

APPLICABILITY OF THE THEORY OF PLANNED BEHAVIOR  
TO EXPLAIN CLINICIANS' INTENTION TO SCREEN  
MEN WHO HAVE SEX WITH MEN FOR SYPHILIS INFECTION

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Doctor of Philosophy

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## **ABSTRACT**

Syphilis prevention in the United States continues to be an enduring public health challenge. Although syphilis is a curable infection, if left untreated it can result in severe, debilitating and potentially life-threatening complications. Routine screening for syphilis in high-risk populations remains an important prevention and control measure. Research consistently demonstrates the relative advantage of greater testing frequency in at-risk populations such as men who have sex with men (MSM) using both cost-effectiveness analyses and mathematical modeling. Despite this, frequency of screening for syphilis among MSM remains sub-optimal, and failure to screen MSM at recommended intervals may be attributable to clinicians' perceptions related to syphilis screening in this population. The Theory of Planned Behavior (TPB) may help to elucidate the attitudes, social and professional norms, and perceived behavioral control that providers experience towards syphilis screening. The extent to which these cognitive-behavioral factors facilitate clinicians' intentions to screening MSM for syphilis has not been previously evaluated. Using the constructs of the TPB, this study developed and validated a new survey tool with a national sample of physicians (n=123) who treat MSM and recruited through a proprietary email list and through passive recruitment on social media and provider Listservs. Results of the survey revealed variability in providers' attitudes, social norms and perceived behavioral control, and these differed in association with self-reported syphilis screening intention and behavior. The survey was also used to validate a measurement model based on the TPB. This measurement model consisted of four factors: attitudes, social norms, perceived behavioral control and intention. This model was then used in structural equation modeling analysis to simultaneously test the strength of associations between these factors and a self-reported behavioral outcome.

Results indicate that attitudes have a significant indirect effect on self-reported screening behavior mediated through intention. Perceived behavioral control was also strongly associated with self-reported behavior, as was intention to screen. By incorporating the TPB into a model of physician behavior, this study provides a framework for interventions targeted at increasing syphilis testing frequency in clinical practice.

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## TABLE OF CONTENTS

	Page
ABSTRACT.....	iii
ACKNOWLEDGEMENTS.....	v
LIST OF TABLES.....	ix
LIST OF FIGURES.....	x
<b>CHAPTER 1: INTRODUCTION AND AND BACKGROUND INFORMATION.....</b>	<b>1</b>
Problem statement and background.....	1
Syphilis among men who have sex with men (MSM).....	4
Screening for Syphilis among MSM .....	6
Barriers to Syphilis Screening.....	8
Barriers Specific to Clinicians.....	9
Strategies to enhance Syphilis Screening in MSM.....	12
Theoretical Framework.....	14
The relationship between Intention and Behavior.....	18
Current study.....	20
Rationale.....	20
Research Objectives and Specific Aims.....	21
Study Overview.....	22
Overview of the three manuscripts.....	26
Description of Manuscript 1.....	27
Description of Manuscript 2.....	30
Description of Manuscript 3.....	34
Conclusion of Introduction.....	37
References.....	38
<b>CHAPTER 2: OPPORTUNITIES TO ENHANCE PROVIDER AND CLINIC-BASED INTERVENTIONS TO INCREASE SYPHILIS SCREENING AMONG MSM THROUGH THE APPLICATION OF BEHAVIORAL THEORY: A SCOPING REVIEW OF REVIEWS AND SYNTHESIS .....</b>	<b>57</b>
Abstract.....	57
Background.....	58
Methods.....	60
Results.....	61
Theory-based literature.....	89
Healthcare providers.....	90
Theory.....	91
Clinical outcomes.....	93
Associations with behavior and intention.....	95
Syphilis screening intervention literature.....	96
Target population.....	97
Study method and intervention modality.....	98
Screening results and associations.....	99
Discussion.....	101

Limitations.....	106
Conclusion.....	107
References.....	108
CHAPTER 3: USE OF BEHAVIORAL THEORY TO EXPLAIN PROVIDERS’ INTENTION AND BEHAVIOR TO SCREEN MSM PATIENTS FOR SYPHILIS INFECTION.....	126
Abstract.....	126
Background.....	127
Methods.....	130
Participants.....	130
Measures.....	131
Analytic plan.....	133
Results.....	134
Discussion.....	143
Limitations.....	146
Conclusion.....	146
References.....	147
CHAPTER 4: PREDICTING HEALTHCARE PROVIDERS’ SYPHILIS SCREENING INTENTION AND BEHAVIOR TOWARD MSM PATIENTS: AN APPLICATION OF THE THEORY OF PLANNED BEHAVIOR .....	166
Abstract.....	166
Background.....	167
Methods.....	169
Participants.....	170
Measures.....	170
Analytic plan.....	171
Hypotheses.....	172
Results.....	174
Sample.....	174
Measurement model.....	176
Structural equation model.....	177
Hypothesis tests.....	178
Discussion.....	182
Limitations.....	183
Conclusion.....	184
References.....	185
CHAPTER 5: DISCUSSION OF MAIN FINDINGS.....	204
Introduction.....	204
Providers as an intervention focus – How it fits with syndemics.....	206
Behavioral interventions for providers.....	208
Limitations.....	210
Lessons learned.....	212
Conclusion.....	213
References.....	215
Appendix A. SURVEY RECRUITMENT LETTER.....	233
Appendix B. SEARCH STRATEGY FOR SCOPING REVIEW .....	234
Appendix C. FULL ONLINE SURVEY (PRINT VERSION).....	235



## **Tables**

Table 1. Theory of Planned Behavior Survey Items by Construct and Knowledge Items..	33
Table 2. Summary of Behavioral Theory Studies.....	64
Table 3. Summary of Syphilis Screening Studies.....	75
Table 4. Descriptive Overview of Included Records.....	89
Table 5. Sample Demographics.....	135
Table 6. Knowledge Item Descriptive Summary.....	138
Table 7. Theory of Planned Behavior Item Descriptive Summary.....	139
Table 8. Distribution of Screening Recommendations for Case Vignettes.....	141
Table 9. Independent Samples T-tests and One-Way ANOVA Comparing TPB means by Self-reported Intention and Behavior.....	142
Table 10. TPB Survey Items by Construct and Knowledge Items.....	174
Table 11. Participant Demographics.....	175
Table 12. Descriptive Statistics and Correlation Coefficients for All Items (r).....	179
Table 13. Revised Measurement Model (with Geomin rotation).....	180

## Figures

Figure 1: Primary and Secondary Syphilis Reported Cases by Sex and Sex Partners, 2014-2018 (CDC, 2018).....	2
Figure 2 The Theory of Planned Behavior as Developed by Ajzen (1992).....	16
Figure 3. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Inclusion Flow-Chart Diagram.....	63
Figure 4. The Theoretical TPB model as Originally Proposed by Ajzen (1992).....	169
Figure 5. Final Structural Model.....	181

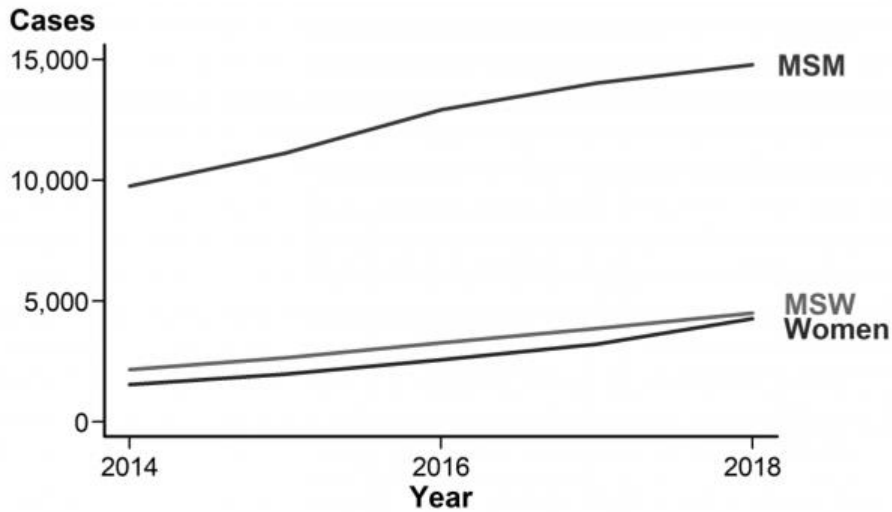
## **CHAPTER 1: INTRODUCTION AND BACKGROUND INFORMATION**

### ***Problem Statement and Background***

Syphilis is a sexually transmitted, genital ulcerative disease caused by the bacterium *Treponema pallidum*. Prevention of syphilis remains a persistent public health challenge. After reaching an historic low in the number of reported syphilis cases in the years 2000 and 2001, new primary and secondary syphilis cases spiked dramatically in 2015 and 2016, with men who have sex with men (MSM) accounting for the majority of new infections (Centers for Disease Control & Prevention (CDC), 2018).

