which the harm reduction programs face and determine the potential value of M-health implementation per factor as well. In preparation for the interview topic guides, participants will be asked for the most prominent struggles they experience in the harm reduction programs. Further questions on the different aspects of access to health care will be probed when participants explain it as a problem.
2.2 The Adherence Framework

As described in the introduction, adherence to medical treatment forms a struggle, especially among HIV or HCV infected PWUD. Adherence forms a priority in public health efforts and an important concept in this study (Chaiyachati et al., 2014). The concept is further explained through the Adherence Framework developed by the WHO (2003) in order to create a broader understanding of the different dimensions of adherence and identify which dimensions are specifically applicable to this study.

2. The Adherence Framework

Adherence is a complex behavioral process, influenced by the living environments of people, the expertise and knowledge of health care providers and the health care systems in general (WHO, 2003). The five dimensions of adherence are:

1. The Social & Economic dimension, which represents the influence of costs and social context of patients on medical adherence (Chaiyachati et al., 2014).
2. Health Care System dimension, which represents the dynamic between different health system stakeholders (Haynes, McDonald, Garg & Montague, 2002).
3. The Condition-Related dimension, which represents the determinants that are related to severity of disease symptoms & disability and the progression rate of the available effective treatments (WHO, 2003).
4. The Therapy-Related dimension, which represents the conditions of treatments, such as the duration, possible side-effects and complexity of regimens (WHO, 2003; Martin et al., 2005).
5. The Patient-Related dimension, which represents the patient’s personal knowledge, motivation, beliefs, confidence and expectations regarding the outcome of health care treatments (WHO, 2003).

For this study, the Health Care System dimension is valuable to research as the provider-patient communication and the patient’s interaction with the health care system form the two major barriers to adherence for PWUD according to Osterberg and Blaschke (2005). These include the lack of information provision to patients which results in poor understanding of the proper use of the medication by PWUD and the link with poor access to health care
contact moments (WHO, 2003; Osterberg & Blaschke, 2005). Moreover, the Patient-Related dimension is important for this research as well, as several studies show specific barriers in treatment adherence for the target population of PWUD. The chaotic and unpredictable lifestyle which is characteristic for especially PWID forms a negative influence on their adherence to treatment (Hinkin et al., 2007; Tucker et al., 2004). Furthermore, PWUD cognitive dysfunction, the severity of drug use and the level of social support are all mechanisms that could influence the impact of the use of drugs on treatment adherence (Hinkin et al., 2007).

Along with the concept of access, the dimensions of adherence specified to the context of PWUD in low-and middle-income countries are worthy to be researched, since they show the adherence struggles which the harm reduction programs face and determine the potential value of M-health implementation per dimension as well. In preparation for the interview topic guides, participants will be asked for the most prominent struggles they experience in the harm reduction programs. Further questions on the different aspects of adherence treatment will be probed when participants explain it as a problem.

2.3 The Triangle Model: adoption of innovative technologies
The research of Osterberg and Blaschke (2005) is an example of a recommendation to implement new technologies to assist patients in their access to care and adherence to treatment. M-health is one of such technologies, developed to improve the quality and safety of health care systems. In this section, the Triangle Model is explained to create a broader understanding of the different components that are part of the implementation process of innovative technologies into health programs.
The Triangle Model consists of the following four components:

- The new technology; The new technology is explained in four components which should eventually lead to quality and safety outcomes in health care systems (Ancker et al., 2012): 1. The capability of the new technology, to fit with the task it replaces or implements. 2. The applicability of the new technology, to make sure it interacts but not impedes the original system (Ancker et al., 2012). 3. The usability as perceived by the users of the technology and the availability of support, consisting of a fluent integration and training on the system. 4. The reliability, such as the prevention of hardware issues of the technology performance in relation to the already existing health system (Chaudhry et al., 2006).

- The healthcare provider; the service providers should have the relevant attributes such as knowledge, skills and experience towards the technology, as the process of new technology implementation can only be effective when properly supported (Ancker et al., 2012).

- The health organization/institution; the organizations’ mission, policies and resources must suit the new technology. A top-down vision and framework of the health management is crucial which will create a solid base for organizational transformations and user compliance (Berg, 2001).

- The health care receivers or the patients; the patients need to be able to adjust and experience benefit of the (new) technology, which implies the bottom-up vision and acceptance of the new technology (Choo, Ranney, Wong & Mello, 2012).
The Triangle Model shows that technology will be connected to all of the health system components: organization, health service providers and patients. The implementation of a new technology in health programs should therefore be considered a process of mutual transformation and of organizational development to allow the new technology to grow gradually, while becoming part of the broader health program (Berg, 2001).

For this study the concepts of access and adherence can be found in the link between the patients who have a central position in the Triangle framework, and the organization and provider. If M-health is considered the new technology that is introduced in the existing harm reduction programs, it could lead to improved quality and safe health outcomes for PWUD according to this model. In preparation for the interview topic guides, participants will be asked for their view on the influences on the implementation of M-health in harm reduction programs in low- and middle-income countries, and specifically for the barriers and opportunities they foresee.
3. Conceptual model

In this section, the three concepts as described in the previous section, are explained and combined in a visualization that suits the research aim. In figure 5, the visualization of this study, which consists of a combined construction of the three central concepts conducted from the previous section, is presented.

![Conceptual Model](image)

*Figure 5: visualization three central concepts*

*M-health* represents the implementation of new technology in a broader health care program or system. For this study, M-health is considered the new technology and the harm reduction program of international partners of Mainline represents the health care program. The implementation of M-health would affect the organization of harm reduction programs of international Mainline partners, as well as the service providers and service users/patients. The potential value of M-health in harm reduction programs should be assessed to find out if the implementation of M-health could become an added value to the program.

*Access* represents an overarching term covering all five aspects of access to health care in the conceptual model, namely: Accessibility, Affordability, Acceptability, Adequacy and Availability. The implementation of M-health into harm reduction programs could potentially lead to an improvement of all the components of access to health care for PWUD.

