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PREFERENCES FOR A M(OBILE)HEALTH APPROACH FOR HIV PREVENTION AMONG MEN WHO HAVE SEX WITH MEN: AN EXPLORATORY CROSS-SECTIONAL SURVEY

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Copyright statement

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Abstract

This thesis presents a critical examination of the acceptability of (mobile) technologically delivered Human Immunodeficiency Virus (HIV) prevention, with a focus on condom uptake among men who have sex with men (MSM). The aim is to increase empirical evidence pertaining to MSM's preferences and acceptance of using mobile technology to promote safer sexual practices in order to inform future capital ventures. This thesis employed the Information-Motivation-Behavioural skills model to explore preferences of mHealth delivery methods and HIV prevention content. Data was exclusively collected through an online survey spread through social media. The thesis provides quantitative evidence of preferences through Likert-scale responses demonstrating how HIV preventative content may be engineered and potentially delivered most effectively. Findings demonstrate that using mobile delivery mechanisms such as; short messaging service (SMS), mobile applications and mobile internet, are indicative of highly acceptable and culturally reflective mechanisms to deliver content encouraging safer sexual practices among MSM. Content such as where to access free condoms, informing end-users of the effects of drug and alcohol on using condoms, and clarifying answers to common misconceptions by providing accurate information on using condoms are highly desired. In light of these findings, developers of mHealth for HIV prevention should provide a holistic resource utilising all facets of condom behaviours and not exclusively focusing on HIV prevention or self-efficacy. It is argued from these results that mHealth initiatives should be co-designed by end-users so that they are relevant to the user's needs and preferences. Future studies should be designed to test the impact of mHealth approaches measured by behavioural outcomes using randomised controlled trial methodology.

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Dedications and Acknowledgements

I wish to thank my supervisors, Professor Elizabeth Hughes and Dr Steve Lui, who were more than generous with their expertise and precious time relaying their wealth of knowledge to me along this process.

A special thank you to my twin brother, Michael, whose words of encouragement and push for tenacity ring in my ears. Thank you for being my mirror and reflecting reality back at me, even if sometimes I did not wish to see it.

I also dedicate this thesis to my late mother, Dawn Clarke. I will appreciate all you have done for me, forever.

Finally, the words that I live by, may they inspire a desire to learn in others as they did in me:

"Education is the most powerful weapon which you can use to change the world"

- Nelson Mandela

List of abbreviations

Abbreviation	Meaning
AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
App(s)	Mobile application(s)
BPS	British Psychological Society
CLAI	Condomless Anal Intercourse
GPS	Global Positioning System
GSN	Geo-social Networking
HAART	Highly Active Antiretroviral Therapy
HIV	Human Immunodeficiency Virus
IAI	Insertive Anal Intercourse
mHealth	Mobile Health
MSM	Men who have Sex with Men
RCT(s)	Randomised Controlled Trial(s)
RAI	Receptive Anal Intercourse
SMS	Short Message Service
UAI	Unprotected Anal Intercourse
UK	United Kingdom
USA	United States of America
PeP	Post-exposure Prophylaxis
PrEP	Pre-exposure Prophylaxis
WHO	World Health Organisation
YMSM	Young Men who have Sex with Men

1. An introduction to the thesis

This chapter begins with a description of the literature describing the current landscape of Human Immunodeficiency Virus (HIV) prevalence and incidence rates among men who have sex with men (MSM), on a global scale as well as literature conducted in the United Kingdom (UK). The term mobile health (mHealth) is defined and pertinent literature contextualising this contemporary phenomenon in the face of HIV is critically examined. A literature review of mHealth approaches specific among MSM participants is discussed and provides an insight into the developing relationship between (mobile) technological approaches to HIV prevention and MSM, highlighting the sparsity of literature informing effective mHealth interventions for the needs of this at-risk population.

Mobile technologies have emerged as a powerful, practical, and effective platform in modern efforts of disease prevention, chronic disease management and healthcare delivery. Yet funding bodies, such as the National Health Service in the United Kingdom have been slow in the uptake of the technological affordances mobile technologies present as a social, user-centred tool (Cotton, Hyatt, & Patric, 2012). The growing need for the ubiquitous nature of mobile phones in society to offer associated connections to healthcare treatment, access to services and communication with healthcare providers is a growing need. This is reflected in the evidence supporting the increasing use of technology in everyday life; such as reports from the Office for National Statistics reporting 90% of households in Great Britain having internet access. This is a remarkable increase from that of a decade ago in which 57% of households had internet access. Similarly, the proliferation of social media sites over the past decade is reflected in 73% of adults having access to the internet via smartphones, more than double than evidence from 2011 (Office of National Statistics, ONS, 2017).

Known as 'mHealth', a growing body of literature is developing with the specific aim of designing, distributing, and evaluating the use of mobile technologies in a variety of health domains. While no consensus on the definition of mHealth is widely used at present, the core of mHealth refers to the application of handheld, wireless, mobile technologies in the dissemination of health information for disease prevention and management (Nilsen et al., 2012). Indeed, the uptake of mHealth in healthcare presents a revolutionary transformation of systematic healthcare efforts in

disease prevention and management by utilising these novel technologies for increased accessibility and interactivity of target demographics (Schnall et al., 2016)

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1.1 The Issue: HIV Prevalence among Men who have Sex with Men

Human Immunodeficiency Virus (HIV) epidemics across the globe are diverse in geography as well as population sub-groups affected by the virus (Hernando et al., 2015). The focus in this thesis is the population known as Men who have Sex with Men (MSM). The term MSM is used in this thesis to denote the behaviours engaged in by self-identifying men which may risk the acquisition or transmission of HIV instead of how the individual self-identifies their sexual orientation. MSM present a concentrated epidemic situation to a disparate level which is similarly reflected in other demographics detected through high risk sexual behaviours such as male (and female) sex working populations, and injecting drug users (Monteiro et al., 2015). Emerging evidence highlights the disproportionate burden of HIV incidences among MSM when compared to other men across countries with similar or generalised epidemics (Gesesew et al., 2017; Mutua et al., 2012; Persson, Ellard, Newman, Holt, & Wit, 2011). In the United Kingdom, MSM are the population most at risk of HIV infection, accounting for over half (55%; n = 3360) of all new HIV diagnoses reported in 2014, which are indicative of a growing trend of positive HIV diagnoses in MSM over the past decade (Skingsley, Yin, & Kirwan, 2015). Other demographics at risk highlighted by Public Health England also included men and women who acquired HIV through heterosexual content, people who inject drugs, and mother to child transmission (Kirwan, Chau, Brown, Gill, & Delpech, 2016). To evidence the disparate incidence rates of HIV among MSM, two cross sectional surveys are discussed. Focusing on MSM in the UK, one survey conducted in 2000 ($n = 686$) and the other in 2010 ($n = 696$) by Flowers et al. (2013) found that gay-identifying and other MSM are the group at highest risk of acquiring HIV infection, with results showing MSM represented 54% of all new diagnoses (Flowers, Knussen, Li, & McDaid, 2013). More recent evidence conducted by McDaid et al. (2016) using an amalgam of surveys and the testing of oral fluid specimen among MSM ($n = 2409$) found regional differences (between Edinburgh, Glasgow, and London) in the HIV testing behaviours of UK-based MSM. Results showed only 1 in 5 MSM reflect Public Health England's recommendation of testing for HIV to obtain a clear HIV status every 3 months (McDaid et al., 2016). Given that HIV testing is fundamental to HIV prevention (i.e. knowing one's status), these results are in line with aforementioned studies maintaining that MSM represent a UK-wide burden of risk events for HIV when compared to the majority of the populous (Witzel, Weatherburn, Rodger, Bourne, & Burns, 2017). Not knowing one's status or the delaying of a positive diagnoses is associated with increased levels of onward transmission (May et al., 2011). The burden of HIV diagnoses among MSM are similarly reflected in an empirical surveillance study across Southern-

Eastern Europe. Across Serbia, Albania, Bosnia, Croatia, and Slovenia, MSM represented over half of HIV diagnoses in Serbia and over 70% of diagnoses across Slovenia and Croatia (Bozicevic & Begovac, 2010). Taken together, the aforementioned studies present a growing concern in the face of positive MSM HIV diagnoses in the UK and across Europe.

The consistently reported high rates of HIV diagnoses among MSM are indicative of the need for evidence-based behaviour change interventions to increase the frequency of HIV-preventative behaviours among those at risk for HIV infection. As there is yet to be a cure for HIV, research should recognise the scale of the HIV epidemic in the United Kingdom, and challenge ongoing rates with prevention at the forefront. More resources are necessary at local and national levels. Therefore, preventative services should be routinely and robustly analysed to inspire future effective preventative programmes and methods.

As stated, a focus on behavioural transmission of HIV must be acknowledged in the future ways in which HIV infection can be challenged. It cannot be ignored that the impact of behaviour change interventions promoting condom use have been somewhat infective. This notion is evidenced by Phillips et al. (2013) in an analysis of the HIV epidemic in the UK among MSM. Results evidenced a modest (26%) rise in condomless sex between 1998 and 2010 among MSM (Phillips et al., 2013). Therefore, while it can be argued that earlier HIV prevention strategies among MSM have been engaged with by the collective response of gay communities in the widespread adoption of safer sex behaviours (Merson, O'Malley, Serwadda, & Apisuk, 2008), conclusions regarding the efficacy of these cannot be drawn as the rates of ongoing condom use have not been evidenced. With these results in mind, HIV preventative strategies must therefore not approach prevention by isolating behaviours, such as focusing on behavioural transmission, or access to HIV testing and condom resources at the exclusion of another focus, but instead must be approached in a holistic method to increase preventative behaviours and reduce potential barriers to optimising biomedical interventions (Lorenc et al., 2011)
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1.2 Risk compensation in the face of biomedical/biobehavioural interventions among MSM.

Biomedical HIV prevention interventions pertain to the use of condoms, vaccines, microbicides, penile circumcision, treatment of sexually transmitted infections (STIs), and the use of antiretroviral drugs by HIV-negative people (post-exposure prophylaxis and pre-exposure prophylaxis) and HIV-positive people (treatment as prevention through antiretroviral drugs; Hugo et al., 2016). Therefore, the introduction of such preventative strategies has prompted a reconceptualisation of 'unprotected' anal intercourse to an inclusive term of 'condomless anal intercourse' (CLAI) as, in the lens of the above preventative approaches, one can be engaging in HIV prevention while not wearing a condom.

This section will focus on those of antiretroviral therapies among MSM. In line with this notion of 'protection', the advent of antiretroviral therapy (ART), and highly active antiretroviral therapy (HAART) have transformed the notion that a positive HIV diagnosis is a death sentence into a manageable chronic condition (Fu et al., 2012). The discussion of the potential risk compensation in the face of biomedical interventions among MSM is a pertinent discussion within this thesis as emerging evidence has established that the availability of biomedical interventions has led to increases in sexual risk behaviour and sexually transmitted diseases (STDs) among MSM (discussed below). A highly frequent method to evidence this notion is the use of cross-sectional studies using MSM respondents by measuring levels of sexual risk behaviour, perceived and real viral loads, risk compensation, and beliefs about HAART (Elford, Bolding, Maguire, & Sherr, 2000).

MSM who perceive low risk of HIV transmission are more likely to forgo condom use (Mao et al., 2011). Risk compensation can be conceptualised as an increase in risky behaviours due to a decrease in perceived risk of HIV, based on beliefs about the protective effect of a biomedical or biobehavioural strategy (Cassell, Halperin, Shelton, & Stanton, 2006). In line with this, drawn from modelling HIV vaccines in South Africa (Andersson et al., 2012), Brazil (Fonseca et al., 2010), and Thailand (Nagelkerke, Hontelez, & de Vlas, 2011), authors have hypothesised that high levels of risk compensation in response to conducting high levels of preventative behaviours present an increasing predisposition to HIV infection. Indeed, researchers have cautiously named this phenomenon a 'chemical prevention' approach; in that, in the place of traditional risk

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reduction strategies such as a condom, adherence to ART may present instrument to facilitating high-risk behaviours which undermine the benefits of ARTs in the reduction of transmission rates (Cassell et al., 2006; Grant et al., 2005).

As HAART improves physical health, HIV-infected individuals may be more likely to engage in unsafe sex; for example, through risk compensation. Risk compensation can also be reflected in the pervasive theory of how individuals manage their personal risk. In this theory, Wilde (1994) argues an individual has an acceptable level of perceived risk which they may exchange for anticipated benefits from particular activities (Wilde, 1994). It can be hypothesised that in permitting risky sexual activities, an individual maintains an approximate and acceptable level of risk. Given that sexual health interventions aim to reduce risky sexual behaviours, this introduction may cause an individual to increase risky behaviour in the face of heightened risk prevention efforts through the intervention. In a longitudinal study of 217 HIV-negative MSM, Stotle et al (2004) report a diminished perception of HIV risk for those who engage in unprotected receptive anal intercourse (RAI) since the availability of HAART (Stolte, Dunkers, Geskus, Coutinho, & Wit, 2004). Similar results were also reported in a cross-sectional study of 547 MSM (218 HIV-negative and 329 HIV-positive) with authors reporting a reduction in the perceived risks associated with HIV transmission due to HAART evidenced through a strong association between HAART and sexual risk taking (Ostrow et al., 2002). In a meta-analysis of biomedical approaches to HIV prevention, Crepaz, Hart, and Marks (2004) found that in individuals who thought antiretroviral medication reduced the likelihood of HIV transmission were more likely to engage in CLAI. Moreover, authors report unprotected sex was associated with the belief that an undetectable viral load afford protection against HIV (Crepaz, Hart, & Marks, 2004). Causality, however, between the perception of HIV risk and behaviours cannot be made. A current health campaign embodying the success of HAART is the 'U = U' campaign which denotes an undetectable level of the virus in a HIV-positive individual's blood does not pose a risk of infection to their sexual partners (NAM aidsmap, 2017). These studies and campaigns evidence how engaging in interventions (HAART) may alter the perceived risks for HIV transmission or acquisition when engaging in unprotected sex.

Given emerging evidence of risk compensation seen in the fact of HAART, it is reasonable to argue that the ART preventative approach used could have similar reflections on sexual behaviour

for those adhering to pre-exposure prophylaxis also known as a PrEP. PrEP is the use of an antiretroviral medication for those who are uninfected to prevent the acquisition of HIV infection. To explore the effectiveness of PrEP, a randomised control trial (RCT) on the use of PrEP is discussed. Over 2 years (2009 – 2011), the Pre-exposure Prophylaxis Initiative (iPrEx) found (from a sample of 2499 MSM in six countries) that taking PrEP daily reduced HIV infection by 44% compared to those given a placebo (Grant et al., 2010). Despite evidence of the effectiveness of PrEP as a viable biomedical and biobehavioural prevention strategy, uncertainty remains on the potential impact PrEP may have on sexual practices. A key concern is that PrEP adherence may lead users to engage in more risky behaviours through risk compensation – reflecting similar concerns to that of HAART. There is a dearth of literature with an explicit focus of risk compensation associated with PrEP. In a double-blind, randomised, placebo-controlled trial Liu et al. (2013) assessed sexual risk in 400 HIV-negative American (San Francisco, Atlanta, and Boston) MSM from audio computer-assisted self-interviews. At baseline, participants reported a mean number of CLAI (in the past 3 means) of 4.78, with marginally significantly greater numbers in the following 3 months (5.79) and a reduction of this following PrEP dosing (to 3.78, p =0.08). The frequency of CLAI did not change significantly with continuation of PrEP dosage (p = 0.22). Therefore, Liu et al., (2013) found no evidence of risk compensation among high-risk MSM among their PrEP clinical trial study. More specifically, mean numbers of partners and frequency of CLAI decreased significantly from baseline to follow up (of a 24-month period). This study presents results with an emerging and continuing need to acknowledge changes in sexual practices in the face of biomedical approaches to HIV prevention. An alternative exploration of sexual practices associated with PrEP was conducted in a cross-sectional study by Whiteside, Harris, Scanlon, Clarkson, and Duffus (2011). Through assessing self-perceived risk of HIV infection and attitudes toward PrEP, MSM were significantly more likely to have knowledge of PrEP (compared to heterosexual participants). Participants whom reported 2 to 4 sexual partners in the past 3 months were also 2.35 times likely to have a lower level of perceived risk of HIV than those who had 1 sexual partner (p=0.0003).