Syphilis accounts for roughly 20% of all STI infections annually in the United States. Since reporting of syphilis in the US began in 1941, rates of infection have followed predictable cycles, demonstrating recurrent peaks and troughs at roughly 10-year intervals. (Kent & Romanelli, 2008). No single explanatory or causal mechanism has emerged that can account for these cycles, and different populations have been affected in different cycles. In recent years, rates of syphilis infection have risen sharply from a historic nadir of 2.1 per 100,000 primary and secondary (P&S) syphilis cases in 2000, to 10.8 per 100,000 in 2018; a greater than fivefold increase. (Centers for Disease Control and Prevention, 2019b) In 2018, MSM accounted for 54% of all incident primary and secondary (P&S) syphilis cases in the US (see Figure 1) (Centers for Disease Control & Prevention (CDC), 2018; Centers for Disease Control and Prevention, 2019b).

Figure 1: Primary and Secondary Syphilis reported cases by sex and sex partners, 2014-2018 (CDC, 2018)



\* 36 states were able to classify  $\geq 70\%$  of reported cases of primary and secondary syphilis as either MSM, MSW, or women for each year during 2014–2018.  
**ACRONYMS:** MSM = Gay, bisexual, and other men who have sex with men; MSW = Men who have sex with women only.

Unlike HIV, syphilis is a curable infection, with most primary and secondary infections requiring a single intramuscular injection of the antibiotic benzathine penicillin G, after which the infection typically resolves within 72 hours (Tipple, Jones, McClure, & Taylor, 2015; K. A. Workowski & Levine, 2002). If left untreated, however, about 15 to 30% of those infected will progress to a tertiary stage at which point potentially severe complications are common and include lasting damage to vital organs including the heart and kidneys; neurological complications including dementia; and the development of gummatous, tumor-like growths and ulcerative sores (Garnett, Aral, Hoyle, Cates, & Anderson, 1997). Clinical presentations of primary and secondary syphilis in men are typically mild and self-limiting. Symptoms often include a primary sore or *chancre* at the infection site. Secondary syphilis symptoms might include rash, lymphedema, and fever. During latent infection, individuals are entirely

asymptomatic (Rompalo, Joesoef, & Donnell, 2001), making syndromic surveillance complicated and unreliable.

The possibility for latently infected individuals to remain asymptomatic for up to a decade or more makes case finding difficult without serologic evidence. The limited availability of rapid syphilis assays also presents a significant barrier to testing for many individuals and clinical settings (Ong, Fu, Smith, & Tucker, 2018b). However, routine screening for syphilis in high-risk populations remains an important control measure, permitting detection of syphilis in the early primary and secondary stages. In turn, early detection allows for earlier treatment, preventing progression to later stages where serious health conditions may manifest. This has the added benefit of limiting the opportunities for the infection to be transmitted sexually. While an optimal screening frequency has not been well established or universally adopted (US Preventive Services Task Force, 2016), studies have consistently demonstrated the advantage of greater testing frequency in at-risk populations using both cost-effectiveness analyses (Chesson, Kidd, Bernstein, Fanfair, & Gift, 2016) and mathematical modeling (Gray et al., 2010; Tuite, Fisman, & Mishra, 2013; Tuite et al., 2018). This is particularly true for controlling syphilis among MSM.

In 2016, the US Preventative Services Task Force (USPSTF) released a report updating their recommendations for syphilis screening in asymptomatic, non-pregnant adults (US Preventive Services Task Force, 2016). The USPSTF concluded that screening for syphilis at three-month intervals in individuals at high risk provides superior detection relative to annual screening. The same report reaffirms that the benefits of greater and earlier detection of syphilis include preventing progression to late-stage disease and preventing sexual transmission to others by curing infections. However, evidence from clinic-based studies suggest that compliance with

this testing regimen remains sub-optimal, especially for MSM (Tai et al., 2008); and this has been shown to be true for men in HIV care (Barbee, Dhanireddy, Tat, & Murrain, 2015; Guiang et al., 2019), and men on Pre Exposure Prophylaxis (PrEP; the use of antiviral medication to prevent HIV infection) (Schumacher et al., 2019; Spinelli et al., 2018). The scientific evidence compiled to-date provides a near universal consensus: an increase in syphilis screening is necessary to control infections, especially within populations at high-risk and in regions where it is locally endemic (Peterman & Furness, 2015).

### ***Syphilis among men who have sex with men (MSM)***

MSM are disproportionately burdened by both HIV and Syphilis (Abara, Hess, Fanfair, Bernstein, & Paz-Bailey, 2016). Along with socio-ecological, structural and biologic factors, there are behavioral risk factors that may be unique to MSM that drive this disparity. As with other bacterial sexually transmitted infections, syphilis may be transmitted during oral, anal, or vaginal sex. Unlike HIV, however, syphilis transmission can occur indirectly through contact with a primary syphilis sore or chancre. MSM report a higher frequency of both number of instances of sexual intercourse and number of concurrent and lifetime partners (Rosario, Scrimshaw, & Hunter, 2006), which may increase both their risk of syphilis exposure and transmission. Men who have sex with men also report an earlier age of sexual debut, which serves to increase lifetime risk for most sexually transmitted infections relative to heterosexual peers (Outlaw et al., 2011). Recently, these behaviorally-linked risk factors have come to be seen as part of a larger syndemic affecting MSM (Halkitis et al., 2015). Syndemic theory suggests that multiple conditions (physical and mental health states, social conditions, exposure to violence and discrimination, etc.) work additively and in a mutually reinforcing way to increase susceptibility to other negative health outcomes (Singer, 2009). The syndemic that has emerged

around HIV risk among MSM has included substance use and misuse, depression, intimate partner violence, and discrimination victimization (Dyer et al., 2012; Stall, Friedman, & Catania, 2008). Further, these effects have been shown to accrue across the lifespan and function additively when studied longitudinally (Halkitis et al., 2015). Adding to this relationship are the intersections of race and social-economic status, which increase vulnerability and may instantiate forms of discrimination unique to those individuals. Experiences of discrimination, both covert and overt, may also adversely affect physical and mental wellbeing through the psychosocial impact of *minority stress*. Decades of research have established the role that stigma and discrimination play in determining health outcomes among sexual minorities (Kelleher, 2009; Meyer, 2014). This effect of stigma is seen across all levels; from structural and policy levels, to the deeply individual level wherein stigma may be internalized (Hatzenbuehler & Pachankis, 2016). This syndemic likely has the same relationship to syphilis.

It is also important to note that there is potentially significant biologic interplay between HIV and syphilis that may increase their co-prevalence. In addition to both being infections that are sexually transmitted, syphilis and HIV have been shown to function synergistically to increase susceptibility to both infections (Fleming & Wasserheit, 1999; Jarzebowski et al., 2012). HIV infection can impair both humoral and cell-mediated immunity, which can facilitate syphilis infection and result in its more rapid progression. Similarly, in persons with primary and secondary syphilis infection, disruption of the mucosal and epithelial barriers may increase the chances of HIV infection during vaginal or anal sex (US Preventive Services Task Force, 2016). In fact, several prospective cohort and longitudinal studies of HIV seroconversion have demonstrated that syphilis predicts HIV incidence in MSM and transgender women (Katz, Dombrowski, Bell, Kerani, & Golden, 2017; Solomon et al., 2014). Despite this heightened risk,

syphilis screening among MSM, especially those on PrEP or in HIV treatment, is not optimal, making it an important research focus.