*Adherence* in the conceptual model represents adherence of PWUD to treatments such as ART and HCV treatment. Adherence proved to be one of the major results of health technology applied in protocol-based programs as patient decision support is embedded in the M-health technology and could therefore potentially overcome barriers in patient adherence.

In the general pathway of this visualization of concepts, M-health is considered the potential new development, as an implementation to overcome the struggles of harm reduction programs. Access and Adherence form the major barriers that M-health could positively influence and overcome, in order to ultimately improve the effects of harm reduction programs on PWUD in low- and middle-income countries.
3.1 Research questions
In this paragraph the main research question and sub questions that are derived from the visualization of concepts are described.

Main research question:

How could the implementation of M-health technology contribute to improving access to harm reduction services and adherence to treatment for people who use drugs in low- and middle-income countries?

Sub questions:

1. What type of M-health technology would be most suitable for harm reduction for people who use drugs in low- and middle-income countries?
2. What factors may influence the proper implementation of M-health in harm reduction for people who use drugs in low- and middle-income countries?
3. How can M-health technology contribute to improving access to harm reduction services for people who use drugs in low- and middle-income countries?
4. How can M-health technology contribute to improve adherence to harm reduction treatment for people who use drugs in low- and middle-income countries?
4. Methods

This chapter includes the methods and materials that are used to perform this qualitative study. It describes the research design, the research population, data collection, and it justifies the setting, analysis and ethical precautions that are made in order to perform the research.

4.1 Research Design

The study is conducted in order to create an exploration and analysis of the potential added value of M-health to harm reduction programs. Qualitative research is the most appropriate method to use for exploration as it leaves room for the emergence of new insights and related topics during the research process (Gray, 2014). The study tests the theory as it is visualized in the conceptual model. The theory was assessed by analyzing the motives, behaviors, perspectives and beliefs of the different interview participants about the research objective (Gray, 2014). The study was performed to come to an understanding of the potential added value of M-health in harm reduction programs in low- and middle- income countries. As there has been limited previous research on the implementation of M-health in these specific contexts, the study was also meant to generate new concepts out of the derived data (Green & Thorogood, 2014).

4.2 Research Population

The study consists of two target populations according to two inclusion criteria: (1) they should either work at a harm reduction organization in a low- and middle-income country and have experience in direct work with PWUD, or they should have professional knowledge and experience with mobile technology in health programs, (2) they need to speak either Dutch or English.

Firstly, the group of harm reduction expert participants who work with PWUD in low- and middle-income countries, including: Georgia, Indonesia, Kenya, Nepal, Pakistan and South Africa. These experts are interviewed to create a more precise image of the program gaps and their view on the possible implementation of M-health technology in their programs. The Mobile technology participant group of experts forms the second target population. Mobile technology participants were interviewed in order to create an in-depth understanding of the value of mobile technology in health programs and of their professional view on the usability of M-health in low- and middle- income countries. In combination, these two perspectives should lead to an answer to the main research question. In total, thirteen interviews have been conducted with thirteen participants:

<table>
<thead>
<tr>
<th>Country of origin</th>
<th>Harm reduction participant</th>
<th>Mobile technology participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mozambique</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Nepal</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>The Netherlands</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Pakistan</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>South Africa</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6</strong></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>

*Table 1: Interview participants*
The participants of this study were recruited via purposive sampling. This is a commonly used sampling method in qualitative research, since it aims to select participants who are informative to the research and have the desirable (and partly resembling) backgrounds (Gray, 2014). The interview participants were recruited directly through the Mainline network and, indirectly, during health expert technology conferences and gatherings or through university webpages.

4.3 Data Collection

For the data collection, the one person interviewing method was considered the most suitable research method for this study since the study aims to understand the perspective of each participant individually; the focus group method or double-/group interviews would therefore not be appropriate (Gray, 2014). The interviews were semi-structured in order to combine a structured line based on the conceptual framework throughout the research, in combination with an unstructured exploration, for example by probing during the interviews as well (Cohen & Crabtree, 2008). Every interview followed a chronological line of primary questions in accordance with the topic-guides that are attached to this document in annex 1. Both topic guides for A. the harm reduction participants and B. the mobile technology participants, were developed by the researcher based on the existing literature and theories out of the conceptual framework. Topic guide A. consist of open questions in general on the struggles that the harm reduction participants experience with their service provision to PWUD, including probe questions specifically on access and adherence. For topic guide B. questions on the specific advantages or disadvantages of M-health and the implementation process are prepared for the mobile technology participants.

The topic guides were reviewed by both the on-site as well as the VU supervisor of this study. The on-site supervisor, the international program coordinator of Mainline, has specifically screened on possible sensitive issues and made sure that the guides were adapted to the (cultural) context of the population. Additionally, the topic guides were discussed with fellow students and the VU supervisor in order to improve the validity of the current study. However, there was room to incorporate new concepts and topics that emerged during the interviews (Gray, 2014). On average, the interviews lasted 30 to 60 minutes. All of the interviews were held in the Netherlands, most of them in the Mainline office. Five of the thirteen interviews were conducted face-to-face, all of which were mobile technology participants which were interviewed in their own personal offices. However, due to considerable geographical distances, the international interviews were conducted via Skype. Six of the thirteen interviews were held in Dutch and others in English.