In consolidation of the aforementioned studies, it can be argued that despite initial concerns of PrEP's impact on risk compensation, one can posit that PrEP adherence may promote safer-sex behaviours by reminding users of their vulnerability to HIV (Golub et al., 2010). However, the aforementioned studies highlight a shift within HIV prevention approaches from one of

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behavioural interventions to that with a biomedical methodological approach. While this thesis acknowledges the lack of support of risk compensation evidenced within PrEP demonstration studies (such as the above), caution is taken in using a singular focus on biomedical interventions to the omission of behavioural components. This sentiment is reflected by Kippax and Stephenson (2012) whom argue the separation of biomedical from behavioural change interventions will have little impact on the trend of HIV intervention rates; going on to urge that researchers must acknowledge the role of behaviour change in promoting adherence to condoms, clean needles, PrEP approaches (Kippax & Stephenson, 2012).

1.3　The role of technology in Sexual Risk among MSM

The last decade has seen a proliferation of mechanisms in which MSM may seek sexual partners from social networking websites, to chat rooms, to mobile applications also known as 'apps' (Paz-Bailey et al., 2017) leading some authors to characterise this population as early adopters of technology in the face of sexual health and sexual partner selection (Rosser et al., 2011). This is in stark contrast to the earlier histories and persecutions of LGBT communities, in which enforced behaviours were due to illegalities of minority sexualities. Anonymous sexual seeking practises when HIV epidemic began often referred to the use of public restrooms, cruising areas, and bathhouses to meeting sexual partners (Kerr, Pollack, Woods, Blair, & Binson, 2015). The role in which technology, as novel mechanisms of sexual seeking, plays in the sexual health of MSM is highly pertinent. McFalane et al. (2000) demonstrated that MSM are more likely to engage in CLAI with sexual partners met through the internet (online) compared to partners they meet in offline venues (McFarlane, Bull, & Rietmeijer, 2000). While it is impossible to argue that the internet serves as a medium which facilitates risky sexual behaviours, it can be argued that this study endorses the notion that the internet provides an environment in which risky sexual behaviours can be explored, negotiated, and acted upon.

Sexual minorities (lesbian, gay, bisexual, transgender, and MSM), represent a marginal group relative to heterosexual people; thus, living in a heteronormative culture where it is not immediately apparent who may be of a minority sexual identity reduces the likelihood of engaging in sexual encounters through face to face situations (Hillier, Mitchell, & Ybarra, 2012). Geosocial networking (GSN) smartphone applications which use global positioning systems (GPS) to locate users present a novel mechanism which facilitate connections between users using physical proximity (Goedel, Halkitis, Greene, Hickson, & Duncan, 2016). The proliferation in the use of these GSN applications might be because they are highly facilitative in procuring a sexual encounter (also known as a 'hook-up') as users can easily find potential sexual partners which are nearby on their smartphone – a device in which people tend to carry with them always and thus may efficiently arrange casual sex through this ubiquitous technology in everyday situations (Macapagal, Coventry, Puckett, Phillips Ii, & Mustanski, 2016). An exploration of the association between sexual health risk and mobile applications, or GSN applications, is pertinent as it encapsulates the developing role in which technologies plays in facilitating sexual encounters and thus informs the design of tailored interventions which can monopolise this developing role.

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Grindr, a popular app targeting MSM using GSN, has reported that it has over six million users worldwide (Rendina, Jimenez, Grov, Ventuneac, & Parsons, 2014). Research must therefore attenuate to the role in which GSN plays in the sexual risk of MSM. This was the focus of a Los Angeles based study focusing on young men who have sex with men (YMSM) by Winetrobe et al (2014). YMSM, as defined by the Centre for Disease Control and Prevention (2011) are between the ages of 13 – 29 years of age. In this study, authors aimed to evidence the association between HIV risk among YMSM using Grindr and the associations of engaging in CLAI in Grindr-facilitated hook-ups (Winetrobe, Rice, Bauermeister, Petering, & Holloway, 2014). From a sample of 195 MSM (25.6% of approached participants), results evidenced that YMSM who continually used Grindr (for at least one year or more) were statistically significantly more likely to engage in CLAI in Grindr-facilitated hook-ups than those who did not. Authors further found that an increase in sexual partners was positively correlated with previous CLAI with Grindr-facilitated hook-ups. Authors claimed the increased familiarity in using Grindr with other users lowered the user's perceived susceptibility to HIV, however, evidence does not support this claim empirically as perceived susceptibility was not directly assessed. Risky sexual behaviours of Grindr using MSM was the focus of Goedel et al. (2017) who reported 40% of participants engaged in insertive and receptive CLAI in the past 6 months with an average of 1.85 for insertive, or 1.76 receptive MSM (Goedel, Krebs, Greene, & Duncan, 2017). The insertive (or commonly known as 'top') and receptive (or commonly known as 'bottom') roles are integral to these findings as the CDC reports the receptive role is 13 times more likely to get infected with HIV than the insertive. These results are in line with Holloway et al. (2015) who found in a sample of American MSM (n = 295), 29% of Grindr users engaged in CLAI (Holloway, Pulsipher, Gibbs, Barman-Adhikari, & Rice, 2015). When controlling for socio-demographic, sexual orientation and relationship status, MSM who used Grindr for more than a year were more likely to have CLAI in the last sexual encounter facilitated through Grindr than those who had used the app for less than a year; evidencing that these more recent findings support that of Winetrobe et al's (2014) earlier unsupported claims. These results, however, are not consistent with other research found in a sample of Chinese MSM (n = 299). In this study, Lee et al. (2012) reported, from a sample recruited from 9 gay saunas, that GSN application users did not have a higher practice of unprotected sex when compared to non-application users, despite the majority of respondents having unprotected sex in the last 3 months. Thus, divergences in the results may be drawn from the recruitment methods (venue-based or

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online) as well as cultural and social norms; that being Winetrobe recruiting in the West and Lee et al. recruiting from the East.

In displaying banner advertisements to recruit MSM for a surveillance study in Pennsylvania, USA, Buckingham et al. (2017) used 4 versions of displaying HIV prevention services that appeared under the opened application Grindr (Buckingham et al., 2017). Results evidence over 329 unique Grindr users engaged with the banner advertisements (59 participated in follow up survey). A risk behaviour survey (defined by the number of sexual partners, and number of unprotected sexual encounters) of Grindr users accessing the banner advertisement revealed a majority (70%, n = 39) White demographic (30%, n = 17 were Black/Hispanic). Of the whole sample, 93% (n = 55) self-reported having multiple partners in the last six months (mean of 5.73 partners). Taken together, these lend support to the notion that MSM who use the internet or applications with access to the internet to meet sexual partners are more likely to have high-risk sexual behaviours represented in a higher chance of having CLAI with a higher than average number of sexual partners (Landovitz et al., 2013).

The aforementioned studies provide an important contemporary snapshot of the patterning of MSM's use of gay social and sexual networking sites and applications. Acknowledging these behaviours is integral for the future of HIV prevention initiatives as research must understand the uniqueness in the sexual behaviours among smartphone users and the potential risk of HIV in order to establish HIV preventative measures with increased rigour and potential efficaciousness. Given the need to address this contemporary way for MSM to engage in sexual and social encounters, the current research represents an exploratory study evidencing this new territory.

1.4   The mHealth approach

There is no unified guidance relating to HIV prevention among MSM across the UK despite considerable guidance from the European Centre for Disease Prevention and Control (European Centre for Disease & Control, 2015). Given that the number of smartphone users has flourished across the globe and downloads of smartphone applications have grown significantly, the role in which mobile technology, including applications, plays in presenting a new platform for mobile health dissemination (and networking) is vital in the context of this thesis (Bert, Giacometti, Gualano, & Siliquini, 2014). Yet while mHealth offers innovative mechanisms in healthcare sectors, uptake is slow across a variety of health conditions (Dale et al., 2014). May et al (2011) argues that uncertainty regarding health policies were to blame for the lack of successful uptake in novel mHealth approaches, going on to say that has impeded the normalisation of mHealth and thus has stagnated future optimal uptake (May et al., 2011).

Intrinsic to the design and engineering of mHealth initiatives as a mechanism for behaviour change is the opportunity (and challenges) of interdisciplinary collaboration between healthcare professionals and researchers. This thesis examines research demonstrating the variability in preferences for mHealth behaviour change content and delivery methods among MSM. Despite a plethora of mobile applications that attempt to tackle health conditions available in the application marketplace, the design process and impact of these apps are not robustly evaluated (Nurmatov et al., 2014). The insurgence of mHealth approaches to health conditions also must be considered in the wider economics of the government healthcare approach; with a focus on streamlining structures and systems of healthcare provided to the populous. This is reflected in the British Government's vision statement pertaining to the transformation of healthcare in the face of austerity measures, noting an "expanding set of NHS accredited health apps that patients will be able to use to organise and manage their own health and care" (NHS England, 2014, p. 32).

At its core, mHealth refers to the use of mobile technologies for medical and public health practices (Nilsen et al., 2012). This thesis will draw on the World Health Organisation's conceptualisation of mHealth defined as; '[the] medical and public health practice supported by mobile devices such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices [involving] the use of and capitalisation on a mobile phone's core utility of voice and short messaging services (SMS) as well as more complex functionalities and applications

including general packet radio services (GPRS), third and fourth generation mobile telecommunications (3G and 4G) and global positioning systems (GPS)' (WHO, 2011, p6). As the most widely used technology across the globe, mHealth has a significant pervasiveness which can be assimilated in the production of disease prevention and management strategies to improve overall health or treatment of health conditions (Fortuin, Salie, Abdullahi, & Douglas, 2016). In this sense, the WHO presents a holistic conceptualisation of mobile technology in the potential application for improving a variety of health conditions. Indeed, utilising mHealth as a platform for health condition interventions may further increase accessibility to the next generation, or young adolescents in "generation Z" whom have extensive access to digital technology resources in order to text, chat, email and interact through social applications (Crosby, Ware, Joffe, & Britto, 2017; Ippoliti & L'Engle, 2017). At the 'core' of contemporary smartphones is the ability to exchange communications in a variety of formats (including SMS or text messaging), share news and photographs, interact on social media application platforms, and obtain information (Cingel & Sundar, 2012; Underwood, Rosen, More, Ehrenreich, & Gentsch, 2012). These functions present an insurmountable potential to deliver behaviour change effectively through mobile technology, especially for those MSM argued to be growing up surrounded by this form of technology (Eisenberg, Bauermeister, Pingel, Johns, & Santana, 2011).

A variety of mHealth interventions have been conducted, however, results appear to be inconsistent. In a systematic review of 8 randomised controlled trials (RCTs) of mHealth for non-communicable diseases, Stephani et al. (2016) argued given the heterogeneity of interventions and outcomes, firm conclusions about the effectiveness of the interventions were unable to be made (Stephani, Opoku, & Quentin, 2016). Similar mixed results regarding efficacy were reported in a systematic literature review of 12 mHealth interventions designed to prevent alcohol and substance abuse (Kazemi et al., 2017). Positive results regarding the effectiveness of mHealth interventions in the promotion of physical activity were reported by Muller and colleagues in their assessment of 15 studies including 8 RCTs and 7 quasi controlled trials (Müller, Alley, Schoeppe, & Vandelanotte, 2016). In a systematic literature review on mHealth for HIV treatment and prevention, Catalani and colleagues reported following a review of 62 studies (5 RCT) that a myriad of mHealth mechanisms such as linkage to care, retention in care, adherence to treatment, educational messaging, and information delivery were used. Catalani et al. (2013) report a promising trend towards mHealth initiatives while acknowledging the likelihood of publication

bias leading to a lack of negative findings being accessible for review (Catalani, Philbrick, Fraser, Mechael, & Israelski, 2013). The possible interference of methodological differences within each review study evaluating evidence in each literature review as well as methodological differences across each study reviewed cannot be ruled out in the conclusions constructed around mHealth interventions. Methodological differences such as small sample sizes, lack of comparison groups, attrition rates, as well as a lack of long-term follow ups and differences in the features of mHealth interventions have been acknowledged to impact on these innovative approaches to delivering health service support (Aranda-Jan, Mohutsiwa-Dibe, & Loukanova, 2014). Despite these methodological concerns, the aforementioned literature reviews indicate a growing body of evidence exploring the usability, acceptability and feasibility of mHealth initiatives in a variety of demographics and associated health conditions.

1.5   mHealth for HIV prevention adherence among MSM

The broad use of mobile applications which have created a new risk environment for the transmission of HIV among MSM also present mechanisms to reach at-risk MSM with behavioural interventions promoting safer sexual practices (George, Phillips, McDavitt, Adams, & Mutchler, 2012). Given the reach, accessibility, affordability, anonymity, and popularity of the internet used by MSM to seek sexual encounters, internet- and mobile-based biomedical and behavioural prevention interventions present exceptional promise in challenging HIV among MSM (Wei, Lim, Guadamuz, & Koe, 2014).

Instead of developing and creating new mobile applications for MSM users to download and engage with, early pioneering research has leveraged established popular apps which may improve the dissemination of health promotion information to an established user base. One such study conducted by Sun et al. (2015) used an anonymous survey to evaluate the acceptability and feasibility of using four popular MSM-targeted apps (Adam4Adam, Grindr, Jack'd and Scruff) to promote HIV and STD testing. Drawn from an older (average age of 41 years old) sample of American active app using (measured through Grindr being the most used app in the past month) MSM (n = 450), 63.8% of users reported that they wanted to receive sexual health information via an app (Sun, Stowers, Miller, Bachmann, & Rhodes, 2015).

Extending to direct contact, in a venue-based testing study in which staff (members of a sexual health clinic) supported high-risk Latino MSM's engagement with HIV prevention and care via SMS, e-mail, social media and mobile applications, Bonnet and Perez (2014) reported enthusiastic engagement from users; identifying 260 MSM (159 of these ages 13 – 29) getting tested for HIV and receiving HIV positive results (Bonnet & Perez, 2014). Similar efforts to pilot a mobile-network based safer sex intervention to reduce HIV transmission among MSM was conducted by Milam et al. (2016). In this study, MSM were randomised (1:1) to receive either a monthly behavioural risk survey instrument alone or with a tailored prevention message targeting condom use, disclosure of HIV status, and adherence to ART medication. From a sample of 181 MSM, authors reported (in comparison to participants receiving a monthly behaviour risk survey instrument) a reduction in CLAI and an increase in HIV status disclosure (Milam et al., 2016). These findings support the further study of technology as a mechanism to deliver HIV prevention.