### ***Screening for Syphilis among MSM***

In 1999, during a period of historically low syphilis rates in the US, the Centers for Disease Control and Prevention (CDC) unveiled a plan to eliminate syphilis (Centers for Disease Control and Prevention, 1999). At the time, national incidence of syphilis had dropped to well below 1,000 newly diagnosed cases per year, making it an ambitious yet feasible public health goal. However, by 2001 rates began a steep and uninterrupted increase that continues to this day. The most recent surveillance data illustrates this rather dramatically such that from this nadir of 1,000 cases in 1999, there was an increase to 27,000 cases recoded in 2016, and 35,000 cases in 2018 (the last year for which data is available) (Centers for Disease Control & Prevention (CDC), 2018; Centers for Disease Control and Prevention, 2019b) The sharpest and most sustained increase in syphilis cases has been among MSM in the US, which is now being referred to as an epidemic.(Taine, Norcross, Pinto-Sander, Fitzpatrick, & Richardson, 2018)

To confront this growing public health crisis, modifications to the screening recommendations for clinicians have been proposed. Screening in this instance refers specifically to serological screening (meaning through the collection and analysis of blood serum). Symptomatic screening for syphilis is frequently unreliable for reasons alluded to previously. Syphilis has been historically known as “the great imitator”, referring to its tendency to mimic the signs of other diseases and conditions (Balagula, Mattei, Wisco, Erdag, & Chien, 2014). Particularly in men, atypical presentations of syphilis are common, which can lead to signs that are easily ignored or misdiagnosed by even experienced health professionals (Marple, Ling, & Pollack, 2014). To this end, the USPSTF published a report in 2016 updating their screening



recommendations for non-pregnant, asymptomatic adults and adolescents (Bibbins-Domingo et al., 2016). The USPSTF identifies persons at greatest risk of syphilis infection to be MSM and men and women living with HIV. They also advise clinicians to screen according to local epidemiology, and to consider sociodemographic factors associated with increased syphilis risk and prevalence, including history of incarceration, commercial sex work, certain racial and ethnic groups, and being a male under the age of 29 years (US Preventive Services Task Force, 2016).

These recommendations were based on the syphilis epidemiological data for the US at the time the report was published, with men accounting for 90.8% of all primary and secondary syphilis cases in 2014. These cases were concentrated among men aged 20 to 29, who had 3 times higher prevalence than the general US male population. The distribution of cases also varied by race such that in the same reporting period, prevalence of primary and secondary syphilis cases was 18.9 per 100,000 among Black individuals, 7.6 per 100,000 among Hispanic individuals, 7.6 per 100,000 among American Indian/Alaskan Native individuals, 6.5 per 100,000 among Pacific Islander individuals, 3.5 per 100,000 among white individuals and 2.8 per 100,000 among Asian individuals (A. Cantor, Nelson, Daeges, & Pappas, 2016).

The recommendations for screening are based on the most commonly used assays, which combine treponemal and non-treponemal tests that rely on detection of antibodies rather than direct detection of the organism (Bibbins-Domingo et al., 2016). This results in a two-step process where first a non-treponemal test is performed (the Venereal Disease Research Laboratory [VDRL] or rapid plasma regain [RPR] test) and confirmed with a treponemal specific test (the fluorescent treponemal antibody absorption [FTA-ABS] or *Treponema pallidum* particle agglutination [TP-PA] test) (Binnicker, Jespersen, & Rollins, 2012). The USPSTF did not make

a definitive statement regarding the recommended screening interval, simply saying that an optimal screening interval has yet to be established. They did, however, cite their own preliminary research, which indicates that screening individuals living with HIV and MSM every three months provides superior coverage (A. Cantor et al., 2016). This recommendation aligns with other practice guidelines that may affect MSM and people living with HIV/AIDS (PLWH). Notably, MSM who are prescribed PrEP are recommended to undergo screening for bacterial sexually transmitted infections including syphilis every three to six months. However, there is substantial evidence to suggest that the failure to screen for syphilis at *every* three month PrEP refill authorization visit results in missing a significant proportion of asymptomatic cases (Golub et al., 2016). Similarly, MSM who are in HIV care are recommended to undergo screening for syphilis at least annually. However, this again has been shown to be inadequate for detecting asymptomatic cases (Branger, van der Meer, van Ketel, Jurriaans, & Prins, 2009; Hart-Malloy et al., 2019). Because individuals being treated for HIV are recommended to undergo viral load testing every 3-4 months (or 4-6 months if they have achieved stable viral suppression, meaning their viral load is consistently undetectable) (Kaplan et al., 2009) some researchers have suggested that this be used as a universal testing frequency for syphilis as well, though no guidelines have officially adopted this recommendation (Callander, Baker, Med, Chen, & Guy, 2013).

### ***Barriers to Syphilis Screening***

Despite the evidence that suggests screening MSM in both PrEP and HIV care at three-month intervals provides superior detection, actual clinical practice appears to fall considerably short of meeting this standard. In fact, there is extensive evidence to suggest that men in these patient populations are not even provided the minimum recommended interval of annual

screening. A longitudinal study following a sexually active cohort of MSM living with HIV found that only 71% had undergone syphilis screening in the past year (de Voux et al., 2018). Similarly, among a sample of male PrEP users, only 53% reported receiving comprehensive STI testing and counseling at their last PrEP care visit (Parsons, John, Whitfield, Cienfuegos-Szalay, & Grov, 2018). It is important to consider that both of these patient populations represent MSM who are connected in some way to clinical care, and therefore barriers to accessing healthcare -- while important to consider for the population at-large -- may be less salient in this instance. It is thus important to attend to the clinic-level barriers that may be implicated in this vast discrepancy between clinical best practices, and what clinicians' actual syphilis screening behavior is. Many of the same barriers to routine screening observed for other conditions such as HIV (Korthuis et al., 2011), colorectal cancer (Guerra et al., 2007), and gynecological cancers (Hawkins et al., 2013), are seen in syphilis screening as well. These include lack of knowledge and awareness about the need for screening, competing priorities, lack of time, and patient reluctance, fear or ambivalence. These clearly intersect with clinic-level barriers, and it is important to note that if clinicians are not offering syphilis screening, patients do not even have the opportunity to refuse. Thus, focusing on clinician barriers to offering syphilis screening is an important area of study.

### ***Barriers Specific to Clinicians***

Clinicians also experience barriers to screening for syphilis. One barrier that is commonly cited among providers is discomfort or difficulty with taking a sexual history (Carter, Hart-Cooper, Butler, Workowski, & Hoover, 2014). The frequency of sexual history taking has been shown to be highly variable, especially among primary care providers (Loeb, Lee, Binswanger, Ellison, & Aagaard, 2011). Routine history taking among these providers has ranged from 10%-

71% of primary care visits (Boekeloo et al., 1991; Lewis & Freeman, 1987; Platano, Margraf, Alder, & Bitzer, 2008; Wimberly, Hogben, Moore-Ruffin, Moore, & Fry-Johnson, 2006). This conforms to what has been reported by patients. Specifically, one study found that a minority of adult patients (28%) who had a routine healthcare maintenance visit in the past year reported being asked about sexually transmitted infections (Tao, Irwin, & Kassler, 2000). The effect of this barrier may be exacerbated by provider discomfort or lack of knowledge specifically related to MSM sexual behavior. Surveys of providers and their sexual history-taking practices consistently reveal that they either perceive themselves to be inadequately trained on, or simply not comfortable with, discussing sex with their MSM patients (Barbee et al., 2015; Barber, Hellard, Jenkinson, Spelman, & Stooze, 2011; Golub, Gamarel, & Lelutiu-Weinberger, 2017).