4.4 Analysis

After all the interviews were conducted and transcribed, the data was analyzed. In the analyzing phase, the transcribed interviews were coded with the MAXQDA internet program. The data was analyzed using the Theme Analyzing method which consists of concepts characterizing the specific experiences of participants through the more general insights evident from the interview data (Bradley et al., 2007). In this method, four different phases are identified. All of these phases were carried out and discussed with the help of fellow students and both the supervisors, in order to improve the reliability of the data. The first
phase started by critically reading the data and generating ideas about the content. The second phase consisted of openly coding the data and inductively identifying those aspects that formed the basis for repeated patterns (Braun et al., 2006). These steps resulted in a bottom-up structure of organizing the data into meaningful groups. The third step mostly consisted of defining the subthemes into themes that were broader and overarching compared to the codes. At this stage, out of the big listed data set of codes, the recurrent topics were identified (Braun et al., 2006). Next, a mind-map was created of these themes in which they branch out into the subthemes and codes. For every theme, an analysis was described according to the conceptual model of the study and the new themes that have been raised during the interviews (Gray, 2014). For the new codes that did not fit the pre-established themes, new themes were created with the original codes. In the fourth phase, the themes were reviewed and the final candidate subthemes were chosen in order to create a theme-map as an ‘accurate representation’ of the dataset (Braun et al., 2006). In this final phase, the essence of the final themes was defined in terms of what aspects are interesting and why; this is described in the result- and discussion section of this study.

4.5 Ethics
Participation in this study was completed voluntary and the participants were allowed to withdraw from the study at any point during the research, without suffering any repercussions. An informed consent form was developed to make sure that interview participants were aware of the privacy considerations of the study. The informed consent forms, attached to this document in annex 2, were issued to be signed as hardcopies to the participants before the face-to-face interviews. However, for the interviews that were conducted through Skype, the informed consent was given orally beforehand (Gray, 2014). After every interview, a summary of the interview was sent to the respondent, this enabled the respondents to verify and adapt outcomes if considered necessary.

The participants were informed prior to the study about the fact that the obtained information could ultimately be used for scientific publications or presentations. However, the data were processed anonymously during the analysis. With regard to the interview outcomes and participant quotations the sole references were the country of origin and the participant’s field of expertise. In addition, the MAXQDA data file and other analysis documents are in possession of and protected by the researcher and can only be requested in confidentiality by Mainline. Permission from the medical ethical committee, based on the Dutch law for medical-scientific research involving human subjects, has not been necessary for the data collection of this study.
5. Results

The themes and subthemes derived out of the interviews are further explained according to the four sub questions of the research. Firstly, the types of mobile technology and the different M-health functions are described, and why participants considered them suitable for the harm reduction programs or not. Secondly, influential factors on the implementation of M-health in harm reduction programs were described as mentioned in the interviews. These range from contextual factors to factors related to the target population and the implementation process. In the last two paragraphs, the possible contributing factors of M-health to access as well as adherence for PWUD to harm reduction services and treatment are described. These include the two main themes of access and adherence placed in a context of possible M-health implementation in the harm reduction programs.

In this results section, the interview participants are referred to as either harm reduction participant ‘HR participant’ or mobile technology participant ‘MT participant’, based on their background of expertise on which they were recruited for the research as explained in the previous section. Furthermore, the results are illustrated with quotes of interview participants which are derived from the interviews. Naturally, these quotes are referred to anonymously. The participant’s expertise, country of origin and the participant number is mentioned according to the following example: HR/MT (HR/MT), Participant 1 (P1), Georgia.

5.1 The most suitable types of M-health technology for harm reduction

In order to answer the first sub question, the types of mobile technology and their different functions are described here. Out of the analyzed interview data, the two themes ‘types of mobile technology’ and ‘M-health functions’ are further described. This paragraph explains what types of mobile technology are present in the low- and middle-income countries included in this study, and which related M-health functions are suitable for implementation in the harm reduction programs for PWUD.

Types of mobile technology

In order to find out if M-health could become a new part of harm reduction programs, it is researched which different types of mobile technology are suitable. All participants agreed that the most suitable mobile technology is dependent on the mostly present mobile technology in the countries. If the larger part of the population uses a smartphone in the particular low- and middle-income country, M-health was preferred to be implemented in the program as an application for smartphones. This was the case in Asian countries according to three Asian HR participants. One HR participant explained the beneficial internet connectivity in Nepal, which creates the opportunity to use smartphone technology for the implementation of M-health in the harm reduction programs:

“It’s possible because internet possibilities are good and I’m using mobile internet while talking to you right now, so internet connectivity is also good and most of the people use smartphones in Nepal.”(HR,P10,Nepal)

The use of tablets was another type of technology mentioned in the interviews by three participants as part of an M-health initiative in harm reduction programs. The harm reduction
service providers could use tablets in the field and link them to smartphone applications of PWUD.

In the low- and middle income contexts where smartphones are not a regular device to own, basic mobile phones are a more suitable mobile technology on which M-health could be implemented in harm reduction services according to the African HR participants. Also the participants from Pakistan emphasized the valuable use of basic phones in their harm reduction program. However, half of MT participants emphasized the fast mobile technological development process in low- and middle-income countries, compared to high income countries, and therefore viewed the smartphone as more suitable for M-health purposes:

“Western people always say that with these mobile phones, we went very slow and incrementally through the technical development steps: starting from no phone to fax and landline phones and then all the different versions. While they have gone immediately from nothing to mobile phones, they have made a radical jump, so why wouldn’t they also make a radical jump with that in health care?” (MT,P8,Netherlands)

On the other hand, HR participants predicted a disadvantage in the use of smartphones, namely that the carrying of smartphones may bring PWUD in dangerous situations due to risks of theft and violence. In general, negative experiences were described by two HR participants about the loss of basic phones and smartphones by PWUD.

**M-health functions**

In order to find out if M-health could become a new part of harm reduction programs, it is important to assess what kind of mobile technology functions could be used for M-health. More than half of the MT participants emphasized that M-health would not be meant to become a new purpose of the harm reduction program itself, but could be introduced as a new communication channel as part of the harm reduction program.