Prior existing mHealth HIV interventions have predominantly used short message service (SMS) texting to provide HIV risk-reduction messages. One such study conducted by Cornelius et al. (2011) used multimedia text messages to depict modes of HIV transmission providing access to videos of role-play scenarios. Results drawn from high response rates by clients for more SMS messages (80%, n = 14) were indicative of the sample's interest in receiving information about safer sex behaviours mediated through technology. While purporting evidence of mHealth for HIV prevention risk reduction, given the small, convenient, and exclusively African American sample caution in generalising results is warranted. Despite this limitations, Cornelius et al (2011) evidence a developing acceptance and supporting role in the novel delivery of HIV risk reduction messages (Cornelius, Cato, Lawrence, Boyer, & Lightfoot, 2011). Results from an earlier meta-analysis support Cornelius et al (2011)'s demonstration that text messaging interventions are effective at promoting healthy behaviour change. In a Cochrane Review of SMS health behaviour change interventions, Fjeldsoe et al. (2009) found 8 empirical studies reporting statistically significant positive behaviour changes (Fjeldsoe, Marshall, & Miller, 2009). These finding have important implications for the future development mHealth promotion in the form of mobile applications; taken together, the use of mobile phone technology as a platform for health promotion is evidenced to be accepted among MSM and presents a viable and accessible mechanism in exposing users to potentially significantly impactful risk reduction stimuli.

As smartphone technology develops so too does the use of mobile applications and new forms of communication such as internet-mediated messaging. Surveillance statistics from comScore – a mobile application traffic surveillance company – reported an increase in mobile application use to 90%, accounting for 77% of total time of user's engagement with digital media content (comScore, 2015). This is reflected in the adoption of novel means for MSM to locate sexual partners through the use of GSN applications which utilise global positioning system (GPS) to allow access between users in close proximity.

The following evidence explores the use of GSN applications as a method of mHealth for HIV prevention. One such study conducted by Holloway et al. (2014) explored young men who have sex with men (YMSM)'s willingness to engage in smartphone application-based HIV prevention efforts (Holloway et al., 2014). Focusing on app acceptance results, participants (n = 195) were asked whether they would be willing to take a class about HIV prevention online (yes/no) and if

they would be willing to participate in a HIV prevention program delivered via a smartphone app (yes/no). Participants were highly accepting of online and smartphone application-based programs (71% and 70%, respectively). Holloway et al., (2014) were unable to demonstrate the type of information participants prefer to receive. This omission, however, was explored in a more recent exploration of MSM acceptance of HIV prevention information delivered through GSN mobile applications, conducted by Czarny and Broaddus (2017). In this study (n = 220), on a 5-point Likert-scale participants indicated a high degree of acceptability regarding receiving informational content such as "negotiating condom use with sexual partners" and "discussing HIV status with potential partners" ($m = 4.00$, SD = 1.27), as well as risk reduction ($m = 3.82$, SD = 1.22, Czarny & Broaddus, 2017). Regarding the delivery of the previously mentioned health information, participants were highly accepting of receiving sexual health information from a designated section within an app ($m = 3.86$, SD = 1.29) and message alerts ($m = 2.92$, SD = 1.48). The results presented by Czarny and Broaddus (2017) support emerging evidence establishing the specific types of information MSM find most acceptable to receive and their preferred method of delivery (in this case, an app). However, as participants were recruited at a Pridefest and excluded heterosexual identifying men, it is plausible that results do not characterise the represent the MSM population. Earlier considerations regarding results comparing that offline recruited participants – such as that of Czarny and Broaddus (2017) – with online recruited participants (Holloway et al., 2014) argue for caution in comparing results drawn from these divergent recruitment methods.

Similar results reporting a high degree of acceptance for mHealth for HIV prevention among black MSM (n = 93) were reported by Levy et al. (2015). In this mixed-methodological approach using surveys and open responses to explore the acceptance of using smartphone applications to improve access to HIV prevention, MSM respondents desired a mHealth initiative that would be an app which was 'gay friendly', 'culturally appropriate', and used geo-location services to signpost users to nearby health services. Moreover, Levy et al. (2015) found MSM respondents endorsed the utility of a mHealth application, with participants evidencing that an app would facilitate access to healthcare. Authors concluded that the high degree of acceptability to a mHealth app for HIV prevention could be attributed to a primary focus on improving end-user's self-efficacy (Levy et al., 2015).

Despite the limitations highlighted in Czarny and Broaddus' (2017) investigation, other empirical research supports their findings regarding interest in and acceptance of information delivered through mHealth initiatives. Shrestha et al. (2016) implemented a similar study, however, in this investigation acceptability of mHealth was measured by asking participants if they were willing to use mHealth by receiving reminders to take medication, receive information about HIV, as well as assess sexual behaviours in order to promote better health outcomes (Shrestha, Karki, & Copenhaver, 2017). Moreover, participants were asked on their preference for the frequency in delivering the aforementioned health promotions (daily, weekly, and monthly) and type of delivery (phone call, text message, or e-mail). From a sample of 400 participants, results indicated the majority of participants (72%, n = 289) desired to receive medication reminders via mHealth. Regarding information on HIV, participants were very interested in receiving information about HIV (66%) and to assess sex-related risk behaviours (65%) on a weekly basis (27%).

These findings make several contributions to the growing literature on mHealth for MSM. Firstly, these findings enhance our understanding of the growing popularity of GSN apps and the emerging evidence that supports claims of the benefits of incorporating the delivery of HIV prevention information into innovative – and already established – mobile applications which may enhance the dissemination of vital information to high risk groups. Secondly, the evidence suggests an amiability to smartphone application-based HIV prevention information among MSM; denoting a growing populous of MSM willing to engage with HIV prevention in innovative methods of delivery. Considering the trend in the shift from offline venue based sexual risk to an association of risk through online mechanisms, findings highlight the need for more research into mHealth HIV interventions (including establishing a robust and rigorously developed evidence base of potential content and delivery methods that MSM are willing to receive and engage with). This will produce highly valid findings should mobile technology continue to play an integral role in HIV incidence rates among MSM.

Some of the studies discussed above regarding MSM and mHealth were conducted in a venue-based settings, or did not acknowledge the role of the internet, and thus lack a key component, namely, that of reflecting the contemporary methods of engaging in sexual encounters through the internet in the methodological approach to analyse such a phenomenon. This study builds on

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previous research by analysing the preferences among MSM regarding mHealth mediated through exclusively recruiting MSM via social media.

2. The current study

2.1 Theoretical Framework

The conceptual framework for the current research was the Information-Motivation-Behavioural skills (IMB) model (see figure 1) which posits an individual who is knowledgeable about HIV transmission and prevention, are motivated to implement preventative behaviours, and perceive themselves to be able to conduct preventative behaviours will engage in behaviours that reduce their risk of HIV infection (Fisher, Fisher, Williams, & Malloy, 1994; Fisher, Willcutts, Misovich, & Weinstein, 1998; Fisher, Williams, Fisher, & Malloy, 1999).
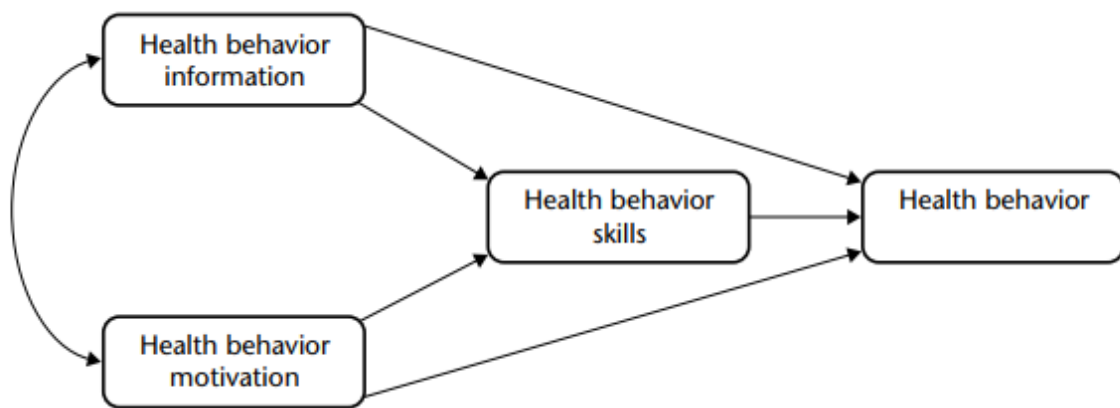
Figure 1 The Information-Motivation-Behavioural Skills Model of health behaviour
From Fisher and Fisher (1992). Changing AIDS risk behaviour. *Psychological Bulletin*, 111, 455 – 74. Copyright APA. Reprinted with permission.

Adequate and accurate information regarding HIV prevention and transmission is crucial for all future preventive behaviour an individual may engage in (Fisher, 2011). This may include, but is not limited to, specific facts associated with HIV prevention and transmission and the clarification of incorrect heuristics (Fisher, Fisher, Bryan, & Misovich, 2002). Kalichman et al. (2008) investigated the role of information in the motivation to reduce HIV risk behaviours in a sample of (n = 391) MSM. A 30-item knowledge scale focusing on factors affecting HIV transmission or proper condom use was used to measure acquired immune deficiency syndrome (AIDS)

knowledge, including items such as 'Is a small hole in a condom okay, as long as the entire condom does not tear?' measured on a 'yes', 'no', or 'don't know' scale. Authors report AIDS knowledge was associated with self-efficacy and self-reported motivation to use HIV prevention methods. In multivariate analyses, AIDS knowledge did not independently predict behaviour to change in the increase of HIV prevention methods, compared to that of motivations to change and perceived self-efficacy (Kalichman, Picciano, & Roffman, 2008). These results, therefore, offer limited support for the IMB model in predicting risk over time among MSM. While relaying on a convenience sample and self-reported measures, Kalichman's results do not negate the importance of delivering HIV information or raising consciousness regarding HIV acquisition and transmission. Instead, results add support to the IMB model's role in conceptualising the active elements which coalesce to influence safer sexual practices. In harnessing a mHealth approach with a focus on knowledge/awareness raising (not in isolation) this offers a logical and theoretical precursor to inform behaviour change.

Motivation to engage in HIV preventative behaviours is also crucial to the implementation of preventative behaviours, as it cannot be ignored that an individual who is highly informed of HIV transmission and prevention may engage in high risk behaviours (Fisher & Fisher, 1992). Motivations for HIV preventative behaviours may be drawn from personal fears of becoming infected and endorsement of HIV preventative behaviours in an individual's social network (Aliabadi et al., 2016). Investigating the integral role of motivation in safer sex practices was explored in a longitudinal analysis of adolescents by Mustanki et al. (2006). In this investigation, attitudes and behavioural intentions were assessed using self-report measured based on IMB model constructs (Fisher & Fisher, 1992). Using items such as 'Friends that I respect think I should use condoms every time I have sex' and 'If I have sex during the next 2 months, using condoms every time would be' then with options of 'very bad' to 'very good', authors found motivation had a significant negative effect on levels of sexual risk. A moderate positive relationship was also reported in association with behavioural skills, suggesting the higher an individual's motivation to prevent HIV transmission, the greater the perceived behavioural skills and less risky sexual behaviours implemented (Mustanski, Donenberg, & Emerson, 2006). This study, however, was limited in its results as the study relied on self-reported data from adolescents. In this regard, many sociocultural variables which influence sexual behaviour during adolescents may not be replicated in that of adult MSM and thus results must be interpreted with these limitations in mind. Despite

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these limitations, Mustanki et al (2006) report robust findings, measured longitudinally, evidencing the importance of acknowledging the social context (social norms and attitudes), the inclusion of broad contextual frameworks, including motivation, in the development of efficacious HIV preventative measures.

Behavioural skills associated with HIV prevention may refer to condom use self-efficacy and safer sex negotiation self-efficacy (Fisher & Fisher, 1992). In a single-session targeted intervention focusing on behavioural skills and self-efficacy among Indian MSM truck drivers ($n = 125$), Cornman et al (2007) measured perceived behavioural skills on to the degree to which participants found it 'hard' or 'easy' to implement condom use with both marital and non-marital partners, as well as to what degree acquiring and using condoms was 'very hard' or 'very easy' to do. Intervention content pertained to participants attending IMB informed workshops in which behavioural skills were addressed by taking participants through a demonstration and a rehearsal of how to put on and store a condom with corrective feedback. Participants were also informed on where to access free government condoms and purchase branded condoms. Authors reported a significant effect of IMB workshops relating to condom use with martial partners but not on skills relating to condom use with non-martial partners, or buying and carrying condoms (Cornman, Schmiege, Bryan, Joseph Benziger, & Fisher, 2007). While the sample of Indian truck drivers may be impacted upon by influences which may not transcend to western MSM such as the essentialism of a masculine identity or gender role norms, it is incredibly note-worthy that a single-session targeted intervention impacted behaviour. While presenting mixed support for the role of behavioural skills as a construct within a theoretical framework to which may inform prevention strategies, Cornman et al. (2007) evidence the growing need to explore how to effectively and safely motivate high risk individuals to use condoms in sexually exclusive and non-exclusive relationship dynamics.

While empirical evidence investigating the IMB model regarding HIV prevention have reported mixed results, particularly regarding the role of HIV prevention information, a sizeable body of research continues to grow exploring HIV prevention among MSM. Indeed, in a review and meta-analysis of 15 studies focusing on the efficaciousness of prevention programmes for HIV-positive MSM, Johnson et al. (2006) found interventions were more successful at increasing condom use if the intervention included motivational and behavioural skill components (Johnson, Carey,

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Chaudoir, & Reid, 2006). In a more broad meta-analysis of 354 intervention studies with the aim to test behaviour change theoretical assumptions by examining outcomes, Albarracín et al. (2005) found the most effective interventions contained attitudinal arguments, educational information and behavioural skills training (Albarracín et al., 2005). The aforementioned reviews support the theoretical model with concepts such as educational information, motivational and skill components being subsumed within the IMB model.

The IMB model is most appropriate for the current thesis as it presents a theoretical framework which identifies the determinants of HIV preventative behaviours, to which can map onto future designs and implementations of risk reduction interventions for MSM. Thus, by using this model which predicts HIV preventative behaviour, the efficacy of HIV content delivered through mHealth can be assessed quantitatively.

2.2 Aim: an end-user focus

Following the previous outlining of mHealth and MSM literature, it is crucial for research to directly involve MSM in the design delivery and acceptability of mHealth initiatives. By developing a distinct online survey to address preferences among MSM for mHealth approaches, this study addresses and builds upon previous studies by generating more detailed preferences by potential end-users in the future construction of mHealth for HIV prevention. Moreover, by disseminating the survey through social media this survey extends the reach of previous studies which exclusively used venue-based settings by spreading the survey to an online platform with potentially limitless reach to social media using MSM. Differences in participants' methods of finding sexual partners related to using mobile technology was also explored. By exploring mobile technology use in partner selection, the current study investigates what role this behaviour is related to preferences of mHealth delivery method.

In addition to mHealth construction preferences, a second concern of the present study was to assess concerns of privacy and confidentiality. Previous studies measuring mHealth interest from Grindr (Holloway et al. 2014) failed to acknowledge any concerns over participation in a mobile application-based mHealth HIV prevention initiative. No previous research could therefore be found that has explored this practical issue in hypothetical participation in mHealth HIV prevention programmes. Thus, a novel contribution to the literature was intended.

Thus, the goal of this study was to recruit a sample of MSM individuals in order to elucidate findings which may be used in guiding the developing of future mHealth applications for HIV prevention via a quantitative research methodology. As smartphone devices and software are ever-expanding, the purpose of the current study was to identify preferred methods of delivery and HIV content delivered through these preferred methods to support condom use. While no direct hypothesis is made, it cannot be ignored that the discussion of previous empirical findings regarding MSM and mHealth suggest a sample of smartphone-owning individuals who would recommend a variety of strategies to maximise the relevance and utility of mHealth apps to support condom use.