Lack of knowledge is also a frequently cited barrier among physicians. A recent study of medical students, residents, fellows, and attending physicians found that, overall, knowledge of syphilis was low (Bonnewell et al., 2020). A survey of medical providers (n=231) assessed five knowledge domains related to syphilis: epidemiology, transmission, clinical signs and symptoms, diagnosis, and treatment. The mean percent of correct responses across all participants were as follows: epidemiology (43%), transmission (44%), clinical features (40%), diagnosis (41%), and treatment (27%). Other facets of provider competence may affect syphilis testing behavior as well. For example, sexual minority-specific discrimination has been demonstrated to be part of a syndemic around syphilis among MSM (Ferlatte et al., 2018). More directly, a study of adolescent MSM found that provider communication regarding sexual health and HIV/STI prevention was negatively correlated with experiences of LGBTQ medical and healthcare discrimination, suggesting that providers who hold attitudes towards MSM and MSM sexual behavior that range from discomfort to outright discrimination are significantly less likely

to discuss STI and HIV prevention and screening with their adolescent MSM patients (Fisher, Fried, Macapagal, & Mustanski, 2018). How these and other factors contribute to clinical decision-making outcomes around syphilis screening is the question at the center of the current study.

Many of these barriers may be usefully categorized according to conceptual models of clinician behavior. Physician knowledge, for instance, may be highly consequential for determining attitudes towards syphilis. If clinicians are not well-versed on the extent of the syphilis epidemic among MSM, they may not be disposed to seeing it as a significant threat to the health of their patients and thus may not form a strong intention to screen. Similarly, there is a well-documented phenomenon which has gained focus during the scale-up and implementation of PrEP known as the ‘purview paradox’ (Hoffman et al., 2016; Lee & Petersen, 2018). The concept is employed to explain why PrEP coverage to high-risk patients remains sub-optimal. The paradox is that neither HIV infectious disease specialists nor primary care doctors perceive PrEP to fall within their purview of care, and rather each see it as the others’ responsibility (Pinto, Berringer, Melendez, & Mmeje, 2018). These same issues regarding subjective norms about who is best suited to provide certain types of care likely apply to syphilis testing as well. Lastly, unlike other bacterial STIs, there are atypical yet complicating features of screening, treating and monitoring patients for syphilis that may limit clinicians’ sense of perceived behavioral control. For instance, decisions about treatment are based on what stage syphilis is diagnosed in. There is the potential for further complications if it is suspected there is central nervous system involvement, which may require a lumbar puncture to confirm. Even further, to determine whether a patient has been adequately treated, follow-up serology is required to establish a  $\geq 4$  fold decrease in their initial antibody titer, which even then may require further

interpretation if a patient is serofast, meaning that nontreponemal antibody titers do not return to undetectable even after successful treatment (Sena et al., 2011). Recognizing these and other potential complications surrounding syphilis, it is perhaps conceivable that clinicians would not have a sense of complete volitional control in evaluating a patient, or confidence that a patient would comply with all recommended follow-up procedures (Clement, Okeke, & Hicks, 2014; Hicks & Clement, 2017). As a result, they may decide to forgo testing altogether in the absence of symptomatic disease.

### ***Strategies to enhance Syphilis Screening in MSM***

Recognizing the need to improve compliance with syphilis screening recommendations among providers treating MSM, several clinic-based interventions have been piloted in both HIV-positive and HIV-negative MSM patient populations. Zou et al., conducted a review of these interventions to assess their efficacy (Zou, Fairley, Guy, & Chen, 2012). Of the eight intervention studies that met their inclusion criteria, four focused specifically on syphilis testing interventions. The first highlighted an intervention implemented in an HIV clinic in the United Kingdom, which modified their standard assessment of HIV-positive patients to include serologic syphilis testing at each intake visit and for all subsequent follow-up care visits (Cohen et al., 2005). A period of 12 months post-implementation was compared to a 12-month pre-intervention period in terms of proportion of patients tested for syphilis at intake and the median time interval between tests. They found that post-implementation, the proportion of HIV patients undergoing syphilis serology at intake increased from 3% to 85%. Additionally, time intervals between syphilis tests decreased from a median of six months to four months. Another intervention targeted to MSM living with HIV followed a similar procedure and produced comparable results (Bissessor, Fairley, Leslie, Howley, & Chen, 2010b). This intervention was

implemented in an Australian HIV clinic and made syphilis serology standard with all blood tests performed as part of routine HIV monitoring. This resulted in a median increase in the number of tests performed at 12-month intervals from one to two and a reduction in the median amount of time between syphilis tests from 107 days to 45 days. Further, the number of asymptomatic male patients that tested positive increased from 21% to 85%. The remaining two interventions were implemented in clinic settings serving both HIV-positive and HIV-negative MSM (Hotton, Gratzer, Pohl, & Mehta, 2011). By incorporating an electronic medical record (EMR) prompt to their clinic workflow, one US clinic was able to increase the proportion of patients previously treated for syphilis that received follow-up testing at six months from 53% to 76%. The median time between detection and re-testing also decreased from 6.5 months to 4.6 months. Finally, an Australian clinic implemented a similar EMR-based prompt to remind clinicians to order syphilis testing for MSM with  $\geq 10$  partners at three month intervals (the frequency recommended by the USPSTF) (Bissessor, Fairley, Leslie, & Chen, 2011a). This resulted in a modest increase in screening rate from 77% to 89%. However, it dramatically increased their detection of asymptomatic primary syphilis cases from 16% to 53%.

Given the apparent success of these types of intervention, how is it that screening compliance remains so low in most clinical practices? It is important to consider that sustained changes to clinician behavior are not as easily achieved as making changes to clinic workflow or lab order procedure. A whole field of research has been dedicated to understanding the declining efficacy of EMR alerts over time, referring to it as “click fatigue” (Collier, 2018; Embi & Leonard, 2012). It is not known whether these gains were sustained over time. It is also the case that, even in instances where clinical practice guidelines are widely known, they routinely demonstrate little measurable effect on changing physician behavior (Cabana et al., 1999). None

of the above studies address the more psycho-social determinants elucidated above. Indeed, a seminal review published in JAMA enumerates the other barriers beyond lack of awareness and familiarity that may impede best practices implementation. These include lack of self-efficacy (Hiddik, Hautvast, van Woerkum, Fieren, & van't Hof, 1995; Kimura & Pacala, 1997; Rimer et al., 1990), lack of outcome expectancies (Ferguson & Lieu, 1997; Hutchison, Abelson, Woodward, & Norman, 1996), and the inertia of previous practice (Hudak, O'Donnell, & Mazyrka, 1995; Pathman, Konrad, Freed, Freeman, & Koch, 1996). **The authors of the review conclude that the application of a theoretical framework could help elucidate these barriers and even enhance interventions to target them specifically** (Cabana et al., 1999).

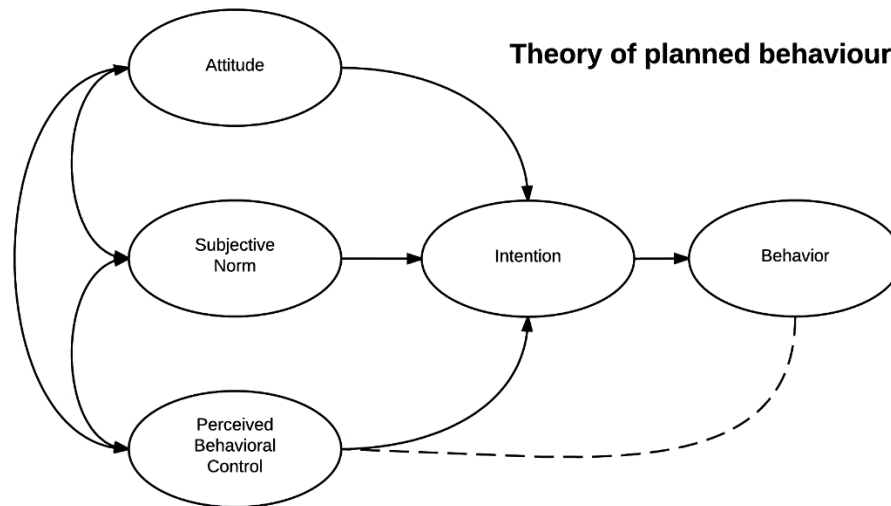
### ***Theoretical Framework***

Several models and theories have been used to reliably predict a variety of health-related behaviors. Each of these health behavior theories includes assumptions about the motivating and constraining forces that lead to the adoption, maintenance and cessation of various health behaviors. While comparing the relative utility of theories is possible through the analysis of the amount of variance in behavior that is explained by one theory over another, selection of a theory is more often motivated by *a priori* assumptions related to the research design, the target behavior, and the population of interest. An important consideration for the present study is its focus on predicting *healthcare provider* behavior. To this end, we have used the Theory of Planned Behavior (TPB) to determine the salient factors for clinical decision-making around syphilis testing in MSM patients.