The different functions of mobile technology known by all MT participants that are used for M-health methods included: text-message, voice-message, e-mail or phone calls. The practical purposes of M-health in harm reduction programs that were mentioned by both MT- and HR participants are mobile information-, education- and counseling services. Using text-message for the above mentioned goals was described by four participants as the most cost-effective method, suitable to all types of mobile phones. The combination of text-messages and counseling services through phone calls on basic phones has already been established in the harm reduction program of Pakistan. Both the HR- and MT participant from Pakistan explained this as a successful part of the program:

“(…) the moment you leave treatment we give you a very basic mobile phone which has a system whereby even if you close the phone, it will send a text-message at 9 o’clock saying: ‘have you had your medication?’ Even if you had it or not it reminds you. We stay in touch
Different advantages of M-health applications for smartphones were mentioned in the interviews as it forms a comprehensive manner to present a variety of possibilities and opportunities compared to basic phones. For instance, the application could include elaborate information updates on specific harm reduction services for PWUD and arrange an instant chat connection between PWUD and service providers as explained by three MT participants. A harm reduction program in Georgia developed a smartphone application especially aimed at information provision to PWUD. According to the Georgian HR participant, global positioning system (GPS) functions form another advantage in smartphone applications. As the exact location of the PWUD could be detected through GPS, the smartphone application could provide targeted instructions about the road to harm reduction or health clinics to PWUD.

5.2 Influential factors on the implementation of M-health in harm reduction

In order to answer the second sub question, different types of factors potentially influencing the implementation of M-health are described here. ‘Implementation’ is the overall theme in this paragraph, divided into sub themes: ‘technological development’, ‘financial conditions’, ‘PWUD context’ and ‘implementation process’. The sub themes represent the factors that were mentioned during the interviews and need to be taken into account before and during the implementation of M-health in harm reduction programs.

Technological development

To implement M-health in harm reduction programs in low- and middle income countries, there is a certain technological developmental state and willingness of the organizations required as was mentioned by ten out of thirteen participants. For instance, an impaired internet connection forms a barrier for M-health that is implemented via smartphone applications. All MT participants mentioned the coverage of and access to- mobile devices as an important influence on the implementation of M-health. The coverage would be sufficient when every PWUD is in the possession of a mobile phone and able to reach the services through a reliable internet or phone connection, as predicted by half of MT participants. This could mean that the harm reduction organization should invest in buying and distributing phones as part of implementation. One HR participant mentioned his positive experience with this part of the implementation process.

“The only major costs that it took for the mobile intervention were actually the cellphones that we had to buy to help the patients...” (MT,P4,Pakistan)

It was advised by three MT participants that organizations should look outside their field of expertise and into local technological experienced companies, in order to reframe existing technological programs into suitable M-health options for harm reduction programs.
Financial conditions
More than half of the MT participants spoke about the financing methods for the potential development of M-health in harm reduction. They mentioned funding as an essential part of the implementation of mobile technology as it specifically influences the sustainability of the program. Three MT participants predicted financing barriers of the implementation of mobile technology in harm reduction programs. One MT participant recommended to diversify finance sources for M-health implementation, as funding for NGO projects is regularly provided by governmental institutions and governmental funds are often meant for only a limited amount of years ahead. More importantly, half of HR participants experienced the preliminary governments’ approval as the most significant barrier before implementation of a new technological aspect of the harm reduction program. Another MT participant mentioned cooperation with private institutions as an alternative to this financing relationship.

PWUD context
For the contextual characteristics of PWUD in low-and middle-income countries, the insecure lifestyle, the lack of personal belongings or resources and the often poor conditions of the target population, were mentioned by all HR participants and half of MT participants as an influence on M-health implementation. The interaction and communication through mobile technology was not considered to fit in with regular communication methods of PWUD by all HR participants. As fear of change often leads to resistance to new developments, it has been mentioned by more than half of the participants that the implementation of M-health needs to be adjusted to PWUD context as much as possible. The development of a language option in the mobile technology through which the PWUD are able to adjust the program to their own language was mentioned by more than half of HR participants. One of them was an HR participant from Indonesia:

“The new technology gives you a number of questions, I believe we need to bear in mind that it needs to be more adjusted to the local context. When you’re doing a program with this high tech stuff we need to be aware that for example in Indonesia not everyone speaks English. So it needs to be translated to Bahasa before it’s implemented that’s for sure the number one factor to make it happen.”(HR,P13,Indonesia)

As the primary barriers mentioned by HR participants in access to care for PWUD were stigmatization and discrimination towards PWUD in the community, specifically within health care clinics, a trustworthy relationship between service providers and PWUD was considered an essential part of harm reduction by more than half of HR participants as well. They considered trust a preliminary condition for the implementation of M-health because PWUD participants would be more likely to use and adopt new M-health technology in the program when they understand the reasoning behind it and trust the service providers with whom they will be in contact with through mobile phones. Two MT participants and one HR participant mentioned privacy as a core component to take into account as well. These participants experienced fear for breach of privacy in PWUD if personal information and contact details would be used in mobile technology systems. This could lead to restraints in the M-health implementation process.
Implementation process
All of the interview participants predicted that the implementation of mobile technology into harm reduction programs in low- and middle-income countries would be a difficult and slow process. However, there seemed to be an agreement on the fact that once implemented, the system could become a sustainable program. One important criterion that was mentioned by the MT participants as well as one HR participant to take into account during implementation was to involve all stakeholders in the process, including the organization, service providers and the PWUD. The involvement of PWUD was considered important in order to make sure that it suits their perspective and needs. One MT participant specifically mentioned this as an important part of implementation:

“Stay near to the perspective and needs of the user during the development of a technological program. They may not understand all the technical details but they can tell you a lot about their needs, routines and usage patterns for example. Innovation never happens one-way, it is an iterative process.” (MT,P8,Netherlands)

One HR participant and two MT participants emphasized the importance of assigning mobile contact persons to train service providers and PWUD at the use of mobile technology. As the understanding and proper adoption of new mobile technology could only be created by training both service providers and PWUD on the use of mobile phone systems. Additionally, more than half of the participants mentioned that the mobile technology program needs to be attractive for the PWUD to use and all of the MT participants stated that there should be ways to make sure PWUD and HR organizations are interested in implementing the program. Two MT participants proposed an incentive and reward system, in order to create interest and achieve the desirable behavior change in the target population. An example of such a system is through provision of discounts at harm reduction services for the PWUD in case the new mobile technology was sufficiently used by them.