2.3   Research questions

The primary research questions are formulated as follows:

1. "What are the preferences of MSM regarding mobile delivery methods for HIV prevention?"
2. "What are the preferences of mHealth for HIV prevention content?"

The secondary research question explores the impact of sociodemographic influences on mHealth preferences within the recruited sample of MSM:

   a. "What, if any, sociodemographic differences occur within mHealth acceptance?

3. Methodology

This chapter will outline the research methodology including a rationale for the research design, how the online survey was designed and implemented and the limitations of the research and ethical considerations.

3.1 Rationale for an online survey research design

The internet presents optimal potential for conducting research; by using this as a medium academics are able to present research to a wider reaching audience for study participants or survey respondents (Christensen, Griffiths, & Korten, 2002). This development is particularly pertinent to the recruitment of hard to reach samples such as MSM populations in rural regions (Wright, 2005).

MSM demonstrate a well-established reliance on social media technology and sexual social media application which enables sexual partner selection (Garofalo, Herrick, Mustanski, & Donenberg, 2007) which may also increase MSM's risk for HIV infection (Allison, Adams, Klindera, Poteat, & Wolf, 2014). Therefore, using online platforms to recruit MSM such as through an online survey represents a promising avenue for conducting research into MSM and HIV prevention which aligns with contemporary use of technology for social and sexual needs (Hooper et al., 2008). In fact, Wohlfeiler and colleagues (2013), when discussing online health promotion services with MSM, reported that MSM identified a strong willingness and preference to receive online health promotion intervention services such as HIV partner notification, records of sexual partners and user-tailored health information derived from an online survey (Wohlfeiler et al., 2013). It can be inferred that the online survey as a methodological approach presents a valuable medium to access MSM populations (Wilkerson, Shenk, Grey, Rosser, & Noor, 2015). Moreover, with the proliferation of the MSM-specific Grindr application reaching over millions of users, MSM using internet applications to source partners are indicative of the growing familiarity with the internet. In measuring differences in behavioural and demographic characteristics by comparing surveys recruited at physical locations (bathhouses, bars/clubs) with online (Craigslist.org), Grov (2012) reported differences in HIV disclosure behaviours, self-reported experience of anal sex and condom use. Importantly, participants recruited via Craigslist reported the least condom use between the groups (Grov, 2012). As such, Grov's (2012) empirical evidence supports the notion

that internet may research reach sub-groups of the MSM population which may engage riskier sexual behaviours through the anonymity the internet facilitates which cannot be accounted for in venue-based recruitment (Raymond et al., 2010).

Using social media to disseminate an online survey allows data to be collected from any eligible MSM in the world. Similar data collection methods have been implemented on a national scale. For example, the European MSM Internet Survey (EMIS), which includes MSM respondents from the UK, utilised the internet to assess behavioural activities of MSM (Weatherburn et al., 2013). Therefore, by utilising data collection methods which correlate to ubiquitous technologies MSM engage with, the use of an online survey for the current research allows the inception, distribution and dissemination of findings to be timely and appropriate for the reasons why the research was primarily undertaken. Like the ease of distributing an online survey, software advances permit results from an online survey to be automatically tabulated in IBM® SPSS® thereby removing the need for data input and the potential human error that may evoke.

While the use of online surveys offers potential benefits, there are drawbacks. The current study used this methodological approach exclusively. In this sense, the following drawbacks directly impact data collection in the current research. One such limitation is the lack of sampling framework, a probability sample cannot be used meaning the representativeness of data collected must be perceived with caution, as primarily research using an online methodological approach immediately excludes individuals without access to the internet or that lack an active social media presence (Lee & Kim, 2014). Perhaps the most serious disadvantage of using online surveys to collect data is that selection bias, or the potential for participants to misrepresent themselves further obfuscates findings (Tuten, 2010). In this sense, the anonymity of the internet and the lack of identifying information needed to participate in online surveys garners caution when taking all participant information at face value. Thus, threats to the legitimacy of the sample recruited are problematic when participants are anonymous in their recruitment. While an online survey is used in this study for its attractive means of data collection, potential reach for more participants, reduced measurement error and bias related to the stigmatised topic of HIV, the lack of sampling technique whereby all individuals in a given population have an equal chance to be selected, subsequently leads the survey to be particularly subjected to selection bias. Ultimately this undermines the external validity of the study and interpretation of findings (outlined below) should

be viewed with this limitation. While these limitations are acknowledged, the practicalities of implementing this approach allows for this research to be conducted and is the catalyst for further research to be performed with the limitations of the current research to be learned from.

Opportunistic sampling was utilised in the current research as the aim of the research was to ascertain an understanding of the relationship of mobile health and MSM (May, 2011). By utilising social media platforms such as Twitter, academic research can take an active role in the recruitment of participants by accessing ubiquitous social networking. However, enticing participants to respond to surveys distributed in these fashions presents a key problem intrinsic to the online survey methodological approach. The issue being these social media platforms are dependent on content; with increasing posts, tweets, shared activity being placed on a user's interactive display content, participants can be equally made aware of the recruitment or the recruitment post being lost on the flood of online data. The current study used a purpose-made Twitter account to disseminate the survey to potential respondents.

3.2   Sample

As the current study explored preferences among MSM, no sexual identity was excluded. Given the advertisement of the current project (see figure 2), the study was interested in all MSM not specifically gay men. The research had a cross-sectional survey design (Neuman, 2003). Thus, within this sample, a convenience sampling method was used as defined by Neuman as a method in which 'gets any cases in any manner that is convenient' (Neuman, 2003, p211). Therefore, for participants to engage with the survey, a Twitter account was created in order to disseminate the survey. The survey was conducted via the internet – disseminated through social media – from February 2017 to April 2017. The questionnaire was administered through an online program (Qualtrics) so that it could be circulated online. This was done by giving a brief introduction of the questionnaire on Twitter and then sharing the link to other Twitter users. Specific MSM community organisers, national and international charities were contacted to disseminate the link to the survey. The questionnaire link was shared through Twitter every couple of hours, most days a week, between February 2017 and April 2017. Participants had to be self-identifying MSM, over the age of 18, and were provided with the details of the academic team involved. As the survey was completely anonymous, participants were made aware they could not withdraw their data once submitted into Qualtrics. By continuing and filling out the questionnaire, participants confirmed

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that they had been fully informed about the research and its purposes. Completing the questionnaire cost the participant approximately 10 minutes.

Figure 2 Advertisement of the current study's online questionnaire. This figure illustrates standard tweets produced between February and April 2017.

3.3   Survey Development

The survey used in the current research was engineered to examine individual levels of preference for mHealth delivery and content therein. Successful questionnaires are efficient when the content they are aiming to measure is successfully reflected in the unambiguous wording of questionnaire items which leads to a valid reflect of subsequent scales and categories developed from these items (Brain, 2002). Statements in the below measures were adapted from existing empirical evidence in which the current study builds upon (see Czarny and Broaddus, 2017; Holloway et al., 2014;

Muessig et al., 2013) in order to produce valid findings. While similar to these studies in aim, the current study is informed by the theoretical framework of the Information-Motivation-Behavioural Skills model (Fisher & Fisher, 1992). Therefore, participants were presented with the questionnaire items of interest (in measuring the primary research question) in the first few questionnaire items of the survey. Each section of the survey included questions aimed to evidence participants' preference and were phrased at an individual level of use; an approach used previously by Czarny and Broaddus (2017) in order to evidence explicit preferences. Likert-style questions were used to measure the preferences of MSM participants which was also previously used in earlier research (Muessig et al. 2013). As the aim of the study was to measure preferences, a four-item Likert response was used which omitted neutral responses. All items were worded positively and as such no reverse coding was implemented. With the positive coding of questionnaire items it is inferred that a higher score (drawn from 1 meaning not at all interested to 4 meaning very interested) equated to a higher preference for the construct or delivery method of interest.

3.3.1 Measures

All the information pertaining to the participants was collected through the online survey questionnaire. The survey questionnaire was pilot tested (n = 10) prior to widespread dissemination for survey data collection. No changes were made thus the pilot users were included in the final data set. Drawn from pilot responses, Cronbach's alpha scores were measured to demonstrate if the survey was consistent and reliable in the responses. Cronbach's alpha scores ranges from zero to one demonstrate the reliability of factors drawn from the rating scale questions. The higher the score, the more reliable the scale. Nunnanly (1978) indicated a Cronbach's alpha score of above 0.7 to be an acceptable reliability coefficient. In the current study, all questionnaire items exceeded this acceptable rate of reliability.

Table A

Cronbach's alpha: internal consistencies of questionnaire scales indicating reliability

Preference Scales	Cronbach's alpha*
mHealth Acceptance	0.87
Preference for Information Content	0.76
Preference for Motivation Content	0.71

| Preference for Behavioural Skills content | 0.79 |
| Perceived impact of participating in a mHealth for HIV prevention initiative | 0.74 |

* Cronbach's alpha > 0.7 is a sign of good reliability

3.3.2   mHealth Acceptance

In order to categories delivery methods on a preference scale, popular delivery methods were identified through literature review as well as empirical studies exploring the associated use of mobile technology among MSM. Identified delivery methods were through SMS text messages, through a smartphone via mobile internet, through mobile applications and through tablet technology via the internet. As such, these methods formed the mHealth acceptance scale. Each item aimed to identify participants' preference for each deliver method by denoting their likelihood of participating in a mHealth HIV programme delivered through mobile technology; culminating in a scale computing all scores into an overall acceptance of mHealth delivery.

A detailed list of mHealth acceptance items can be found in a duplicate of the survey located in appendix 1. Participants were asked to rate their level of likelihood of participating in a HIV prevention programme delivered through mHealth technology on a Likert-type scale measures from 1- 4 respectively which were displayed in the following format according to the literacy of the statement:

Very likely   somewhat likely   not very likely   not at all likely

Example of a mHealth acceptance as they appear can be seen below:

How likely would you be to participate in a HIV prevention programme if delivered through the following options:

Through a smartphone via SMS (text messaging)

Very likely   somewhat likely   not very likely   not at all likely

As mHealth acceptance statements are designed to measure preference for the delivery method of health promotion information and the literature review discussed mHealth acceptance a composite of different mobile technology delivery methods, numeric values of each given rating were combined to provide a total rating of mHealth acceptance. All items were positively worded with regard to likelihood of participating through the associated mobile technology, thus no reverse coding was needed. Moreover, as participants scored higher on the items, the higher the degree of acceptance of using mobile technologies to delivery health promotion. The 4 items produced a sum where higher scores suggested greater preference of mHealth for HIV prevention. Internal reliability for mHealth acceptance scale was a = 0.87.

3.3.3 Interest in mHealth promotion content across the IMB theoretical framework

Ascale was constructed to measure interest across information, motivation, and behavioural skill associated content inspired by Fisher and Fisher (1992). Measuring the interest in receiving information associated with HIV prevention is not novel, with evidence cited in the literature review employing methodological approaches to evidence this (Czarny and Broaddus, 2017). However, while interest in receiving HIV prevention information has been measured, two scales were developed to measure motivation-associated content and behavioural skill-associated content. Across all three construct measures, items were assessed using a four-item Likert-type response.

A foundation for the quantitative exploration of these scales was the risk compensation literature which established concerns associated with the reduction in perceived risk of HIV in the face of engaging in biobehavioural interventions (see previous literature review). Therefore, items used within these two scales were used to assess the role of self-efficacy and motivations for using condoms as a HIV prevention approach, with appropriate items denoting language which is neutral and non-judgemental.

The developed items were peer reviewed by three fellow researchers in order to assess the suitability of each item in measuring interest in receiving motivation, and behavioural skill health promotion content. A copy of survey items can be found in Appendix 1. During the development

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of questionnaire items regarding these scales, reviewers assessed each item on how accurately it reflected the constructs denoted by Fisher and Fisher (1992) in reflect to condom use and so it is anticipated that internal validity of the scales were to be improved (see Table A). Following previous evidence exploring the IMB constructs in HIV prevention (Misovich et al., 1998), responses were formatted on a 1 (not at all interested) to 4 (very interested) scale. Motivation to practice condom use preparatory behaviours was assessed through 4 items (e.g. discussing condoms and persuading unwilling partners to use them).

3.4 Ethical approval

The current research followed the Code of Human Research Ethics framework put forth by the British Psychological Society (BPS, 2010) and received approval from the University of Huddersfield School of Research Ethics panel within the Human and Health Sciences school prior to any data collection being conducted (a copy of the approval form can be found in appendix 2). As discussing sexual practices such as that of using condoms, as well as the stigma attached to HIV despite the focus of HIV prevention, the researcher understood the potential for distress to participants due to the sensitive nature of HIV incidence and transmission. Therefore, using information collected anonymously posed inherently fewer risks to participants than identifiable data. By using an anonymous online survey and advertising the online survey with an emphasis of the anonymity involved, the study acknowledged the need to traverse the area of HIV research among MSM attentively (Chiasson, Parsons, Tesoriero, Carballo-Dieguez, Hirshfield, & Remien, 2006).

The BPS Code of Human Research Ethics requires participants acknowledge informed consent before research is to be conducted (BPS, 2010). With regard to the online survey the use of participants clicking a series of buttons acknowledging their understanding of; their right to withdraw, anonymity, expectations of participation, and data storage and management. Moreover, an information sheet explained the aims, objectives and goals of the research and potential risks and benefits of participating in the research as well as emphasising the voluntary nature of participation. Participants also had to click to acknowledge they read the information sheet. The contact details of the researching team was also presented to participants in order to alleviate any potential concerns regarding the interactivity between the researcher and participants which may make it difficult for participants' to ask any questions prior to participating (Childress, 2000). The

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contact details of the research team were also provided at the end of the survey if participants had any questions regarding the current study.

A primary concern with the online survey was the risk associated with participation in the research itself and breaches in confidentiality. The anonymous survey presented minimal risk as participants were free to withdraw at any time from the research. This also presented the concern that the impact of participating in the current research cannot be monitored and therefore the condition of the participant goes unknown. In order to minimise this risk (and despite the survey being able to be accessed by any MSM engaging with the survey disseminated through twitter), drawn from similar research conducted among MSM, contact details of United Kingdom based HIV-associated charities were provided at the end of the survey as these charities were most appropriate to the study material (Hirshfield, Remien, Humberstone, Walavalkar, & Chiasson, 2004).

3.4.1 Data storage and management

All data from the online survey was downloaded from Qualtrics into IBM SPSS version 22. Qualtrics creates a complete dataset with variables names and coding frames to be readily inputted into SPSS. Some variables were re-coded or merged to facilitate subsequent analysis (e.g.: relationship status was re-coded by taking into consideration sexual relationship exclusivity and thus single and open relationships were merged). Scrutiny was applied to missing values by assessing whether socio-demographic variables were associated with a lower or higher number of missing values (e.g.: the proportion of missing values across one factor was compared according to ethnicity, age, education). An assessment of statistical analytical approaches was employed to explore appropriate analyses suited to dealing with missing values. This analysis was conducted with SPSS 22.

The researcher followed the Data Protection Act (1998) which adhered to University policies regarding data storage. In line with this, data was retrieved from the online survey tool Qualtrics and stored in secure password protected files. The University regulations state research data has to be kept for a period of 5 years under the supervision of the lead supervisor. The entirety of the data collection and analysis process was completed by the researcher only in which no transfer of data was conducted.