The Theory of Planned Behavior (TPB) was developed as an extension of the Theory of Reasoned Action. (Ajzen, 1991) The theory was produced to account for the variability observed in behaviors across different contexts and situations. Similar to the Theory of Reasoned Action,



the TPB postulates that behavioral outcomes are the product of attitudes, subjective norms, and behavioral intentions. The notable addition made by the TPB, however, is the inclusion of *perceived behavioral control*. The original Theory of Reasoned Action was limited in its ability to account for variability in behavior that resulted from individuals' incomplete volitional control, and thus the TPB was developed. It is important to emphasize that the model is primarily concerned with *perceived* behavioral control. While *actual* behavioral control is undoubtedly influential, such as in the availability of resources and opportunity that might define the likelihood of a behavior occurring; it is *perceived* behavioral control that is of greatest interest to TPB theorists. This is not to be confused with other constructs such as Rotter's *locus of control* (Rotter, 1966). While perceived locus of control is considered to be a psychological constant-unvarying across situations and actions- perceived behavioral control as construed by the TPB assumes context-specified variability, and in fact expects perceived control to vary according to action and situation. Thus, as Ajzen explains by example: a person may hold the belief that, generally, the outcomes they experience are the result of their own behavior (internal locus of control), yet they may simultaneously believe the odds of becoming a commercial airline pilot are very low (perceived behavioral control) (Ajzen, 1991). Perceived behavioral control is most often associated with Bandura's concept of *perceived self-efficacy* (Bandura, 1977, 1982). This comparison is apt considering that the idea of perceived behavioral control was derived from Bandura's research. Uniting these two psychological concepts is the notion that people's behavior is often determined in part by their confidence in their ability to perform said behavior (see Figure 2).



*Figure 2 The Theory of Planned Behavior as developed by Ajzen (1992)*

The TPB has been applied to a range of health behaviors and intentions including healthcare utilization (Britt et al., 2011; Steele & Porche, 2005), smoking/cessation (Norman, Conner, & Bell, 1999; Topa & Moriano, 2010), and vaccination uptake (Agarwal, 2014; Gerend & Shepherd, 2012). It has also been used to predict healthcare worker behavior (McLaws, Maharlouei, Yousefi, & Askarian, 2012; Nelson, Cook, & Ingram, 2014), and more specifically physician behavior, such as implementing hand hygiene procedures, and prescribing treatment for asthma (McGinty & Anderson, 2008; Rashidian & Russell, 2012). The broad applicability of the TPB is due in part to its ability to account for a range of contributing factors as depicted in Figure 2. The theory defines the four constructs comprising the model as the following:

**Attitudes** – The extent to which an individual holds favorable or unfavorable attitudes towards a behavior. These attitudes also reflect outcome expectancies related to the behavior that can be seen as beneficial or harmful.

**Subjective norms-** Beliefs held by an individual that they feel reflect a societal consensus about the behavior. It is an appraisal of what they believe their peers think about the behavior.

**Perceived behavioral control-** The culmination of perceived power and control beliefs that determine the perceived ease or difficulty of performing a behavior.

**Behavioral intention-** The motivation to perform a behavior that influences whether or not a behavior will occur. Higher intention is associated with greater likelihood of occurrence.

These constructs of subjective norms, attitudes and perceived behavioral control are theorized to operate in aggregate by producing a favorable or unfavorable disposition towards the behavior, which generates an intention to perform said behavior. This is in-turn further subject to perceived behavioral control in the form of volitional control as outlined above. The end result, in theory, is an action either occurring or not (Ajzen, 1991).

Given the TPB's ability to account for both the cognitive and contextual dimensions of behavioral outcomes, it has found wide use in studies aimed to predict clinician and healthcare professional behavior. Healthcare professionals are expected to continually augment or alter their clinical practice to align with new research findings. However, it is well-documented that clinicians' responsiveness to these updates to best practices guidelines varies (Grimshaw, Eccles, Walker, & Thomas, 2002), leading to inconsistencies in patient care. This often manifests as a gap between evidence-based practices and the routine provision of healthcare as experienced by patients (Lenfant, 2003). Many factors may ultimately determine whether evidence-based guidelines are translated into effective practice. These might include dispositional factors like providers' individual motivation to change, or more logistical concerns tied to time and resources.

### *The relationship between Intention and Behavior*

Both TPB and TRA are predicated on the notion that most people do what they intend to do and do not do what they do not intend to do. While this may seem like a facile observation, it is important to highlight the presumed relationship between an intention to perform an action and that action taking place. If this assumption holds true, then intentions may be suitable predictors of behavior.

In general, Ajzen and other TPB researchers have found that behavioral intentions do in fact provide good predictive power in determining future behavior (Ajzen, 1991; Fishbein & Ajzen, 1980; Jaccard & Wood, 1986). This has also been borne out in studies on clinician behavior as well (Eccles et al., 2006). In fact, due to the myriad factors that may determine clinician behaviors, studies have favored measuring intentions over actual behavior, as they have been shown to be a reliable proxy to clinical practice outcomes and easier to assess (Eccles et al., 2006; Grimshaw et al., 2002). This relationship between clinicians' intentions and behavioral outcomes may be counterintuitive to some. Most behavioral theories are predicated on idea that the motivation to perform an action is based in-part on the perception that the consequences of the behavior will be directly experienced by the actor (eg. "if I quit smoking, my risk of pulmonary disease will decrease"). However, in the case of clinician's behavior, the default assumption is that the consequences of their clinical behavior will be experienced by others (namely, their patients).

Eccles et al. sought to investigate whether this intention-behavior paradigm held for clinician behavior as it does for the general population. To do this, they reviewed studies that examined the relationship between intention and clinical behaviors (Eccles et al., 2006). Their meta-analysis consisted of 1,623 health professionals across ten studies. They found that the

proportion of the variance in behavior that was accounted for by intention was equivalent to that seen in the general population literature, which amounts to a medium to large effect (Eccles et al., 2006). While the authors acknowledge that the number of extant studies upon which to base this analysis is small compared to the number of studies conducted in the non-health professional population, they point to the consistency with which intention and self-reported behavioral outcomes demonstrated a high degree of correspondence as evidence that clinicians' intentions do predict subsequent behavior. One notable example carried out by Millstein sought to estimate the variance accounted for in physicians' decision to deliver STI prevention education to adolescent patients by their intention to do so using TPB constructs. They found a high degree of association between intention and behavioral outcome. They also found that a significant proportion of the variance in both intention and behavioral outcome was accounted for by perceived behavioral control, a defining construct of the TPB (Millstein, 1996).

Having established an evidence base that behavioral intentions do predict clinicians' self-reported behavior, it is then necessary to assess how the other constructs comprising the TPB framework contribute to behavioral intentions. Similar to the meta-analysis conducted by Eccles et al., Perkins and colleagues reviewed a series of studies that used TPB and/or TRA to predict a variety of clinical behavioral outcomes (Perkins et al., 2007). They separated their findings between studies conducted with general health care physicians and mental health providers. Among physicians, constructs varied in terms of their strengths of association with behavioral intention based on the behavior under study and the sample of physicians being assessed. For example, a study of physicians' use of drug label indications was found to be most strongly correlated with social norms (Gaither, Bagozzi, Ascione, & Kirking, 1996) where as in the aforementioned Millstein study, primary care doctors' intentions to educate teenage patients on

sexually transmitted infections was found to be most strongly correlated with perceived behavioral control (Millstein, 1996). This variability suggests that, while the TPB provides a robust framework through which to evaluate the cognitive dimensions of clinical decision-making, the degree of association between attitudes, perceived behavioral control, subjective norms and intention may be context specific. This was used to inform our approach to studying how these constructs help determine clinicians' behavioral outcomes regarding syphilis testing.