Two MT participants as well as one HR participant, who are already experienced with the use of mobile technology in the organization, mentioned the benefit of data collection and monitoring and evaluation through the use of the new mobile technology itself as part of implementation. The participant explained that in their program, monitoring with the use of text-messages between service providers and PWUD proceeds positively:

“Because of large distances between districts, we’ve started monitoring with a follow-up on mobile phones, where clients will respond to questions of service providers: if they are running out of care or if somebody is relapsed you know they can be brought in to treatment, which we can inform the locally clinic will rigidly organize etc. (...) It provides us all the accurate information in real-time.” (HR,P9,Pakistan)

5.3 Contribution of M-health on access to harm reduction services
In order to answer the third sub question, this paragraph explains what advantages M-health would have on the harm reduction programs and especially how it would contribute to the
access of the harm reduction services for PWUD. The theme ‘access’ is explained here in the context of M-health in harm reduction programs and further divided into the sub themes ‘fastened services’, ‘social networks’, ‘personalized services’ and ‘cost-effectiveness’. The sub themes represent the different advantages of M-health in harm reduction programs that emerged in the interviews.

Fastened services
The problems in health seeking behavior and specifically the negative influence of drugs on communication for PWUD were mentioned as access to care barriers by more than half of the HR participants. In the service-on-demand structure that is characteristic for harm reduction, mobile technology was considered valuable amongst all MT participants for it provides the PWUD with the opportunity to easily reach service providers. A positive result of M-health in harm reduction programs, mentioned by more than half of the HR- and MT participants, are the targeted and fastened services provided through mobile technology. This was considered to lead to faster and an increased amount of contact moments between service providers and PWUD. Another valuable opportunity of M-health mentioned by the majority of both MT- and HR participants was the increased outreach that mobile technology could provide to harm reduction services, as it is not depended on location or time in contrast with face-to-face service provision. One MT participant emphasized this as the main added value of M-health to health programs:

“If I had to name one big added value of M-health I would say the big outreach, the fact that you can reach a larger group of patients and also service provider colleagues in the field from a central position with just one phone call or text-message." (MT,P12,Netherlands)

For M-health in smartphone applications, the instant access to an elaborate source of harm reduction information and guidance through mobile technology was predicted to create an improvement in virtual as well as physical access to harm reduction services by more than half of MT participants.

Two MT participants predicted that the faster services through mobile technology would eventually even reduce the need for access to health services in general as it could lead to improved prevention of illness and subsequently less hospital visits for PWUD.

Social networks
Creating interaction with- and between clients in a peer-network was mentioned by two HR- and one MT participant as one of the important purposes of the use of mobile technology harm reduction programs. The terms acceptability and applicability were used multiple times by half of the HR and half of the MT participants, as PWUD already use several types of technology to find support within the PWUD community. These HR as well as MT participants clearly saw the potential of M-health to link harm reduction services to these existing PWUD networks:

“There are people who answer that they are afraid and that they don’t want to receive something on their phone, but others are already networking quite well. (...) they use mailing
systems for information or they are trying to use these Facebook special groups. We have this self-organization with the representatives of drug users.” (HR,P6,Georgia)

One HR- and one MT participant predicted that family support of PWUD would have a positive influence on access to harm reduction service providers through M-health. Through the use of mobile technology, these participants foresaw that PWUD would be able to borrow a phone of family members and help them to take part in the mobile system if necessary.

**Personalized services**

Diverse opinions on whether the implementation of mobile technology would lead to increased personalized access to harm reduction services emerged during the research. On the one hand, it was mentioned by four out of seven MT participants that the fast checks via mobile phones would lead to more time for personal depth in the face-to-face encounters between service providers and PWUD. The idea that the discussion of sensitive topics through mobile phone conversations would be easier for PWUD compared to face-to-face encounters was mentioned by one MT participant as a positive argument as well:

“I recognized that patients found it easier to talk about sensitive topics online. And it made it also easier for me as a service provider, to reach back to a certain topic that we had already discussed in an online conversation, during a face-to-face conversation.” (MT,P5,Netherlands)

However, the individual service provided through mobile technology could also lead to feelings of disconnection from the community according to two HR participants. Two other HR participants and one MT participant predicted the increased self-dependence and empowerment of PWUD, and a more humane way of care provision as positive outcomes of individual harm reduction services through mobile technology.

**Cost-effectiveness**

All MT participants and half of the HR participants explained the cost-effectiveness of M-health as an important improvement and were convinced of the increased sustainability that it would provide to the program ones it would be fully implemented. The cost-effectiveness of the program has a positive influence on the affordability of harm reduction services according to three HR participants, as PWUD would only need their phone and a good connection in order to receive the services.

One of the MT participants specifically appointed the link between the quick outreach and the affordability of M-health to harm reduction services:

“That is because they have calculated that it actually saves a lot of costs when you are able to reach a large public or when you can react sooner in critical cases before it escalates in a more complex situation, which occurs a lot in people who use drugs and leads to more costs in order to help them.” (MT,P12,Netherlands)
5.4 Contribution of M-health to adherence to harm reduction medical treatment

In order to answer the fourth and last sub question, the theme ‘adherence’ is further described here. This paragraph explains what advantages M-health would have on the harm reduction programs and especially how it would contribute to the adherence of PWUD to treatment. This theme was not one of the most prominent themes that emerged out of the interview research data; it has not been mentioned by all interview participants as three interview participants did not recognize the problem of adherence amongst PWUD.

Adherence

Several M-health functions are specifically aimed at increasing adherence to medical treatment, as mentioned by ten HR- and MT participants. The first and foremost was text-messages, this was described by four participants as a rather beneficial method as it could easily remind and motivate PWUD to take their medicine without taking much of their time. Voice messages and service calls were mentioned as M-health functions that contributed to adherence levels of PWUD to harm reduction as well. Half of the HR participants emphasized the benefits of these M-health functions over text-messages, because this way the illiterate PWUD could also be included in the services.