3.5   Recruitment Method

Pivotal to quantitative research is the desire to empirically evidence complex phenomena in a systematic approach by reducing pertinent variables to measureable constructs; thus, exploring hypotheses through objectively conveying associations or cause and effect where appropriate (Creswell, 2003). In the current research, using a quantitative approach was appropriate in order to establish controllable measures in the examination of the interest in and acceptance of mHealth for HIV prevention among MSM; with further aims to evidence preferences of the content delivered via mHealth and the delivery method of such content, thus addressing the primary research question. In order to achieve this, and with the previously discussed suitability of an online survey participants were invited to participate in the current research through posts made on the social media platform Twitter (see figure 2). Posts were generated and routinely disseminated several times throughout the week, routinely between February 2017 and April 2017.

3.6   Data analysis approach

Descriptive statistical analyses were conducted to determine the profile of the participants recruited for the current research. Frequency tables were created to determine the age and educational distribution of the recruited participants and to identify the percentage of participants which belong to an educational or age bracket. The frequency table therefore allows a demonstration of; firstly, whether there were any response sets which were particularly common across the sample or, secondly, whether question items were likely to elicit negative response answers. Histograms, bar charts were created to provide a visual representation of the data and to identify any outliers. To determine any relationship between mHealth content preferences a correlational research method was adopted. Correlational analysis is the statistical analysis of the relationship between two variables and the extent to which these variables influence one another. Through exploring this form of relationship, the primary question is satisfied as establishing the potential relationships between variables would demonstrate the nature of preferences of mHealth within the sample.

3.7 Conclusion

This chapter set out the methodological approach taken in this survey, which contained Likert-style items. By distributing the survey online, the study aimed to achieve a large-scale dataset. The method, while providing several advantages in other studies in the literature in the current context, did not reap the same benefits in this research. Where appropriately proving successful

4. Results

Statements of the results will be followed by a summary of the findings, leading into the next chapter in which these will be discussed regarding their relationship to each other and in accordance with previous literature. As results were generated through Likert-style questionnaire items, the current thesis considered mean score greater than 2 (the point of not being interested) to be generally acceptable to participants.

4.1   Demographic profile of respondents

This section describes the demographic profile of 92 respondents collected from the survey. Close-ended questions were used in the questionnaire and thus choices of answers in the questionnaires are limited. A sample of MSM was specifically chosen to inform and further the literature. There was no alternate comparison group as the current study wanted to inform MSM specific mHealth perceptions. If there were to be a comparison group this would be inappropriate as previous studies have highlighted divergent intrinsic and extrinsic factors influencing MSM and non-MSM samples and therefore would be inappropriate (Czarny & Broaddus, 2017). As an alternative, the current study compares the within the sample of recruited MSM to elicit any factors which may significantly impact preferences. By comparing results within a MSM sample any discrimination towards sexual behaviours or identities is almost controlled for and kept constant and therefore preferences indicated in results would be specific to the sample demographics. If there are within-group differences in the recruited sample this will bring to attention the divergences of relationship status, age, or ethnicity. Therefore, any divergences would continue to contribute significantly to MSM-specific research. The exploration of differences, however, is within the secondary research question as the current research aims to gain a measure of mHealth HIV prevention preferences in a recruited sample overall.

As shown in table 1, out of 92 respondents, 83 (90.2%) are gay identifying, 5 (5.4%) are bisexual identifying, 3 (3.3%) are heterosexual identifying and 1 (1.1%) identifies as Other. Thus, the majority of participants are gay identifying, however, the inclusion of non-gay identifying male respondents (9.8% of the sample) is noteworthy.

Table 1

Sexual Identity of survey respondents

Sexual Identity	Frequency	Percentage of sample
Heterosexual / Straight	3	3.3
Bisexual / Bi	5	5.4
Homosexual	83	90.2
Other	1	1.1

Table 1.1 presents the distribution of respondents according to three main age groups which are 18 to 28, 29 to 39 and 40 or above. Here, there are 37 (40.2%) respondents who are 18 to 28, 29 (31.5%) of respondents who are 29 to 39, and 26 (28.3%) respondents who are 40 or above. This shows a somewhat fairly distributed representation of age groups across the sample, despite the majority (40.2%) being 18 to 28.

Table 1.1

Age groups of survey respondents

Age	Frequency	Percentage of sample
18 – 28	37	40.2
29 – 39	29	31.5
40+	26	28.3

From table 1.2, there are 5 ethnicity groups are which; White, Mixed / multi-racial, Asian, Black, or other. Based on the results, there are 79 (85.9%) White, 7 (7.6%) Asian, 3 (3.3%) Mixed / multi-racial, 1 Black (1.1%) and 2 (2.2%) other ethnicities such as Turkish and Latino. This shows that the sample has a majority White ethnicity. The results (discussed below) should be viewed with this proportion of White respondents in mind.

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Table 1.2

Ethnicity of survey respondents

Ethnicity	Frequency	Percentage of sample
White	79	85.9
Mixed/ Multi-racial	3	3.3
Asian	7	7.6
Black / African / Caribbean	1	1
Other	2	2.2

Stated in table 1.3, there are 3 different education levels created from the responses in the questionnaire (see appendix) which are compulsory education (up to the age of 18), further education (following compulsory but not higher education) and higher education (postgraduate qualifications). Here, 4 (4.3%) respondents have a compulsory level of education, 13 (14.1%) have a further education level of education, and 75 (81.6%) of respondents have a postgraduate level of education. Thus, the majority of the sample (81.6%) are well educated to a degree level or higher level of education.

Table 1.3

Education level of survey respondents

Education Level	Frequency	Percentage of sample
Compulsory education	4	4.3
Further Education	13	14.1
Higher education	75	81.6

As resulted in table 1.4, there are three categories of relationship which are single, in a relationship (exclusive), and in a relationship (open). Here, 43 (46.7%) respondents are single, 19 (20.7%) are in an open relationship, and 30 (32.6%) are in an exclusive relationship. This shows that a large majority (67.4%) of respondents are in non-exclusive sexual relationships.

Table 1.4

Relationship status of survey respondents

Relationship Status	Frequency	Percentage of sample
Single	43	46.7
In a relationship (exclusive)	30	32.6
In a relationship (open)	19	20.7

According to table 1.5, the use of technology regarding sexual partner selection offered 3 categories which are via social media applications (exclusively), via gay-associated venues (exclusively) and via a combination of social media and gay-associated venues, and other. Here, 25 (27.2%) of respondents use social media applications exclusively, 12 (13.0%) use gay-associated venues exclusively, 49 (53.3%) use a combination of two while 6 (6.6%) are Other, pertaining to internet forums and specific applications.

Table 1.5

Sexual Partner Selection including mobile applications preferences among survey respondents

Methods of sexual partner selection	Frequency	Percentage of sample
Via Social Media Applications (exclusively)	25	27.2
Via gay-associated venues (exclusively)	12	13
Via combination of social media and gay-associated venues	49	53.3
Other	6	6.6

From the results in table 1.6, respondents were asked to tick all that apply to a list of offline mechanisms in finding sexual partners which were; nightclubs, saunas, pubs, and cruising environments. Here, the option with the highest count were nightclubs (n = 50), followed by pubs (n = 40), saunas (n = 34), and cruising environments (n = 25). 20 respondents also acknowledged 'not applicable'.

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Table 1.6

Offline mechanisms of partner selection of survey respondents

Methods of sexual partner selection without social media/geolocation apps	Frequency
Gay nightclubs	50
Gay saunas	34
Gay pubs	40
Cruising environments	25
Not applicable	20

As stated in table 1.7, drawn from a list of tick all that apply, respondents were asked which applications they used drawn from a list of popular mobile applications which were Facebook, Twitter, Instagram, Snapchat, Grindr, Scruff, and Hornet. Pertaining to the sexual and geolocation-based applications, the application with the highest count of use was Grindr (n = 48), followed by Scruff (n = 23), Hornet (n = 17) and Tinder (n = 15).

Table 1.7

Mobile application used by survey respondents

Mobile application used	Frequency
Facebook	75
Twitter	81
Instagram	53
Snapchat	41
Grindr	48
Scruff	23
Hornet	17

From the results in table 1.8, the frequency of use of mobile applications vary. The majority (41.3%, n = 38) of participants use mobile applications several times each week, 21 (22.8%) several times a day, 19 (20.7%) once a month, 12 (13.0%) once a day, 2 (2.2%) once every hour.

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From here, the highest number of respondents often use mobile applications more than several times a week.

Table 1.8

Mobile Application use of survey respondents

Mobile Application Use	Frequency	Percentage of sample
Once every hour	2	2.2
Several times a day	21	22.8
Once a day	12	13.0
Several times each week	38	41.3
Once a month	19	20.7

4.2 mHealth Acceptance

4.2.1 Preferred delivery of mHealth initiatives

Table 2 summarises participants' responses to items regarding their interested delivery method for mHealth for HIV prevention. The preference for mHealth delivery for HIV prevention subscale consisted of 4 items ($\alpha = 0.78$). Descriptive analysis showed that out of a possible maximum of 4, average mHealth preference score was fairly high (M = 2.88), with 52% of participants scoring between 3.00 and 4.00 (SD = 0.79) Further item analysis was conducted. Notably, as items were on a 1 (not at all interested) to 4 (very interested) scale, all the items received a score greater than 2.50 out of a possible 4. The items with the highest impact was 'through a smartphone via an application' with a mean of 3.11. The item with the lowest impact rating was 'through a tablet via the internet' with a mean score of 2.61

Table 2

The average (SD) preference of mHealth participation through mobile delivery method

mHealth delivery method	Average preference (SD)
Through a smartphone via SMS (text messaging)	2.77 (1)
Through a smartphone via an application	3.11 (1)
Through a smartphone via the internet	3.07 (0.9)
Through a tablet via the internet	2.61 (1.1)

4.2.2 Preference for Information content

Table 2.1 presents participants' responses to items regarding information-associated content of a mHealth initiative for HIV prevention. The preference for information-associated content subscale consisted of 4 items ($\alpha = .76$), each measured on a 4-point Likert scale, and the numerical value of each response was totally to give a preference for Information-associated content for each participant. Descriptive analysis showed that out of a possible 4, average information-associated items was high (M = 3), with 65% of participants scoring between 3.00 and 4.00 (SD = 0.55) Furth item analysis was conducted. As with the delivery method items, participants gave many items mean scores greater than 2.5 out of a possible maximum of 4. The items participants rated the highest were "Receiving 'myth busting' information which clarifies some common misconceptions

associated with using condoms" and "Accurate information regarding risks to transmitting and acquiring HIV" with mean scores of 3.37 and 3.22, respectively. Notably, the item participants rated the lowest was "Accurate information on the benefits of using condoms consistently with sexual partner(s)" with a mean score of 2.45.

Table 2.1

The average (SD) preference of information-associated mHealth for HIV prevention content

mHealth information content	Average preference (SD)
Accurate information on the benefits of using condoms consistently with sexual partner(s).	2.45 (1)
Accurate information regarding risks to transmitting and acquiring HIV.	3.22 (0.9)
Receiving 'myth busting' information which clarifies some common misconceptions associated with using condoms.	3.37 (0.9)
Information which provides answers to some frequently asked questions related to using condoms.	3.14 (0.9)

4.2.3   Preference for motivation content

Table 2.2 presents participants' responses regarding motivations associated with using condoms with sexual partners. The preference for motivation-associated content subscale consisted of 4 items ($\alpha = .71$), each measured on a 4-point Likert scale, and the numerical value of each response was totalled to give a preference for motivation-associated content for each participant. Descriptive analysis showed that out of a possible for, average motivation-associate items was fairly low (M = 2.2), with 51.4% of participants scoring between 1.00 and 2.00 (SD = .85). Further item analysis was conducted. Unlike information-associated content, all items received mean scores lower than 2.5 out of a possible 4. The items with the lowest mean scores were "tips on how to negotiate using condoms with sexual partner(s)" and "information aimed to increase confidence in initiating using condoms", with mean scores of 2.08 and 2.18, respectively. Items with higher scores were "Information on how to use condoms as a form of mutual respect for yours and your

sexual partner(s)'s sexual health" and "The benefits of keeping a record on how often condoms are used with sexual partner(s)" with mean scores of 2.20 and 2.31, respectively.

Table 2.2

The average (SD) preference for motivation-associated mHealth for HIV prevention content

mHealth motivation content	Average preference (SD)
The benefits of keeping a record on how often condoms are used with sexual partner(s)	2.31 (1)
Tips on how to negotiate using condoms with sexual partner(s)	2.08 (1)
Information on how to use condoms as a form of mutual respect for yours and your sexual partner(s)'s sexual health	2.20 (1.1)
Information aimed to increase confidence in initiating using condoms	2.18 (1.1)

4.2.4 Preference for behavioural skills content

Table 2.3 summarises participants' responses to items regarding behavioural skill content for HIV prevention. The preference for behavioural skills content subscale consisted of 6 items ($\alpha = .79$), each measured on a 4-point Likert scale, and the numerical value of each response was totalled to give a preference for behavioural skills content for each participant. Descriptive analysis showed that out of a possible maximum of 4, average behavioural skills was fairly low (M = 2.19), with 51% of participants scoring between 1.00 and 2.00 (SD = .85). Further item analysis was conducted. Responses varied within this content, notably "where to access free condoms" receiving the highest mean score of 3.33. Other items scoring above 2.5 included "information on how a condom may affect sexual" and "accurate information on how to avoid condom splitting / slippage" with both items coring 2.85 each, as well as "how drugs and alcohol may affect decisions to use condoms" and "the benefits of carrying condoms on your person" with mean scores of 2.69 and 2.61, respectively. The item with the lowest impact rating was "links to video testimonials from other men who have used condoms consistently with sexual partner(s)", with a mean score of 2.36 out of a maximum of 4.

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Table 2.3

The average (SD) preference for behavioural skill-associated mHealth for HIV prevention content

mHealth behavioural skills	Average preference (SD)
Links to video testimonials from other men who have used condoms consistently with sexual partner(s)	2.36 (1)
Accurate information on how to avoid condom splitting / slippage	2.85 (1)
Information on how a condom may affect sexual pleasure	2.85 (1)
Where to access free condoms	3.33 (1)
How drugs and alcohol may affect decisions to use condoms	2.69 (1)
The benefits of carrying condoms on your person	2.61 (0.9)

4.2.5 Perceived impact of participating in a mHealth initiative for HIV prevention

Table 2.4 presents participants' response to items regarding the perceived impact of participating in a mHealth initiative for HIV prevention. The perceived impact subscale consisted of 3 items α = .74), each measured on a 4-point Likert scale, and the numerical value of each response was totalled to give a perceived impact score for each participant. Descriptive analysis showed that out of a possible maximum of 4, average perceived impact was fairly high (M = 2.61), with 65% of participants scoring between 3.00 and 4.00 (SD = .68). Further item analysis as conducted. Notably, all items received mean scores greater than 2.5 out of a possible maximum of 4. The items with the highest perceived impact were "engaging in a HIV prevention programme would improve my knowledge on condoms" and "engaging in a HIV prevention programme would increase my ability to discuss using condoms with my sexual partner(s)", with mean scores of 2.69 and 2.64, respectively. "Engaging in a HIV prevention programme would increase the frequency I use condoms in sexual encounters" was rated lower with a mean score of 2.53.