### ***Current Study***

#### ***Rationale***

The research activities carried out in this study constitute an important first step in describing clinicians' syphilis screening behavior by testing the application of the Theory of Planned Behavior. It further addresses a public health problem of some urgency. Trends in HIV care and prevention that predominantly affect MSM are shifting in ways that are likely to exacerbate, not improve, this syphilis disparity. Somewhat paradoxically, as both rates of HIV treatment and PrEP use continue to improve both in terms of efficacy and accessibility, opportunities to screen patients for syphilis may markedly decrease. For example, as our ability to treat HIV improves, more patients receiving antiretroviral therapy (ART) will become stably virally suppressed, and thus require less frequent viral load testing. This may amount to fewer doctors' visits and fewer blood draws. Similarly, as our evidence base of PrEP's short and long-term efficacy expands, and new formulations of the drug are studied (i.e. long-acting injectable formulations), recommendations regarding timing of administration may evolve. Already some studies have suggested that taking a double-dose of PrEP immediately before a risk exposure and then for two days following the exposure, a strategy known as event-driven or intermittent PrEP (2-1-1), has provided adequate HIV protection (Spinner et al., 2016). As this PrEP strategy

would require fewer doses of PrEP, it would likely result in fewer PrEP re-fill visits, and thus also fewer opportunities to screen for STIs. We are therefore in the midst of a critical period, wherein maximizing the opportunities to screen for syphilis will become increasingly vital if any progress in reducing infections is to be made.

Adding to this is the recent disruption to our preventive care infrastructure resulting from the ongoing COVID-19 pandemic. Due to diminished resources, concerns about potential COVID-19 exposure, and other factors, STI screening has seen a marked decrease (Centers for Disease Control and Prevention (CDC), 2021; Nagendra, Carnevale, Neu, Cohall, & Zucker, 2020). How this has affected and will continue to affect the delivery of needed services to MSM such as syphilis screening is an important area of research. This study is intended to form the theoretical foundation for studying providers' syphilis screening intention, which can then be employed in multiple ways to improve clinical outcomes and inform future interventions.

### ***Research Objectives and Specific Aims***

This study had three specific aims. They are:

**Aim 1:** Develop and validate a questionnaire to evaluate clinicians' attitudes, subjective norms, perceived behavioral control and intention related to testing MSM patients for syphilis infection based on previously conducted research.

**Research Question 1:** How have behavioral theories been used in prior research to assess healthcare providers' behavioral intentions and clinical behavior?

**Research Question 2:** What interventions have been used to successfully increase screening in MSM populations?

**Research Question 3:** How can theoretical constructs be applied to better understand and ultimately enhance clinicians' syphilis screening behavior?

**Aim 2:** Through descriptive, univariate and bivariate analysis, assess how healthcare providers' syphilis screening intentions and behaviors vary according to provider knowledge, differences in TPB variables, and demographics.

**Hypothesis to support aim 2:** Variability in provider intention and behavior will be observed and this variation will be associated with provider knowledge, demographics and TPB variables such as attitudes, perceived behavioral control and social norms.

**Aim 3:** To evaluate the psychometric properties and factor structure of the TPB survey in a sample of healthcare providers who prescribe syphilis screening.

**Hypothesis to support aim 3:** The model obtained through exploratory and confirmatory factor analysis will reveal a factor structure consistent with the TPB, with factors consisting of strongly loading items with high internal consistency.

**Aim 4:** Evaluate whether TPB provides a model that can be used to predict clinician syphilis screening intention and behavior using structural equation modeling.

**Hypothesis to support aim 4:** In structural equation modeling analysis, the latent variables of the TPB model will exhibit significant direct and indirect effects on clinician screening intention and behavior.

### ***Study overview***

The primary objective of this study was to develop and validate a survey instrument and test the application of the Theory of Planned Behavior in determining clinicians' intentions to screen and actual screening of MSM patients for syphilis. By meeting this objective, we have demonstrated that the TPB can be used as a model to predict clinicians' intentions and self-reported syphilis screening behavior toward MSM patients. Because this study proposed a novel application of TPB, preliminary steps were first carried out to ensure that appropriate indicators



had been selected that assess the latent constructs in the model. Thus, the first stage of this study was to conduct a comprehensive review of the current literature on how behavioral theory has been used to study clinician behavior, and further, how the constructs employed in said theories may be applied to the problem of clinicians' syphilis screening behavior. These findings support the use of behavioral theory, specifically the Theory of Planned Behavior, to elucidate the underlying social, cognitive and dispositional factors associated with behavioral intention to screen MSM patients for syphilis.

The survey used in this study was developed in accordance with the TPB (Ajzen, 1991) and informed through collaboration with healthcare providers who specialize in sexual minority health. This included key informant interviews with providers, as well as input from infectious disease and sexual health experts during survey development and item refinement. Ajzen (1991) provides guidance on how items to assess each of the TPB constructs should be formulated. To the extent possible, these recommendations were followed, though some adaptation was needed to better assess provider behavior in relation to patient outcomes. For instance, Ajzen suggests the use of bipolar scale items to assess unique dimensions that form individuals' attitudes toward a behavior, such as the following (Fishbein & Ajzen, 2011):

*My exercising for at least 20 minutes, three times per week for the next three months would be bad : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : good*

Because our primary focus was providers' attitudes toward a behavior that would affect their patients' health outcomes, items were instead presented in the form of statements such as:

*Screening for syphilis more frequently is an effective way to detect asymptomatic cases*

*Strongly Disagree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : Strongly Agree*

Comparable statements were used to assess perceived ease, benefit, importance, etc. Similarly, Ajzen suggests assessing perceived behavioral control by addressing individuals' capacity to perform a behavior as well as their sense of autonomy, for example (Fishbein & Ajzen, 2011):

*I am confident that I can exercise for at least 20 minutes, three times per week for the next three months.*

*true : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : false*

*My exercising for at least 20 minutes, three times per week for the next three months is up to me*

*disagree: \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : agree*

Capacity to perform items on our survey adopted a similar form:

*How confident are you in your ability to order syphilis screening for your MSM patients?*

*Not at all confident: \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : Completely Confident*

Autonomy items were used that assessed restrictions imposed on autonomy by logistical constraints:

To what extent would any of the following factors limit your ability to screen your MSM patients for syphilis? Not enough time:

*Not at all factor: \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : Definitely a factor*

Rather than measure intention as whether providers are generally inclined or disinclined to screen MSM patients for syphilis at recommended frequencies, we adopted a *case vignette* method that has been used previously to assess healthcare provider behavioral intention (Jui-Ying Feng & Wu, 2005; Rashidian & Russell, 2012). These vignettes are designed to capture patient profiles of individuals for whom increased syphilis screening would be indicated according to guidelines (US Preventive Services Task Force, 2016). In doing so, we intended to

directly assess providers' decision-making regarding syphilis screening, and not simply their agreement or disagreement with screening guidelines. This also avoided the potential for providers to be predisposed to responding a particular way if presented with a set of guidelines. While these modifications do represent a modest divergence from the methods to measure the TPB components as originally conceived by Ajzen, they are consistent with the way similar provider surveys have been constructed, and we believe they better capture the complexity and nuance of healthcare provider behavior toward their patients (Barsevick et al., 2008; C. L. Pessoa-Silva, K. Posfay-Barbe, R. Pfister, S. Touveneau, T. V. Perneger, 2005; Levin, 1999). (See survey in Appendix 3)

The survey was administered to a national sample of healthcare providers via an online questionnaire. In total, surveys were submitted by 167 individual healthcare providers. Of those, 123 were complete, yielding a complete response rate of 74%. Participants were recruited through a variety of means, which included a proprietary email list of United States physicians purchased from Complete Medical Lists Inc., an online research and marketing firm that specializes in healthcare, email Listservs that cater to clinicians, and targeted social media posts. Our target sampling frame included any US physician, nurse practitioner, physician assistant or other clinician who treats MSM patients and who may prescribe syphilis screening. The survey took an average of 9 minutes to complete. As an incentive, providers who completed the survey were given the opportunity to be entered into a sweepstakes to receive one of five \$100.00 e-gift cards redeemable online.