On the other hand, three MT participants stated that the implementation of M-health could also lead to discouragement of treatment adherence when PWUD experience an overload of messages and treatment information through mobile systems. One MT participant predicted that excessive amounts of text-messages or service calls would lead to negative experiences for PWUD, and ultimately to avoidance of M-health services:

“I think, you can’t say well we will do an SMS project to solve our adherence problem. What do you want to send through SMS? Are you going to send content then your clients need to read many long texts on their phones, they are going to feel spammed and they stop interacting with you” (MT,P3,Mozambique)

In order to improve adherence levels of PWUD with M-health, half of the MT participants and two HR participants mentioned the importance of finding a balance in accurate outreach and the amount of messages send through mobile technology.
6. Discussion

The aim of this study was to contribute to optimizing harm reduction for people who use drugs by assessing the potential of implementing M-health in harm reduction programs based in low- and middle-income countries. This study provides new information on M-health as the implementation and advantages of M-health have not been properly researched for this specific target population in this specific setting before. Interestingly, every interview participant in this study recognized the added value of M-health to the harm reduction program. The findings of this study can be used to inform harm reduction organizations who are interested in the implementation of M-health in their program.

The following paragraphs include main findings as well as three major points of discussion and the extent to which they reflect findings from the literature. This is then followed by a theoretical reflection and the strengths and limitations of the study. This section ends with the conclusion in which an answer to the main research is provided. The recommendations for the harm reduction program and for further research are explained throughout this section.

6.1 Main findings

The study showed that M-health could contribute to the accessibility of harm reduction services for PWUD as it would increase and personalize the amount of contact moments between PWUD and service providers. However, for the implementation and acceptability of M-health by PWUD, it is important that M-health would be adapted to the context of their lifestyle in the specific low-and middle-income country. If a country is rather technologically developed it is preferred to implement the M-health on smartphones, otherwise basic mobile phones would be a more suitable and sustainable choice. As trust and the protection of privacy is important for PWUD, it is important to involve the PWUD in the M-health implementation process to ensure that the program is adequate and meets the needs of the patients. Moreover, if M-health is properly implemented in a harm reduction program, it would be a cost-effective addition to harm reduction as it would make use of the mobile network that is already in place. It would make the harm reduction services easier accessible through mobile phones and more affordable for PWUD.

6.2 Contextual influence

This study showed that the contextual factors of PWUD living in low- and middle-income countries form an important influence on the implementation of M-health in harm reduction programs. It is advised in the study that the program should be adapted to the local context of the specific target population before implementation. This is confirmed in literature, as the innovations for health programs have shown more effectivity over the last decades when implemented and pursued in a cultural appropriate manner (Kreuter et al., 2003). In line with scientifically recognized strategies to target programs to culturally defined groups, three criteria should be met for M-health to become an acceptable new part of the harm reduction program for PWUD in low- and middle-income countries (Kreuter et al., 2003). In the first place, the type of mobile technology should be capable, reliable and appealing to fit the M-health tasks within the already existing harm reduction program as was already stated in this study (Kreuter et al., 2003). For an applicable and fluent integration of the M-health program, it is recommended to choose a type that can be adapted to the network that is already in place.
as it should be built upon the local context and resources (Tamrat & Kachnowski, 2011). In addition, the content of M-health should be able to be provided in the native or local language of PWUD (Kreuter et al., 2003). And as proposed both in this study and in literature, local partners should be included to cooperate on developing a specified, language-friendly and culturally appropriate M-health system (Tamrat & Kachnowski, 2011).

On the other hand, M-health has the competence to cope with part of these contextual barriers. For instance, as there are many remote areas in low-and middle-income countries, M-health would make it possible for outreach workers to provide their services far from the clinical setting (Braun, Catalani, Wimbush & Israelski, 2013). In the service-on-demand structure that is characteristic for harm reduction, mobile technology has the ability to not only improve outreach of harm reduction services and information to all PWUD, but it would also make it easier and faster for PWUD to access harm reduction service providers, since it would be independent of time and location (Braun, Catalani, Wimbush & Israelski, 2013). In line with the study outcomes, the harm reduction services would become more accessible through M-health for PWUD because of reduced time and expense to reach the services. This is especially important for target groups like PWUD, who are underserved for cultural or logistic reasons (Worldbank, 2012).

6.3 Adherence
In this study, M-health showed merely contributions to access to harm reduction programs but few for the adherence to treatment. Not all HR participants recognized the problem of non-adherence of PWUD in their programs. This is in contrast with the studies of Edlin (2002) and Hinkin et al. (2007), which clearly state the problem of non-adherence among PWUD. It could be the case that non-adherence levels are not unusually high among PWUD in the specific low- and middle-income countries included in this study, compared to other patient groups. Even though there are some studies which state that antiretroviral resistance levels are not higher in PWUD compared to non-PWUD, clinicians still see ART non-adherence as a major concern in this target population (Kamarulzaman & Altice, 2015). Additionally, M-health applications and text-message reminder services are most successful in the increasing adherence of patients to complex treatments such as ART (Kahn et al., 2010). However, other studies show that there is not sufficient evidence for interventions that have shown promising adherence improvements because they are tested in a limited diversity of settings (Chaiyachati et al., 2014). According to Mimiaga et al. (2010) specific tailored interventions should be designed to improve therapy adherence among PWUD. Perhaps M-health is not able to contribute to adherence levels for the specific setting and target population of this study. Note that these are suggestive interpretations and further in-depth research is required.