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Table 2.4

The average (SD) of perceived impact of participating in a mHealth for HIV prevention initiative

Perceived impact	Average preference (SD)
Engaging in a HIV prevention programme would increase my ability to discuss using condoms with my sexual partner(s)	2.64 (0.8)
Engaging in a HIV prevention programme would improve my knowledge on condoms	2.69 (0.8)
Engaging in a HIV prevention programme would increase the frequency I use condoms in sexual encounters	2.53 (0.8)

4.2.6   Perceived level of concerns of participating in a mHealth initiative for HIV prevention

Table 2.5 summarises participants' responses to items regarding perceived concerns of participating in a mHealth initiative. The perceived concern subscale consisted of 2, each measured on a 4-point Likert scale, and the numerical value of each response was totally to give a perceived concern sore for each participant. Out of a possible maximum of 4, mean concern score was low (M = 2.22), with 52% of participants scoring between 1.00 and 2.00 (SD = .96). Further item analysis was conducted. Notably, items received mean scores below 2.5 out of a possible maximum of 4. The item with the higher mean score was "concerns associated with the confidentiality of participating in a HIV prevention programme (for example, having identifying features such as name and city of residence)" with mean score of 2.40. "Concerns associated with the privacy of participating in a HIV prevention programme" received a lower mean score of 2.11.

Table 2.5

The average (SD) of perceived concern of participating in a mHealth for HIV prevention initiative

Perceived participation concern	Average preference (SD)
Concerns associated with the privacy of participating in a HIV prevention programme	2.11 (1)
Concerns associated with the confidentiality of participating in a HIV prevention programme (for example, having identifying features such as name and city of residence)	2.40 (1.1)

4.3   Further (nonparametric) analyses

In order to answer the secondary research question exploring moderators to the preferences of MSM (age, gender, and relationship status), further analyses were conducted on questionnaire items. The survey yielded categorical data (ordinal and nominal), meaning nonparametric tests had to be conducted. The research questions regarding associations between ordinal data (Likert-scale answer options) were answered using the Spearman's Rank-Order Correlation test (r_s against p=0.05).

4.3.1   Spearman's Rho test and results

A correlational analysis was employed in order to measure the degree of linear association between the continuous variables of preferences for information, motivation, behavioural skills, and mHealth acceptance.

A Spearman's correlation was run to determine the relation between mHealth acceptance and preference for Information content. There was a weak, positive monotonic correlation between mHealth and Information preferences (r_s= .33, n = 80, p = .002). There was a weak, negative monotonic correlation between mHealth and Motivation preferences (r_s= -.38, n = 74, p = .001). There was a moderate, positive monotonic correlation between mHealth acceptance and Behavioural Skills (r_s= .51, n = 72, p <.001).

A Spearman's correlation was run to determine the relationship between preference for Information content and Motivation content. Results were non-significant (r_s= -.15, n = 74, p = .202). There was also a non-significant negative monotonic relationship between preference for Information content and preference for Behavioural Skills content (r_s= .12, n = 72, p = .317). There was a non-significant, weak, positive correlation between preferences for Information content and Behavioural Skills content (r_s= .12, n = 72, p = .31). A Spearman's correlation was run to determine the relationship between preferences for Motivation and Information content. Results were a non-significant, weak negative correlation (r_s= -.15, n = 74, p = .202). A Spearman's correlation was run to determine the relationship between preference for Behavioural Skills content and Motivation content. There was a strong, negative monotonic correlation between preferences for Behavioural Skills content and Motivation content (r_s= -.61, n = 72, p <.001).

4.4 Conclusion

This chapter described the demographic profile of the respondents and the results of descriptive and correlational data analysis. The following chapter will summarise the results found in this chapter, and discuss major findings, limitations, recommendations and the implications of this study.

5. Discussion

5.1 Introduction

This chapter concludes the thesis by considering all the work done so far in relation to the research questions and the wider literature in related fields. This chapter will examine to what extent the research questions have been answered, how findings of the survey items relate to previous work, and limitations of the survey. This chapter will summarise the main contributions of this thesis and conclude with further suggestions, public health significance, and directions for future work. The primary purpose of this thesis was to investigate the acceptability of using mHealth for HIV prevention among MSM and the preferences of MSM associated in this context. This research follows an ongoing trajectory of innovative and efficient methods explored within private and public Governance in 21st century approaches to challenging the ongoing HIV epidemic among MSM.

5.2 Principle Findings

Participants were interested in a comprehensive mHealth initiative delivered through a variety of mobile phone methods (SMS, mobile application, and through mobile internet). The survey was disseminated online via Twitter between February and April 2017. The survey aimed to measure preferences among MSM for mHealth for HIV prevention initiatives. Also explored were the HIV prevention content of such an initiative and privacy and confidentiality concern with engaging in this mechanism of behaviour change. Results demonstrate that the content of a mHealth for HIV prevention initiative should be elaborative and provide accurate and wide-ranging information which supports risk reduction behaviours through providing; information on the acquisition and transmission of HIV, and information which answers frequently asked questions and clarifies common misconceptions on using condoms. MSM in this study desired a mHealth initiative which provides resources which demonstrates how to avoid a condom splitting or slipping off, how condoms effect sexual pleasure, and how drugs and alcohol effect using condoms. Most notably, participants desired a mHealth for HIV prevention initiative that provides information on where to access condoms. These findings suggest that if a mHealth for HIV prevention product was to be developed then it should provide a holistic approach taking into account a myriad of condom-associated behaviours and considerations in order to be effective. Given the small sample size, only small average differences occurred between demographic characteristics, all of which were

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non-significant. Thus, if addressing these preferences in the development of a mHealth app, then it may be possible to address individual, interpersonal, and community-based points of concern regarding condom use.

5.3 What are the preferences of MSM regarding mobile delivery methods for HIV prevention?

All items were measured on a four-point Likert-scale items, for example; very interest, somewhat interest, not very interest, not at all interested. Respondents were very interested (noted as a mean of 3 or more, out of 4) in engaging with a mHealth initiative delivered through a smartphone application, and through a smartphone via the internet. Mean scores were somewhat lower for a mHealth initiative delivered through SMS and through a tablet device. Thus, with respect to mHealth acceptance, the current findings show considerable interest among MSM in mHealth initiatives delivered through a variable of mobile phone functions irrespective of content. These findings are reflected in those observed in Cornelius et al. (2011) whom found high degrees of acceptability in the delivery of safer sex messages delivered through mobile phones. As noted, the delivery of HIV prevention resources through mobile applications was highly accepted among the current study's MSM respondents. These results are also in accord with a recent study conducted by Czarny and Broaddus (2017) whom found gay-identifying respondents were highly accepting of a sexual health section within an application. While Czarny and Broaddus (2017) recruited exclusively in an offline venue-based recruitment method '(Pridefest' which is an LGBT pride festival based in Milwaukee, USA), results are consistent across the acceptance of mobile delivery methods for HIV prevention. Thus, taken together, these findings indicate that the high degree of interest for mHealth for HIV prevention were sought out by both online and offline recruited respondents and not divergent across recruitment methods.

It cannot be ignored that a criterion to participate in the current study was that the respondent must own a smartphone. So, results must be interpreted in the view that those participating in the current study were already adopting highly sophisticated mobile technology. It is reasonable to argue that the respondents' mobile phone literacy (the ease of using of a mobile phone) may in fact skew results as participants' are experienced in using such a technology and as such find no difference in engaging with a mHealth app for HIV prevention as other apps already used. This criteria, however, was not implemented in the qualitative approached used by Muessig et al (2013). Here,
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while all MSM respondents (n = 29) owned a smartphone, this did not permit respondents to participate. Given this lack of criterion, participants in Muessig et al (2013)'s study reflect the current study's high degree of acceptability for mHealth delivered content. More broadly, the current study's results are consistent with earlier empirical evidence which report MSM to be early adopters of communication technologies and thus with participants already owning a smartphone, reflect the quickly evolving mobile technology landscape (Rosser et al., 2011). This affinity therefore highlights the MSM populations' ability to engage with sophisticated mobile software, establishing this demographic as inclined to be responsive to a mHealth approach to HIV prevention.

The highly advantageous utilities of mHealth such as anonymity and ease of use when combined with widespread availability of internet access coalesces into an important finding which denotes a vital symbiotic relationship between cost-effective preventative intervention strategies and end-user behaviours. Of note, however, respondents were not as interested in using tablet-devices for engaging with mHealth when compared to the utility of smartphone delivery methods. It may be that users found a distinction between the handheld devices, or alternatively, that they may not have access to such a device as a criterion for the current study was that respondents own a smartphone. Tablet ownership, however similar to smartphones, was not measured.

5.4   What are preferences for mHealth HIV prevention content?

In the current study, participants were highly interested in receiving accurate information regarding risks to transmitting and acquiring HIV. This result is indicative of a trend in emerging research evidencing MSM's desire for more information regarding HIV transmission and acquisition as reflected by Shrestha et al. (2017). Shrestha found a substantial in respondents wanting to receive mHealth-based risk reduction information and to assess HIV risk behaviours, while Muessig et al. (2013) found MSM desired education on STDs and information on risks to HIV infection. Moreover, in a similar age sample to the current study (average age of 33), the finding that MSM desire accurate information on the risks of transmitting and acquiring HIV were also found by Aliabadi et al. (2016). In their focus groups, MSM interviewees expressed a strong wish for access to accurate information which debunks misconceptions regarding HIV transmission (Aliabadi et al., 2016). Overall, this study has documented empirical support for the

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growing need to disseminate HIV risk reduction skills for MSM with the adage that MSM are highly interested in receiving this information. While differing methodologies such as that of qualitative interviewees (Alibadi et al., 2016) have generated similar but different ways to express HIV risk reduction information to MSM via mHealth, it is worth noting the constant and consistent expression of MSM wanting more information at a quick pace via through smartphones across these studies.

The present study was also designed to determine the extent to which MSM preferred receiving HIV information on the effect that drugs and alcohol may have on using condoms. MSM respondents were not as accepting of receiving this form of preventative information. This contrasts that of Czarny and Broaddus (2017) who reported that MSM respondents were accepting of this type of information. This result may be explained by the fact in the study conducted by Czarny and Broaddus (2017) had no measure of educational attainment while in the current study the MSM respondents were highly educated with a large majority attaining a University degree or higher qualifications. Thus, it can be acknowledged in this study that participants were highly educated which cannot be explained within Czarny and Broaddus' (2017) study. The notion that MSM desire content regarding the effects of drugs on alcohol on using condoms was also reported by Muessig et al. (2013). Here, interviewees acknowledged the lack of inhibition due to drugs and alcohol and the effect these may have on using condoms. Participants desired the addition of adding this type of information in order to 'let everybody to be knowledge about drug use. Because drug use tends to play a majority part in STDs and different things like that" (p. 217). While the aforementioned literature review (described above) did not focus on the role of substance abuse (alcohol specifically), it is clear that understanding this predictor of condom use in important given participants' expression for help in this domain found in other studies. These divergent findings underscores the need for more exploration of the role of drugs and alcohol on condom use among MSM. A future exploration of this may endeavour to explore the role of mHealth for HIV prevention with a focus on substance abuse during sexual risk at peak times of drinking, or the role in which mHealth may play in substance use during risky situations for a clearer understanding of sexual behaviour which was not explored in the current study.

The current study found MSM respondents were not interested in receiving mHealth content which increased confidence in initiating using condoms. While the reasons behind such a lack of interest

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was not explored due to the quantitative approach utilised, this result is consistent with that of Aliabadi et al. (2016) whom found in their study population lacked a desire for content which provided emotional support or aimed to improve interpersonal skills in safer sex negotiations (Aliabadi et al., 2016). This lack of interest in confidence building content is in contrast to the highly interested content of providing access to free condoms. These differences in interests among mHealth content is indicative of the need for mHealth initiatives to not necessary target self-efficacy or exclusively target HIV prevention and care.

Most of the respondents in the current study found no cause of concern regarding their privacy and confidentiality in using a mHealth initiative for HIV prevention. These results are in agreement with Muessig et al's (2013) findings which showed most MSM were no concerned about the privacy of receiving, accessing, or storing health related information on their phones. In contrast, maintaining the privacy of participating in a mHealth for HIV prevention initiative was pivotal to interviewees reported by Alibadi et al. (2016). In this exploration of mHealth for MSM, interviewees identified the need for strong password protection in order to keep privacy secure.

In the current study, MSM respondents were not very interested in receiving support via mHealth on how to negotiate using condoms with sexual partners. This is not in line with results reported by Alibadi et al. (2016) who reported MSM interviewees expressed difficulty in negotiating safer sex with partners. Authors went on to report that another interviewee suggested having an app available to download to provide a way to demonstrate one's HIV status.

Content regarding condom self-efficacy in the face of HIV prevention has also been acknowledged in MSM's adoption of mHealth initiatives. As Mustanki et al (2006) claim, the role of social norms and attitudes surrounding condom use in the MSM population play a pivotal role in this biomedical methodology's frequency of use. Confidence in initiating the use of condoms may likely diminish in the interplay of lack of prior experience and if the social norm supports the lack of condom adherence (Landovitz et al., 2013). In this research, motivation encompasses attitudes toward HIV prevention behaviour, perceived social norms regarding HIV prevention behaviour and the intention to engage in HIV prevention behaviours. The findings in the current study show that MSM were interested in maintaining a consciousness of condom use with a preference for keeping a record on how often condoms are used with sexual partners. Other perceptions on using condoms as a form of mutual respect for sexual health and confidence in initiating using condoms were also

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of interest to recruited MSM. This is an interesting result in itself given the role of condom self-efficacy in the face of prior empirical evidence purporting a social norm of limited condom use; as also evidence in 'barebacking' communities (Muessig et al., 2013; Landovitz et al., 2013). This result may indicate that MSM are interested in raising their consciousness regarding the relationship between self-efficacy and its impact on sexual health.

Kellermann et al. (2013) argued that a reason for the failure of mHealth is that the user's needs are not met due to poor design. This exploratory study was inspired through emerging evidence which argues that end-users must be included in the design of tools dedicated to supporting them in order to make them as optimal as possible. With this in mind, the current study has found evidence supporting the popularity of content such as providing access to free condoms, accurate information on HIV acquisition and transmission, as well as the effect of drugs and alcohol on using condoms. Findings from this study help to illustrate the power of empirically gathering end-users preferences and the benefits of accessing the extent of acceptability.

5.5. What, if any, sociodemographic differences occur within mHealth acceptance?

The ethnic and educational profile of the current study is similar to those observed in other studies exploring mHealth acceptance among MSM. For example, in Holloway et al. (2014) participants were predominantly White, gay-identifying and well educated. In splitting the current sample between White and non-white respondents there were no significant differences found in mHealth acceptance. However, non-white participants had a higher acceptance of mobile application-based HIV prevention than white respondents. This result is in line with that of Stratha et al. (2017) whom found through multivariate analyses that being White was associated with significantly less interest in the use of mHealth for risk reduction information. Across the three age groups, younger MSM (18 – 28) had a higher degree of acceptance for HIV prevention through a mobile application compared to older groups. A non-parametric Kruskal-Wallis Test found these differences to be non-significant.

In the current study, the average age of participants was 33, with the largest group of participants (40%, n = 37) being between 18 – 28 years of age. This is in stark comparison to that of Holloway

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et al. (2014) whom recruited participants between the ages of 18 and 24. Here, a younger (average age of 22) sample of MSM were recruited. Despite age differences between these two cross-sectional survey samples, the current study evidenced a high degree of acceptance of engaging with HIV prevention through mHealth resources which is reflected in Holloway et al's (2014) findings. Moreover, as participants in the current study were highly interested in receiving HIV prevention content through apps, text messages, and mobile internet, this is also reflected in the 80% of young MSM whom expressed a willingness to participate in online and smartphone application-based HIV prevention reported by Holloway et al (2014). Therefore, the consistency between these results present a universality in the acceptance of mHealth for HIV and thus do not argue for an increasingly culturally-relevant designer-specific mHealth for HIV prevention approach for younger MSM, as argued by Eisenberg et al. (2011).