Once data from these surveys was collected, several analyses were performed. First, all survey items pertaining to the TPB constructs, knowledge and demographics were subjected to descriptive analysis to determine their frequencies and distributions. Following that, bivariate

associations between attitudes, perceived behavioral control variables, social norms, knowledge, and both intention and self-reported behavior were assessed. Having established these significant associations, further analysis was performed, which allowed for the simultaneous estimation of effects between the TPB variables and their associated outcomes. This was accomplished through the use of structural equation modeling (SEM) parameterization. Before conducting SEM analysis, survey items were subjected to both exploratory and confirmatory factor analysis. This was used to develop a final SEM model, which included latent TPB factors of attitudes, perceived behavioral control, social norms and intention, and an observed self-reported behavioral outcome.

### ***Overview of Three Manuscripts***

This dissertation follows a three-paper model. The three-paper format is designed to produce manuscripts that describe distinct research activities under the dissertation project that are suitable for publication in peer reviewed journals. Each of the manuscripts described below cover a phase in the development, execution, and analysis of the overall project. Manuscript one details the formative literature review that was carried out to establish both the rationale for the project, as well as the potential application of behavioral theory to provider-targeted syphilis screening interventions. Manuscript two details the preliminary analyses conducted with the survey data collected from the 123 respondents. This includes a descriptive summary of the data, and the results of bivariate tests of association between TPB variables and intention and behavioral outcomes. Manuscript three describes the final set of analyses, which include validation of a measurement model of healthcare provider screening behavior using the TPB and the results of structural equation modeling aimed at predicting both healthcare provider syphilis screening intention and self-reported behavior using this model.

**Description of Manuscript 1: *Opportunities to enhance provider and clinic-based interventions to increase syphilis screening among MSM through the application of behavioral theory: A scoping review of reviews and synthesis***

The first manuscript submitted as part of this dissertation serves as the foundation for the research activities of the two subsequent manuscripts and addresses Research Questions 1, 2, and 3.

***RQ1: How have behavioral theories been used in prior research to assess healthcare providers' behavioral intentions and clinical behavior?***

***RQ2: What interventions have been used to successfully increase screening in MSM populations?***

***RQ3: How can theoretical constructs be applied to better understand and ultimately enhance clinicians' syphilis screening behavior?***

Since this study entails a novel application of the TPB to the problem of healthcare providers' syphilis screening intention and behavior, a review of both the behavioral theory and syphilis screening intervention literature was necessary to provide background and establish the study rationale. Since these two bodies of research had not been previously examined together, a focus of this manuscript was the synthesis of results from the theory literature to assess potential application to existing syphilis screening interventions. In addition to this, the lack of behavioral syphilis screening interventions based on established theory identified a research gap, thus providing rationale for the current study.

## *Sample and Methods*

The sample included published reviews of both the behavioral theory and syphilis screening literature and their constituent studies. Inclusion of review articles was based on the following criteria:

1. For behavioral theory literature:
  - a) Review article (systematic, scoping, mapping, meta-analyses, etc.)
  - b) Review must focus on healthcare providers' intention and behavior
  - c) Review must include constructs derived from behavioral theory/theories
  - d) Review must be published in English
  
1. For syphilis screening intervention literature:
  - a) Review article (systematic, scoping, mapping, meta-analyses, etc.)
  - b) Review must include MSM as a target population
  - c) Review must include syphilis screening (proportion screened, number of incident/prevalent cases, etc.) as a primary outcome
  - d) Review must be published in English

Using these criteria, a total of five review articles were identified; three from the behavioral theory literature and two from the syphilis screening intervention literature. Contained in these reviews were a total of 82 original studies; 70 from the theory literature and 12 from the syphilis screening intervention literature, which included additional hand-searched records. Sample citations are provided below:

**Behavioral theory literature:**

- 1: Godin, G., Beaulieu, D., Touchette, J. S., Lambert, L. D., & Dodin, S. (2007). Intention to encourage complementary and alternative medicine among general practitioners and medical students. *Behavioral Medicine*, 33(2), 67-79.
2. Liabsuetrakul, T., Chongsuvivatwong, V., Lumbiganon, P., & Lindmark, G. (2003). Obstetricians' attitudes, subjective norms, perceived controls, and intentions on antibiotic prophylaxis in caesarean section. *Social science & medicine*, 57(9), 1665-1674.
3. Maue, S. K., Segal, R., Kimberlin, C. L., & Lipowski, E. E. (2004). Predicting physician guideline compliance: an assessment of motivators and perceived barriers. *Am J Manag Care*, 10(6), 383-391.

**Syphilis screening intervention literature:**

1. Bissessor, M., Fairley, C. K., Leslie, D., Howley, K., & Chen, M. Y. (2010). Frequent screening for syphilis as part of HIV monitoring increases the detection of early asymptomatic syphilis among HIV-positive homosexual men. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 55(2), 211-216.
2. Chow, E. P., Callander, D., Fairley, C. K., Zhang, L., Donovan, B., Guy, R., ... & Chen, M. Y. (2017). Increased syphilis testing of men who have sex with men: greater detection of asymptomatic early syphilis and relative reduction in secondary syphilis. *Clinical Infectious Diseases*, 65(3), 389-395.
3. Snow, A. F., Vodstrcil, L. A., Fairley, C. K., El-Hayek, C., Cummings, R., Owen, L., ... & Chen, M. Y. (2013). Introduction of a sexual health practice nurse is associated with increased STI testing of men who have sex with men in primary care. *BMC infectious diseases*, 13(1), 1-7.

All studies extracted from reviews were assessed based on the following characteristics:

(1) population (e.g. primary care physicians, nurse practitioners, psychiatrists, etc. for theory articles; HIV-negative and or HIV-positive MSM for syphilis screening literature), and (2) sample size. In addition, behavioral theory studies were assessed based on (1) the behavior or intentional outcome, (2) the theory used and its associated variables (e.g., attitudes, perceived behavioral control, etc.), and (3) associations reported between variables and outcome. Syphilis screening intervention studies were also assessed based on (1) intervention modality, and (2) screening-related results and associations.

***Analysis***

A descriptive summary of each article was provided in tables. For analysis, an overview of both the behavioral theory and the syphilis screening literature was included that quantified

articles based on the criteria described above. Following this, a research synthesis was provided, which identifies areas where behavioral theory could have plausible application to existing syphilis screening interventions. This inductive approach is well-suited for literature reviews to generate hypotheses and inferences, especially when cross-application between two or more research areas is desired (Briner & Denyer, 2012).

### ***Summary***

By reviewing both the behavioral theory literature and the syphilis screening literature, a research gap was identified that provides rationale for the current study. By creating synthesis between these two research areas, we establish a foundation for applying the principles of behavioral theories such as the TPB to provider-targeted behavioral interventions in the interest of promoting more frequent syphilis screening of their MSM patients.

### ***Description of Manuscript 2: Use of Behavioral Theory to Explain Providers' Intention and Behavior to Screen MSM Patients for Syphilis Infection***

This manuscript reports the results of the preliminary analyses carried out using the survey data collected from all 123 respondents. These analyses address the following hypotheses:

***H2: Variability in provider intention and behavior will be observed, and this variation will be associated with provider knowledge, demographics, and TPB variables such as attitudes, perceived behavioral control and social norms.***

By addressing this hypothesis, this manuscript presents novel data in the form of providers' self-reported attitudes, social norms, perceived behavioral control and intention related to syphilis screening in MSM patients.

### ***Sample***



The sample used in this study was n=123 individual health care providers who completed the online survey.