6.4 Monitoring & Evaluation
Next to the contribution to access or adherence to harm reduction services and treatment, other advantages of M-health have come up during the interviews. The monitoring & evaluation purpose of M-health in harm reduction programs was the most prominent study outcome. Data collection through mobile technology is not a new phenomenon; several studies show the benefits of providing health care while simultaneously collecting data through mobile technology (Tamrat & Kachnowski, 2011). In order to evaluate and manage
integrated M-health programs, measurements through the mobile system itself is highly beneficial. Studies show that projects that collect data through mobile technology could measure and compare the quality, accuracy, time and costs of the health services provided through M-health and through the original system (Leon, Schneider & Daviaud, 2012). It would be ideal if through mobile monitoring & evaluation the data on the amount of PWUD who access the harm reduction services and adhere to treatment could be gathered. The actual contribution of M-health to harm reduction services could be measured this way. Another opportunity of data collection through monitoring & evaluation through M-health as mentioned in this study, was for the harm reduction organizations to monitor the intensity of the health problems of PWUD and process this data into an advocacy statement directed to the national government, in order to create awareness on the health problems that PWUD face and the importance of harm reduction services.

6.4 Theoretical reflection
The three concepts of access, adherence and implementation of M-health, have provided a broad background to this study. Although the theories were broad, an essential preliminary factor that has come up during the interviews but is not included in the concept theories of this study, was the financial picture behind M-health implementation. It was stated in literature that it is important for health programs to negotiate financial implications for all stakeholders before the implementation of M-health (Tamrat & Kachnowski, 2011). Especially in NGOs which are dependent on funds, the financial aspect should be incorporated in the discussion.

The national governments form a key stakeholder in the financial picture as in the majority of countries they are able to influence health strategies by investing in health programs (Tamrat & Kachnowski, 2011). It was accordingly emphasized in the interviews that the preliminary approval of national governmental institutions is a dependent factor for the functioning of harm reduction programs. This is in line with the ‘Policies, Institutions, Organizations and Processes’ component of the ACCESS Framework.

As the background theories were too detailed to be extensively covered in the interview of this study, it is recommended to use the concept theories for further research and specifically for the implementation process of M-health in harm reduction programs.

6.5 Strengths & limitations
This study provides new information on M-health as the implementation and advantages of M-health have not been properly researched for this specific target population in this specific setting before. However, that automatically means that the literature which has been used to provide background theories for this study or to reflect on the outcomes, is based in different settings or in different populations.

It should be noted that for the setting of this research, the category of low- and middle-income countries was chosen as the harm reduction program experienced most access and adherence problems in these countries. However, low- and middle-income countries are divergent on many levels, such as cultural and economic. As for this research only five countries are included, the research outcomes are not generalizable for all low-and middle-income settings.
It is recommended that before the implementation of M-health in a harm reduction program, an explorative study for the specific country context is conducted.

Furthermore, for the research population of this study, two perspectives of harm reduction experts and mobile technology experts were analyzed and combined. The target population of PWUD was not included as a group of interview participants as this study concerned a program management topic and was aimed to generate expert views on how the implementation of a new part of the program could be developed. However, one of the HR participants was a peer-service provider in a harm reduction program and was able to answer questions as a representative for the PWUD community as well. For further research, the inclusion of PWUD representatives as a third target population is recommended. This would enrich the data with the patient perspective and is in line with the study outcome to involve PWUD in every stage of the M-health implementation process.

Another limitation was the interview translations. Four of the interviews were held in Dutch and afterwards translated and coded to English, which could have led to minor bias by the researcher in the understanding and interpretation of the data in the phase of analysis. Moreover, as the interview participants were aware of the fact that this research was not conducted independently but in the request of Mainline, the donor role and partner relation between harm reduction organizations has assumedly influenced led to certain social desirable answers by the HR participants.

6.6 Conclusion
The implementation of M-health in harm reduction programs would lead to more accessible information and more frequent and individual harm reduction services through mobile phones for PWUD. If M-health is included in a context appropriate manner, it is expected to be an added value to harm reduction programs in low- and middle-income countries. For further research, the inclusion of the PWUD perspective and the focus on one specific country context before the implementation of M-health is recommended.
7. Acknowledgements
I would like to offer my special thanks to the interview participants of this study for the valuable conversations and the insightful answers they provided me with. I would like to express my gratitude towards my two supervisors who guided me through this research process. First of all, my VU supervisor Lia van der Ham, who provided me with valuable insights and supported me ever since the first of many moments I stepped into her office. Secondly, I would like to express my appreciation for my on-site supervisor Machteld Busz, who I admire in her work ethic and for her compassionate guidance and advice during this internship. Lastly, I would like to thank every colleague in the Mainline office who I had the sincere pleasure of working with.
Literature


Annex 1
Semi-structured Interview Topic Guide

A: Harm Reduction participants

Introduction

Word of welcome: thank you for agreeing to participate in this interview.

Introducing interviewer: my name is Fleur Godrie, I am a master student International Public Health at VU University in Amsterdam. For my master thesis I am currently conducting a qualitative research on mobile health in Harm Reduction strategies for the Mainline foundation. (The interviews will be conducted for this study in the Netherlands and for the international candidates via Skype.)

The aim of the study: the aim is to contribute to optimizing Harm Reduction for people who use drugs in low- and middle-income countries by exploring the potential of M-health technology.

The aim of this interview: the aim of conducting interviews in this research is to create an overview of expertise and experience concerning Harm Reduction programs in low- and middle-income countries and the use of M-health. Note that there are no ‘right’ or ‘wrong’ answers and if you have any information that may be relevant for the study which has not been questioned, do not hesitate to add this in the interview.

Scheduled time for the interview: the interview will last approximately 30 to 60 minutes.

Informed consent & recording: I would like for you to read the consent form and sign if you agree and feel sufficiently informed on the reasoning behind this interview and the way it will be anonymously referred to in the final article. Note that you may interrupt me at any moment if you do not want to answer a question or if you want to stop the interview. Is it okay if I record this interview orally?

Questions: before we start, do you have any remaining questions about the study or interview?