Thus, a key strength of the present study was the diverse demographic regarding a proportionate reflection of white and non-white respondents, as well as the acknowledgment of non-gay identifying MSM and their inclusion within the current study. This acceptance of non-gay identifying MSM is in contrast to that of Czarny and Broaddus (2017) whom exclusively used self-identifying gay-MSM when reporting findings. As research has evidenced that HIV acquisition through male-to-male contact is frequent among MSM, to remove those non-gay identifying reduces the likelihood of including a wider breadth of the MSM sample. Subsequently, a benefit of the current study is the definition of MSM which pertained to the sexual behaviour of male respondents instead of the sexual identity.

This thesis posited the benefits of using an online survey methodological approach (see above). However, given the limitations of the study (described below), the demographic profile of the sample reduced statistical testing regarding the parsing of the sample on demographic information. While evidence in the current study is limited, it is crucial to continue to analyse and explore the varying role of different ethnicities, sexual identities, and levels of education in the face of HIV prevention. Variability in any of these factors may impact on HIV prevention in a myriad of different ways; for example, alternating social norms, divergent accesses to healthcare, and varying levels of stigma associated with MSM behaviours and HIV.

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6.   Limitations

The current research is not without limitations. Firstly, the sample was recruited via a social media platform and thus users who engaged in the survey were exclusive to those who had access to the internet and subsequently used social media. Subsequently, a bias in the respondents is likely to have occurred. Given that the topic of this thesis relates to technology, as well as innovative method of using technology, results should be viewed with this bias in mind. Similarly, given the dissemination of the survey, the majority of the sample were well educated i.e. possessing a degree of higher levels of education. Therefore, while presenting interesting results in the face of mHealth acceptance, MSM in this study is not representative due to the network to which the survey was disseminated predominantly used the research team's social networking contacts. Moreover, the sample was relatively small, more specifically in perspective, containing less than half of previous explorations of mHeath acceptance among MSM (see Czarny and Broaddus, 2017), thus limiting the ability to detect differences in mHealth acceptance by demographic characteristics.

Previous explorations of MSM information have assessed HIV prevention information using test knowledge of HIV transmission. For example, Fisher et al (2002) assessed MSM participants' knowledge using a nine-item "AIDS information Heuristics" subscale. As a method to supporting the construct of Information, results evidenced that a majority of participants who were better informed were more motivated to prevention HIV infection. While evidence in the thesis supports the inclusion of HIV information in the delivery of mHealth for HIV prevention, the current study did not include a measure to assess participants' previous knowledge of HIV transmission. The variability in one's knowledge of HIV acquisition and transmission is likely to affect the participants' use of mHealth and therefore should be included in future work which aims to measure the acceptability of mHealth for HIV prevention.

Finally, the findings of the current research are limited because only so much can be determined from findings examining the preferences of a concept. In this study, as the survey was delivered online – and despite providing participants with contact details of the researcher and academic team – the researcher could not effectively elucidate the varying constructions of mHealth within the literature. Therefore, if participants were unaware or confused by the notion of mobile delivered HIV prevention in the survey, they were being asked to evaluate their perceptions of a concept with limited understanding. This would not be true in previous mHealth technology

studies which have used semi-structure, qualitative, approaches which enable the researcher to elaborate or define mHealth in situ.

7. Public Health Significance

The highest disparity of HIV infection is among MSM. mHealth prevention strategies such as PrEP are touted to support a reduction in the number of infections among MSM. Integrating knowledge, awareness of social norms, personal motivations, providing access to self-efficacy increasing resources, and signposting individuals to HIV preventative services requires a concerted, collaborative effort involving a myriad of government, private, and charity funded agencies which, in turn, must reflect the role of technology in the contemporary landscape of public health service engagement. The findings from this study did not pertain to a particular geolocation and thus may not be applicable to all official state-funded or charitable organisations, however; insight is provided on the dynamicity of mHealth for HIV prevention strategies desired in this population.

For HIV prevention, it is crucial for health professionals to evaluate and manage the possible factors of behaviour change regarding safer sexual practices. Whilst many of the issues of behaviour change (lack of self-efficacy, limited resources, and social norms) may not be specific to HIV prevention, they have specific meanings in relation to risk compensation and HIV acquisition (Kippax and Stephenson, 2012). The difficulties faced when implementing novel strategies for HIV prevention are highlighted in this study as accessing a large scale sample of MSM was unachievable despite empirical evidence touting the benefits of online HIV prevention research (Chiasson et al., 2006). HIV prevention care providers may benefit from further training in the design and construction of HIV prevention resources which may encourage MSM to access, engage with and maintain a relationship with behaviour change influencers. Primary healthcare providers such as STI clinics or services that offer HIV testing should also be encouraged to address the role of mHealth technology in HIV prevention, as the time devoted to addressing HIV preventative measures promote fiscal benefits in comparison to that of the treatment of HIV positive diagnoses and care. mHealth technology offers an alternative, cost-effective, method which can be distributed largely across healthcare professionals and clients to integrate this method in healthcare approaches and assist those who may have difficulties attending face-to-face healthcare services. MSM surveillance literature on HIV prevention and treatment suggest a sub-par use of healthcare services among this population in which can be impacted by a lack of previous testing history (Flowers et al., 2013). Further, the use of mHealth technology provides additional support for HIV prevention clients which may increase consciousness of wider sexual

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health measures. Therefore, a shift in HIV prevention services from a face-to-face one-stop-shop of sexual health clinics to an access anytime anywhere service recognises that there may be more optimal methods to meet MSM needs.

Understanding and promoting sexual health and preventative methods for MSM demographics across the global remains pivotal. Utilising theoretical models such as the IMB model in situating behavioural adherence to preventative methods are indicative of a growing critical health approach to health promotion for at high risk groups. In this thesis, condom adherence is conceptualised to occur in reflection of relevant information, motivation, and behavioural skills factors. According to the IMB model, information is directly relevant to condom use as an initial prerequisite for condom adherence. Findings of the current study reflect a growing need for a greater yearning for the awareness of the benefits of using condoms via mHealth technology. As the model informed the construction of the survey used to garner a measure of MSM's preference, the current study supports the increasing trend of using theoretical models in health promotion. With regard to the current motivational-associated findings and the IMB model, it can be argued this thesis reflects the influence of social motivation, that is, the salience of others' sexual health represented with the individual's motivation to comply with preventative behaviours. Evidence supporting this notion is reflected in the high mean score of respondents wanting to keep a track record of condoms used with other sexual partners. Thus, public health interventions should acknowledge the social influence of others in the generation and adherence to the sexual behaviours of MSM. As is the case for many behaviours, adherence and compliance to specific behaviours is complicated. The current author is aware of this, however, it can be argued that the results of table 2.3 which demonstrate a high indication of participants wanting information on where to free condoms, and information on how a condom may affect sexual pleasure, are indicative of participants' desires to adhere to using condoms through representing their wanting to use condoms by maximising their opportunity to use condoms in seeking out mHealth methods which direct them to the condom resources. This thesis has outlined constructs and relationships of the IMB model and its applicability to mHealth for HIV prevention. After reviewing considerable empirical evidence establishing the conceptual utility of the model in a formative assessment for methods to approach the context of understanding mHealth for HIV prevention, this thesis asserts the conceptual utility of the IMB model which is reinforced by the empirical generalisability of the model itself. It is hoped that evidence in this thesis will stimulate applications of the theoretical model to

understanding the complex interplay of the IMB constructs in MSM fidelity to condom adherence and other novel mechanisms to support HIV prevention approaches.

MSM reported that engaging in a HIV prevention programme delivered through mobile technology would improve their knowledge. Of note, in respondents who were interested in receiving mHealth content delivered by SMS (text messaging) reported the highest perceived impact compared to those interested in receiving mHealth prevention content through an application and through mobile internet. This raises the question that perhaps different delivery methods should be made available to MSM. This also raises the question that perhaps intervention delivery should not transcend the 'basic' delivery method of SMS technology in the pursuit of more sophisticated technologies.

8. Recommendations for future research

Based on the limitations that exist in this research, future studies should involve greater respondents in minority ethnicities, or conduct a multi-country comparison study to better understand the acceptance of and interest in mHealth HIV prevention in different cultural contexts. Additionally, future research can build on this study by further testing the remits of social networking recruitment for MSM, given emerging evidence touting the reliance of social networking technologies in this demographic.

Future studies can extend the questionnaire that was applied in this study to explore more innovative educational technologies such as online peer-networked software and virtual reality delivery in order to continue to evaluate novel methods of HIV prevention education. Follow-up studies can also construct a more comprehensive account of changing social norms regarding HIV prevention and may reveal alternating influences on an individual's risk perception of HIV and subsequent HIV preventative behaviours. Moreover, motivations for using mHealth measured through open-ended questions may provide a mixed-methodological approach to generate greater levels of data which may be triangulated to create a clear snapshot of current feasibility, acceptability, and constructions of mHealth in the face of HIV prevention.

Demographic information is, undoubtedly, an important variable to collection information on. While the ethnicity and education levels were collected in the current study, the current research did not conduct variance analyses to ascertain whether or not these variables had any influence on the IMB constructs. The collection and subsequent inferential analyses of such variables may elucidate sub-group perceptions and attitudes toward mHealth and HIV prevention which may extend and inform future mHealth initiatives.

9. **Lastly, future researchers should use a longitudinal approach to elucidate findings on the intention to use, or interest in, mHealth for behaviour change. As such, the theoretical framework used should be validated at different points in time. For example, future studies may replicate the current study's methodological procedure in order to establish interest in mHealth then build on this to explore pre-adoption**

and post-adoption of mHealth for HIV prevention and the impact of these on HIV preventative behaviours. Conclusion

In this thesis, it has been argued that MSM present a disparate burden of HIV diagnoses when compared to other populations. The role of mobile health (mHealth) technology has been discussed in the face of HIV prevention targeting MSM. Given that technology is developing rapidly and has proliferated across the globe, this paper has argued that mHealth presents an innovative, cost-effective, and ubiquitous mechanism to deliver HIV prevention. But, while the affordances of mHealth are alluring, there has been a significant lack of end-users involved in the developing of behaviour change initiatives which are designed for them. Therefore, end-users must be acknowledged and at the forefront of the design process in order for mHealth to be optimal. This paper has elucidated on HIV prevention delivery approaches and desired content. It cannot be understated that participants have expressed a need for a mHealth initiative which provides accurate information on the risks of acquiring and transmitting HIV and where to access free condoms. These results are tantamount to supporting ongoing arguments regarding the failings of local and national efforts which aim to curb incidence rates of HIV among MSM. Incidence and prevalence rates of HIV among MSM are high, even to the day this thesis is submitted. For mHealth to progress and for widespread adoption, and hopefully widespread reduction of HIV among MSM, research must endeavour to include end-users in the evaluation of future behaviour endeavours in order to increase awareness and acceptance and to more broadly raise the consciousness of those with the means to implement mHealth as a viable and effective method of prevention. Looking to the future, research must explore longitudinal efforts of measuring the impact of mHealth for behaviour change in real-time measures. As technology plays an ever increasing role in the social and sexual lives of every individual, it is time healthcare providers and researchers become the champions of mHealth.

Appendices

Appendix 1: Qualtrics output of Survey

Initial Welcome Page

Please read this section to understand the purpose of this survey.

This survey will be used to collect data about how individuals use smart technologies and their potential applications. If you decide to participate in this survey you are contributing information which may help develop future HIV prevention materials delivered through smart technologies. The survey should take approximately 15 minutes to complete.

If you are interested in participating, please click next.

Project Information

What is the study about?

The purpose of this study is to gain a better understanding of what men who have sex with men prefer when considering to participate in a HIV prevention programme. A focus here is on the delivery of a HIV prevention programme through the technical capabilities of smartphones. The main aim of the survey is to contribute to an establishing field of psychology which may best inform the future creation of HIV programmes delivered through mobile phones in order to garner the biggest positive impact for men who have sex with men.

Do I have to take part?

It is your decision whether to participate in the survey. If you decide to participate you will be asked to electronically sign a consent form following this information page in which by doing so will acknowledge that you will be free to withdraw at any time and without providing any reason. It will be very much appreciated if you complete all questions in the survey.

What will I need to do?

If you agree to participate in the survey you will be asked to answer a series of questions; these questions are merely to ascertain your opinions on your preferred method of delivery and interest in potential content of a HIV prevention programme. If you have any questions at any time you are welcome to email the student researcher to assist with any questions you may have regarding the survey.

Lewis.Clarke@Hud.ac.uk

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Will my identity be disclosed?

NO. All data participants provide within the survey will be kept confidential from any inappropriate disclosure and will not be shared by anyone other than the academic research team invested in the survey. Your identity will not be revealed as the survey is to be completed anonymously. You will be allocated an ID number only.

What will happen to the information?

All information connected with your participation in this survey will be kept secure and there is no identifying material connected with you so as to ensure your anonymity. It is anticipated that the research associated with this survey may, at some point in the future, be published in an academic journal or report. If this should happen no one will be able to identify you or associate you with your responses to the survey you provided.

Who can I contact for further information?

If you would like further information on the current survey, please contact the student researcher:
Lewis Clarke   Lewis.Clarke@hud.ac.uk

Or their supervisor(s):

Elizabeth Hughes   E.C.Hughes@hud.ac.uk
Steve Lui   S.Lui@hud.ac.uk

Thank you for your time and cooperation.

Consent Page

Please ensure that you have read, understand and sign the following consent form by checking the boxes next to each statement. Participation in the current survey is completely voluntary and you are not obligated to participate. If you require further details, please contact the student researcher Lewis Clarke (Lewis.Clarke@hud.ac.uk). You are not required to provide your name or a signature to participate. Checking the boxes next to the following series of statements is considered a signature and is an indication that you agree to the statements, including that this survey should be completed anonymously.

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I have been fully informed of the nature and aims of this research

○ Yes
○ No

I understand that I have the right to withdraw from the research at any time without giving any reason

○ Yes

I understand that following my participation I have no right to withdraw the data I have provided as data provided is anonymous

○ Yes

I understand that the information collected will be kept in secure conditions indefinitely at the University of Huddersfield

○ Yes

I understand no other person(s) have access to the data provided in the survey other than the academic research team which includes the student researcher and their supervisor(s)

○ Yes

I understand my identity will be protected and the current survey is to only be completed anonymously

○ Yes

I am satisfied that I understand the information and are happy to participate in the project. By clicking 'I consent' I understand that this provides an electronic signature agreeing to participate in the current study.

○ I consent
○ I do not consent

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Participant Demographics

How old are you? (Please answer in years and in numbers)

[   ]

Do you consider yourself to be (check all that apply):

- ☐ Female
- ☐ Intersex
- ☐ Male
- ☐ Transgender FTM
- ☐ Transgender MTF
- ☐ [   ] Other (please state)

Please tick on which of the following best describes your ethnicity:

- ○ White
- ○ Mixed / Multi-racial
- ○ Asian / Asian British
- ○ Black / African / Caribbean / Black British
- ○ [   ] Other (please state)

What is your level of education?

- ○ GCSE
- ○ A-Level/BTEC
- ○ Degree
- ○ Masters Degree
- ○ PhD

Please tick on which of the following best describes your sexual identity:

- ○ Heterosexual / straight
- ○ Bisexual / bi
- ○ Homosexual / gay
- ○ Same gender loving
- ○ [   ] Other (please state)

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Which of the following best describes your relationship situation?

O Single
O In a relationship (exclusive)
O In a relationship (open)

Intersex_Demographic

Thank you for answering. As you have identified as Intersex in the demographic question of this study and this study focuses upon the preferences of identifying males you do not meet the eligibility requirements to participate in the study.

Thank you for your time, your may close your browser.

Smartphone Assessment

Do you own a smartphone?

O Yes
O No

Which of the following methods best describe how you meet sexual partner(s)?

O via social media applications (exclusively)
O via gay-associated venues such as gay bars, nightclubs (without using social media)
O via combination of social media and gay-associated venues
O [   ] via other internet platforms (please describe)
O Not applicable

How often do you use smartphone applications?

O At least once every hour
O Several times each day
O Once a day
O Several times each week

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○ Once a week

○ Once a month

○ Less than once a month

○ Never

Which, if any, of the following applications do you use more than once a week? (Tick all that apply)

☐ Facebook

☐ Grindr

☐ Twitter

☐ Scruff

☐ Instagram

☐ Snapchat

☐ Hornet

☐ Tinder

Without the use of social media and/or without using any geo-location based applications, which of the following would you use to find sexual partners? (tick all that apply)

☐ Gay nightclubs

☐ Gay saunas

☐ Gay pubs

☐ Cruising environments

☐ Not applicable

No_Phone

Thank you for participating in this survey. This survey focuses on delivering HIV prevention methods through mobile phone technology. You have identified that you do not own a mobile phone. You may close your browser now.

Female_Ps

Thank you for participating in this survey. The current study aims to explore the delivery of HIV promotion information in a sample of male-identifying men who have sex with men. You may close

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your browser now.

General Interest

This section focuses on your preferences on how a HIV prevention programme may be delivered. Please try and answer all questions.

How likely would you be to participate in a HIV prevention programme if delivered through the following options:

	Very likely	Somewhat likely	Not very likely	Not at all likely
Through a smartphone via SMS (text messaging)	O	O	O	O
Through a smartphone via an application	O	O	O	O
Through a smartphone via the internet	O	O	O	O
Through a tablet via the internet	O	O	O	O

How interested would you be in the following HIV prevention education content delivered through your preferred delivery mode (answered previously):

	Very interested	Somewhat interested	Not very interested	Not interested at all
Accurate information on the benefits of using condoms consistently with sexual partner(s)	O	O	O	O
Accurate information regarding risks to transmitting and acquiring HIV	O	O	O	O
Receiving 'myth busting' information which clarifies some common misconceptions associated with using condoms	O	O	O	O
Information which provides answers to some frequently asked questions related to using condoms	O	O	O	O

How interested would you be in the following HIV prevention education content delivered through your preferred delivery mode (answered previously):

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	Very interested	Somewhat interested	Not very interested	Not interested at all
The benefits of keeping a record on how often condoms are used with sexual partner(s)	O	O	O	O
Tips on how to negotiate using condoms with sexual partner(s)	O	O	O	O
Information on how to use condoms as a form of mutual respect for your's and your sexual partner(s)'s sexual health	O	O	O	O
Information aimed to increase confidence in initiating using condoms	O	O	O	O

How interested would you be in the following HIV prevention education content delivered through your preferred delivery mode (answered previously):

	Very interested	Somewhat interested	Not very interested	Not interested at all
Links to video testimonials from other men who have used condoms consistently with sexual partner(s)	O	O	O	O
Accurate information on how to avoid condom splitting / slippage	O	O	O	O
Information on how a condom may effect sexual pleasure	O	O	O	O
Where to access free condoms	O	O	O	O
How drugs and alcohol may effect decisions to use condoms	O	O	O	O
The benefits of carrying condoms on your person	O	O	O	O

If you were to participate in receiving HIV prevention information [in your preferred method of delivery] how often would you want to engage in receiving information [of the content you were previously on]? (Tick all that apply)

O At least once every hour

O Several times each day

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○ Once a day

○ Several times each week

○ Once a week

○ Once a month

○ Less than once a month

The following questions aim to measure the perceived impact participating in a HIV prevention programme delivered through your preferred method and receiving your preferred content would impact upon your behaviours. Please tick the answer which reflects your opinion to the following statements.

Engaging in a HIV prevention programme would increase my ability to discuss using condoms with my sexual partner(s)

○ Strongly disagree

○ Disagree

○ Agree

○ Strongly agree

Engaging in a HIV prevention programme would improve my knowledge on condoms

○ Strongly disagree

○ Disagree

○ Agree

○ Strongly agree

Engaging in a HIV prevention programme would increase the frequency I use condoms in sexual encounters

○ Strongly disagree

○ Disagree

○ Agree

○ Strongly agree

The next series of questions aim to measure any concerns of privacy associated with participating in a HIV prevention programme.

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To what extent would you have concerns associated with the privacy of your participation in a HIV prevention programme?

○ No concern at all
○ Of little concern
○ Moderately concerned
○ Very concerned

To what extent would you have concerns associated with the confidentiality of your participation in a HIV prevention programme (for example, having identifying features such as your name and city of residence used)?

○ No concern at all
○ Of little concern
○ Moderately concerned
○ Very concerned

Thank You

Thank you for participating.

If you require further associated sexual services, please contact your local sexual health clinic or go to www.nhs.uk/livewell/sexual health for associated sexual health information.

For more opportunities to receive sexual health information, such where to access free condoms or get a HIV test please go to:

http://www.mesmac.co.uk/

You may now close your browser window.

No Participation

Thank you for answering. As you decided not to participate you can go ahead and close the browser window.

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Appendix 2: (Approved) School of Research Ethics Panel Form

School of Human and Health Sciences – School Research Ethics Panel

APPLICATION FORM
 Please complete and return via email to:
Kirsty Thomson SREP Administrator: hhs_srep@hud.ac.uk

Name of applicant: Lewis Clarke

Title of study: Exploring the opportunities for mobile phone-based HIV health promotion messages among a sample of men who have sex with men.

Department: Health and Human Sciences   Date sent: 27/01/17

Please provide sufficient detail below for SREP to assess the ethical conduct of your research. You should consult the guidance on filling out this form and applying to SREP at http://www.hud.ac.uk/hhs/research/srep/.

Researcher(s) details	Lewis Clarke, in fulfilment of MSc by Research
Supervisor(s) details	Elizabeth Hughes Steve Lui
All documentation has been read by supervisor (where applicable)	Yes

Aim / objectives	Worldwide, men who have sex with men (MSM) represent highly disproportionate incidence rates of human immunodeficiency virus (HIV) compared to heterosexual men. Surveillance data from a systematic review from samples in low and middle-income countries report that MSM are 19.3 times more likely to be living with HIV than the general population (Baral, Sifakis, Cleghorn & Beyrer, 2007). Moreover, reported from routinely collected data on the HIV epidemic in the United Kingdom in 2013, Rice and authors (2016) posit 107,900 (CI 101,600-115,800) persons are living with HIV of whom 26,1100 (CI 20,260-33,810) are living with an undiagnosed HIV (Rice, Yin, Brown, Croxford, Conti, Angelis & Delpech, 2016). Despite advancements in treatment such as pre-exposure prophylactic (PReP), there is currently no cure for HIV. Therefore, with an absence of a HIV vaccine, behavioural interventions continue to be pivotal in targeting risky sexual behaviours to reduce transmission and acquisition of HIV among this high-risk sample (Coates, Richter & Caceres, 2008). With advancements in mobile technology, the next generation of behavioural interventions focusing on reducing HIV incidence rates among MSM have begun to use handheld smart technology such as mobile phones and tablets with access to the internet, offering efficacious strategies in optimising HIV prevention (Boyer, Smelson, Fletcher, Ziedonis & Picard, 2010). In this sector of preventative treatment, mobile health (mHealth) offers the greatest, cost-effective, access to samples which may not attend face-to-face clinical treatment, such as MSM populations (Clifton et al., 2016). This study will assess the preferences of mHealth technologies when (1) deciding upon delivery method of HIV prevention messages, (2) the preferred content of the HIV prevention messages, (3) the familiarity with mobile technology, and (4) concerns over

	privacy and confidentiality when using mHealth technology. In this study, it is anticipated participants will prefer mobile phone 'applications' in the delivery of HIV prevention methods with an increased association with this mobile technology platform. But, in the absence of this, cross-tabulated findings will offer a significant insight into the preferences of this sample.
Brief overview of research methods	Participants will complete an online survey measuring; participant demographics, mobile phone ownership, mobile phone application use, methods of sexual partner selection, preferred method of HIV prevention messages, preferred content of HIV prevention messages (collapsed into information, associated prevention motivations and behavioural skills), perceived frequency of engagement with prevention messages, concerns over privacy and confidentiality and perceived impact of receiving prevention messages. A duplicate of the Qualtrics questionnaire is attached to this application. The survey will last approximately 15 minutes.
Project start date	10/02/16 or following SREP approval.
Project completion date	June 2017
Permissions for study	MSM associated venues will be asked by the student researcher to post an advert of the current study and will take no other part in data collection or recruitment.

Access to participants	Participants will be recruited using two methods. The first method will be asking MSM associated venues to display an advert for the current study which will provide a QR code and link to the online Qualtrics survey. The second method will be distributing a link to the Qualtrics survey via twitter posts. Using an academic Twitter account, a post shall be made using an advert for the study [*see attached material 1]*. Other users will be asked to distribute this twitter post which provides a QR code and link to the online survey. Participants following the QR code or link to the current survey will be met with the project's information sheet [*see duplicate of Qualtrics outpu*t]. To participate, a consent sheet follows this which clearly outlines that by clicking 'I consent' participants are knowingly providing an electronic signature acknowledging they have been fully informed of what is expected of them and the nature and aims of the study. The population will be (1) male identifying, (2) over the age of 18, (3) own a smartphone, (4) men who have sex with men and (5) have access to the internet to complete the survey.
Confidentiality	Data and details of participants will not be shared with anyone other than the researching student and supervisors. Informed consent will be obtained through participants signing a consent form before beginning online survey [*see duplicate of Qualtrics question output*]. There are no threats to confidentiality as participants will report survey data anonymously. No further measures are required to prevent confidentiality being comprised while data is being collected.

Anonymity	Questionnaire data is to be completed anonymously. Participants are reminded throughout the information sheet of this. In signing the consent page, they must also sign that they are aware the survey is to be completed anonymous [*see duplicate of Qualtrics question output*].
Right to withdraw	Participants are reminded of their right to withdraw in the information sheet and must sign that they acknowledge this right in the consent form [*see duplicate of Qualtrics question output*]. Participants are reminded that as data provided within the study is anonymous they cannot withdraw the data once it has been submitted as there are no identifying features. Surveys not completed will not be included within analysis to ensure the participant's right to withdraw data at any time during the survey.
Data Storage	No survey data will be completed in paper format. Online data will be stored on a password protected file in a password protected computer. Otherwise, data will be stored on a password protected USB stick accessible to the student researcher and supervisors. Custodian of the data generated from the current study will be oversaw by the lead supervisor (Elizabeth Hughes).
Psychological support for participants	With a focus on sexual health, at the end of the survey participants will be provided with the information of relevant sexual health services.
Researcher safety / support (attach completed University Risk Analysis and Management form)	This study is of minimal risk to the researcher. Offline distribution of study associated materials (i.e. flyers/leaflets/posters with the QR code and link to the survey) further presents minimal risk as the student researcher will distribute these and not engage in participant recruitment face-to-face [*see attached materials 3*].

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Information sheet	See duplicate of Qualtrics output.
Consent form	Participants will asked to tick a box that shows they understand the nature, aims and understand what to expect within the survey. Participants are also made aware of how data is stored and their anonymity. *See duplicate of Qualtrics output.*
Letters / posters / flyers	See attached material **1**
Questionnaire / Interview guide	See duplicate of Qualtrics output
Debrief (if appropriate)	See duplicate of Qualtrics output
Dissemination of results	The results of the current study will be submitted for completion of a MSc by Research (Psychology). The results may also be presented at academic conferences and constitute data used for a submission for publication in an academic journal.
Identify any potential conflicts of interest	N/A
Does the research involve accessing data or visiting websites that could constitute a legal and/or reputational risk to yourself or the University if misconstrued? Please state Yes/No If Yes, please explain how you will minimise this risk	No

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The next four questions relate to Security Sensitive Information – please read the following guidance before completing these questions: http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2012/oversight-of-security-sensitive-research-material.pdf	
Is the research commissioned by, or on behalf of the military or the intelligence services? Please state Yes/No If Yes, please outline the requirements from the funding body regarding the collection and storage of Security Sensitive Data	No
Is the research commissioned under an EU security call Please state Yes/No If Yes, please outline the requirements from the funding body regarding the collection and storage of Security Sensitive Data	No

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Does the research involve the acquisition of security clearances? Please state Yes/No If Yes, please outline how your data collection and storages complies with the requirements of these clearances	No
Does the research concern terrorist or extreme groups? Please state Yes/No If Yes, please complete a Security Sensitive Information Declaration Form	No
Does the research involve covert information gathering or active deception? Please state Yes/No	No

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Does the research involve children under 18 or participants who may be unable to give fully informed consent? Please state Yes/No	No
Does the research involve prisoners or others in custodial care (e.g. young offenders)? Please state Yes/No	No
Does the research involve significantly increased danger of physical or psychological harm for the researcher(s) and/or the subject(s), either from the research process or from the publication of findings? Please state Yes/No	No

Does the research involve risk of unplanned disclosure of information you would be obliged to act on? Please state Yes/No	No
Other issues	N/A
Where application is to be made to NHS Research Ethics Committee / External Agencies	No
Please supply copies of all relevant supporting documentation electronically. If this is not available electronically, please provide explanation and supply hard copy	

All documentation must be submitted to the SREP administrator. All proposals will be reviewed by two members of SREP.

If you have any queries relating to the completion of this form or any other queries relating to SREP's consideration of this proposal, please contact the SREP administrator (Kirsty Thomson) in the first instance – hhs_srep@hud.ac.uk

Attached material(s): Risk assessment

RISK ANALYSIS & MANAGEMENT

ACTIVITY: Research Involving Human Participants			Name: Lewis Clarke	
Hazard(s) Identified	Details of Risk(s)	People at Risk	Risk management measures	Other comments
Loss/ theft of data	Security of data	Participants	Electronic data to be stored only on password secured computer equipment and storage devises.	Information to be stored on password protected 'cloud' system.
Manual handling	Personal wellbeing	Researcher	To move and carry equipment with consideration of personal health and well-being.	
Display screen equipment	Poor posture sat working for prolonged periods resulting in musculosketal problems, visual/physical fatigue	Researcher	All workstations subject to DSE assessment process	
Slips trips or falls	Obstructions or trailing cables on thoroughfares throughout University campus	Researcher	Researcher vigilance in public areas Regular review of working space to ensure health and safety	

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Physical or emotional conflict	Personal wellbeing. Potential for researcher to mistreat a participant, or vice versa	Researcher and Participants	Participants have the right to not answer questions Exclusively online, participants must discuss current study via university e-mail provided.	
Distributing advertisement for current study	Personal wellbeing. Potential for research to be mistreated or vice versa.	Researcher	Ensure whereabouts of researcher are known during distribution Researcher to inform venues before distributing advertisement Vigilance in public areas	

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