➔ Explain why chose the participant for the interview

➔ Explain structure of the interview

Background

• What kind of work do you do at … (the organization)? (in regard to Harm Reduction)

Harm Reduction

• What does the harm reduction program provide to PWUD in order to decrease the health harms in your country?
Struggles in harm reduction

- Could you describe to what extend the harm reduction program helps PWUD to receive the appropriate health services?
- What kind of difficulties do PWUD face in receiving appropriate health care?
- Do you experience difficulties in access to health care among PWUD?
  - what forms of inaccessibility have you seen?
  - how do/would you cope with this in your program?
- Do you experience difficulties in adherence to medical treatment among PWUD?
  - what forms of adherence have you seen?
  - how do/would you cope with this in your program?

Technology

- Have you considered using technology in your harm reduction program?
  - what kind of technology?
- Are you familiar with the term Mobile health? * Short explanation*
- Do you see possibilities in using M-health in your harm reduction program?
  - what kind of function would it fulfill?
  - what improvements would it create?
  - where would you want it to be included in the harm reduction program?
  - what barriers would it face?
- How could M-health become properly implemented in your harm reduction program in order to meet the needs of the PWID as well as the care providers?
  - would you consider M-health to be applicable?
  - would you consider M-health to be usable?

Closing

Summary: summarize the most important topics and answers out of the interview
Additional information: would you like to add any other information that might be relevant for this study?

Procedure: the information of this interview will be carefully processed and analyzed Mainline and me as a researcher. I will report to this interview anonymously. If you prefer, I can send you a short summary of the interview if you wish, in order to assure the rightful processing of the interview information in the research.

Questions: do you have any remaining questions at this stage? Feel free to contact me in case any question arises or additional information to share with me at a later stage.

Thank you: thank you for your time and for sharing valuable experiences and insights for this research.
B: M-health participants

Introduction

Word of welcome: thank you for agreeing to participate in this interview.

Introducing interviewer: my name is Fleur Godrie, I am a master student International Public Health at VU University in Amsterdam. For my master thesis I am currently conducting a qualitative research on mobile health in Harm Reduction strategies for the Mainline foundation. (The interviews will be conducted for this study in the Netherlands and for the international candidates via Skype.)

The aim of the study: the aim of this study is to contribute to optimizing Harm Reduction for people who inject drugs in low- and middle-income countries by exploring the potential of M-health technology.

The aim of this interview: the aim of conducting interviews in this research is to create an overview of expertise and experience concerning Harm Reduction programs in certain contexts and the use of M-health. Note that there are no ‘right’ or ‘wrong’ answers and if you have any information that may be relevant for the study but has not been questioned, do not hesitate to add this in the interview.

Scheduled time for the interview: the interview will last approximately 30 to 60 minutes.

Informed consent & recording: I would like for you to read the consent form and sign if you agree and feel sufficiently informed on the reasoning behind this interview and the way it will be anonymously referred to in the final article. Subsequently, do you mind if I record this interview orally?

Questions: before we start, do you have any remaining questions about the study or interview?

→ Explain why chose the participant for the interview

→ Explain structure of the interview

Background

- For how long have you been working in the field of (mobile) technology?
- What kind of work do you do in your current position at … (the organization)?
- What is your experience in the field of technology in relation to health care? (and harm reduction?)

M-health

- What is your experience with M-health?
- How would you describe the value of M-health?

- What is your experience with M-health implementations in Low- and middle-income countries? Could you give examples/elaborate?
- What is your experience with M-health implementations in order to improve the access to care for patients? Could you give examples/elaborate?
- What is your experience with M-health implementations in order to increase patient medical treatment adherence? Could you give examples/elaborate?

Harm Reduction

- Are you familiar with Harm Reduction programs? *short explanation*
- Would you recommend M-health to become a part of these harm reduction programs?
  - what would be the added value?
  - what could cause difficulties?
- How could M-health influence access to health care in harm reduction programs?
- How could M-health influence adherence to health care in harm reduction programs?
- How could M-health become properly implemented in harm reduction programs in low- and middle-income countries, in order to meet the needs of the PWID as well as the care providers?
  - would you consider M-health to be capable?
  - would you consider M-health to be reliable?
- And in practice:
  - what technical aspects need to be taken into account?
  - what would be the financial picture of such an M-health implementation?
  - what kind of parties should be involved?

Advice

- Do you have any advice for the potential of M-health implementation in harm reduction programs for PWUD (for Mainline)?

Closing
**Summary:** summarize the most important topics and answers out of the interview

**Additional information:** would you like to add any other information that might be relevant for this study?

**Procedure:** the information of this interview will be carefully processed and analyzed Mainline and me as a researcher. I will report to this interview anonymously. If you prefer, I can send you a short summary of the interview if you wish, in order to assure the rightful processing of the interview information in the research.

**Questions:** do you have any remaining questions at this stage? Feel free to contact me in case any question arises or additional information to share with me at a later stage.

**Thank you:** thank you for your time and for sharing valuable experiences and insights for this research.
Annex 2

Informed consent form interviews

Purpose of the study

The aim of this study by Mainline is to contribute to optimizing Harm Reduction for people who inject drugs in low- and middle-income countries by exploring the potential of M-health technology. The aim of conducting interviews in this research is to create an overview of expertise and experience concerning Harm Reduction programs in certain contexts and the use of M-health.

Confidentiality

Every answer of the participant will be kept strictly confidential. The information of this interview will only be used for this research and will be anonymously referred to unless the participant agrees otherwise. The interview will only be recorded on tape if the participant agrees with this. After analyzing the interviews, the recordings will be destroyed.

Participation

Participation in this interview is totally voluntarily and participants may withdraw from the interview or refuse to answer a question at any time. At the end of the interview, the main topics and answers will be summarized by the interviewer, which provides the participants with an opportunity to decide if they want to add or retract parts of the information for the research. Accordingly, the researcher will share a short summary of the interview with the participants through e-mail, in order to assure the confidentiality and rightful processing of the interview information in the research.

If you have any further questions regarding this study you may contact Fleur Godrie:

f.godrie@mainline.nl

I have read this consent form and voluntarily agree to participate in this study:

Signature:

__________________________________________________________________________