### ***Measures***

Twenty-nine items were used to assess the TPB variables of attitudes, social norms, perceived behavioral control and intention (for list of items see Table 1.). Attitudes, social norms and perceived behavioral control items utilized a bi-polar, 7-point Likert scale. For instance, attitude items assessed the perceived ease, benefit and importance of syphilis screening in MSM populations using statements like, “*screening for syphilis more frequently is an effective way to detect asymptomatic cases*”, and “*screening patients for syphilis is easy*”, with respondents rating their agreement or disagreement from 1 to 7. Social norms were assessed using items that asked providers to indicate the degree of importance placed on syphilis screening by professional referents including healthcare provider peers and professional organizations with statements such as, “*my healthcare provider peers think it is important that I screen my MSM patients for syphilis regularly*”, again rated based on agreement. Perceived behavioral control was assessed two ways. First providers were asked to indicate their confidence in conducting activities related to syphilis screening such as, “*how confident are you in your ability to conduct a sexual history with your MSM patients?*” with responses ranging from (1) *not at all* to (7) *confident completely confident*. Providers were also asked the extent to which different clinical factors and logistical constraints affected their ability to conduct syphilis screening in MSM including “*not enough time*” and “*not enough training*” with responses ranging from (1) *Definitely a factor* to (7) *Not at all a factor*. Behavioral intention was assessed using 5 brief case vignettes. This method has been used previously to assess healthcare provider intention (Jui-Ying Feng & Wu, 2005; Rashidian & Russell, 2012). Each vignette represented a patient for whom frequent syphilis

screening would be indicated according to USPSTF guidelines. Providers were asked to indicate the syphilis screening frequency they would recommend for each vignette with responses ranging from (1) *More frequently than every three months* to (5) *Less frequently than annually*. Finally, self-reported behavior was assessed by first asking providers to estimate the number of their last 10 MSM patients in the previous year who they had recommended be screened for syphilis. A follow-up question was then asked for those who had seen at least one MSM patient in the last year, how many were actually screened.

In addition to these TPB items, provider knowledge was assessed by six true or false items that included items to assess provider knowledge of syphilis epidemiology in MSM populations, knowledge of syphilis' disease course and progression and knowledge of standard syphilis treatment. These were assessed both individually and by computing a sum score of correct responses with a range of 0-6. The survey also contained a range of demographic items to assess providers' profession (e.g., general physician, specialist physician, nurse practitioner, etc.) medical specialty (e.g., infectious disease, family medicine, internal medicine, etc.), number of years post-residency, practice setting (e.g., public hospital, academic, private agency, etc.), and sociodemographics such as gender, sexual orientation, race, and ethnicity.

<b>Table 1.Theory of Planned Behavior Survey Items by Construct and Knowledge Items</b>
<b>Attitudes (General) (0-7; Strongly Disagree-Strongly Agree)</b>
Routine screening for syphilis is effective at preventing new infections
I only order syphilis screening if requested by a patient
Screening for syphilis more frequently is an effective way to detect asymptomatic cases
There are risks associated with syphilis screening that should be considered
Screening patients for syphilis is easy
Syphilis infection is a serious condition that can lead to disability or death
<b>Attitudes (MSM) (0-7; Strongly Disagree-Strongly Agree)</b>
Screening for syphilis infection in all MSM patients should be a top priority
There is little benefit to screening MSM patients for syphilis more frequently
MSM who are also living with HIV are not screened for syphilis as frequently as they should
MSM who are taking PrEP for HIV prevention are not screened for syphilis as frequently as they should
MSM are likely to refuse syphilis screening
MSM are well informed about the potential harms associated with syphilis infection
<b>Social Norms (0-7; Strongly Disagree-Strongly Agree)</b>
My MSM patients think it is important for me to screen them for syphilis infection regularly
My healthcare provider peers think it is important that I screen my MSM patients for syphilis regularly
My profession has clear guidelines for how frequently to screen MSM patients for syphilis
My medical practice has clear guidelines for how frequently to screen MSM patients for syphilis
<b>Control Beliefs (0-7; Not at all confident – Very confident)</b>
How confident are you in your ability to conduct a sexual history with your MSM patients?
How confident are you in your ability to order syphilis screening for your MSM patients?
How confident are you in your ability to interpret syphilis screening results?
How confident are you in your ability to provide treatment for patients who screen positive for syphilis?
<b>Behavioral Control (0-7; Not at all a factor- Definitely a factor)</b>
Not enough time
Not enough training
Not enough resources
Not enough support from clinical staff
<b>Knowledge (True/False)</b>
The number of annual cases of primary and secondary syphilis in the United States has remained stable over the last 15 years
Gay, bisexual, and other men who have sex with men account for approximately half of all new primary and secondary syphilis cases in the United States each year.
The median time from transmission to onset of symptoms of primary syphilis is one week.
Without treatment, half of people infected with syphilis will develop tertiary disease.
Non-treponemal tests remain elevated through all stages of syphilis (e.g. RPR, VDRL).
Secondary syphilis is treated with intramuscular Benzathine penicillin G for three doses at weekly intervals.

## *Analysis*

All survey items, including demographics, were first analyzed descriptively to calculate frequencies and distributions. Following this, scale items were used to compute sum scores for each TPB variable (attitudes, social norms, actual behavioral control and control beliefs). These sum score items alongside knowledge sum scores were then used in bivariable analyses with

both intention and self-reported behavior as the dependent variable. This was done through the use of independent samples T-tests to assess mean differences between providers who recommended screening at 3 month intervals or less and those who did not; and through One-Way ANOVA to assess mean differences between those providers who screened all of their last 10 MSM patients, those who screened less than all of their last 10 MSM patients, and those providers who had not seen 10 MSM patients in the previous year.

### ***Summary***

Manuscript two presents data that has not been presented elsewhere in the literature. Namely, the variability observed in TPB factors and knowledge and their associations with intention to screen MSM at risk for syphilis infection and their self-reported syphilis screening behavior. This analysis substantially adds to the understanding of how providers' syphilis screening behavior may be influenced by subjective factors such as those included in the TPB. This provides further support for the TPB as a model to evaluate a range of healthcare provider behaviors, which now includes syphilis screening. By demonstrating the variability in factors such as providers' attitudes and perceived behavioral control, and their association with syphilis screening intention, this analysis can help direct future efforts to increase providers' guideline adherence.

### ***Description of Manuscript 3: Predicting healthcare providers' syphilis screening intention and behavior toward MSM patients: An application of the Theory of Planned Behavior***

The third manuscript represents a culmination of the previous research activities carried out under this project by exploring and testing a measurement model using the Theory of Planned Behavior. This in turn was used to determine the relationship between the latent TPB variables and their indicators, and to test a structural model, which discerns how the latent TPB

variables are interrelated and may predict behavioral outcomes. The paper addresses the following hypotheses:

***H3: The model obtained through exploratory and confirmatory factor analysis will reveal a factor structure consistent with the TPB, with factors consisting of strongly loading items with high internal consistency.***

***H4: In structural equation modeling analysis, the latent variables of the TPB model will exhibit significant direct and indirect effects in accordance with the theory.***

Our hypotheses are based on the underlying, *a priori* assumptions of the TPB. The TPB assumes a direct relationship between attitudes, social norms, perceived behavioral control and intention. It also assumes a direct relationship between intention and behavior (See Figure 2 diagram for example). Certain applications of the TPB also assume a direct relationship between perceived behavioral control and behavior. This emphasizes an important feature of the TPB. Since the TPB has been shown to be highly sensitive to context-specific variability in the way its constituent factors are associated with intention and behavioral outcomes, varying degrees of strength and significance of associations observed in the model are possible and even expected (Ramsay, Thomas, Croal, Grimshaw, & Eccles, 2010). This was affirmed in our literature review, wherein models that utilized the TPB to explain healthcare provider behavior and intention varied in terms of which factors were the most salient predictors of these outcomes (Bolman, Vries, & Mesters, 2002; Godin, Naccache, Morel, & Ébacher, 2000). This paper aimed to understand how these factors relate in the context of providers syphilis screening behavior in MSM patients.

### ***Sample***

The sample used in this study was the n=123 individual healthcare providers who completed the online survey.

### ***Methods***

The primary analysis used in this manuscript was structural equation modeling (SEM); an extension of the multivariate regression model, which allows the significance and magnitude of relationships between theoretical constructs to be estimated (Bollen, 1989). Before these estimates can be obtained, the relationship between the observed measures and their presumed underlying constructs must first be established (Anderson & Gerbing, 1988). Therefore, prior to estimating the association between latent variables and outcome using SEM parameterization, a measurement model was first evaluated and validated using exploratory (EFA) and confirmatory factor analysis (CFA). This produced a four-factor model containing four latent factors of attitudes, social norms, perceived behavioral control, and intention, and an observed self-reported behavior outcome. This model was then used in SEM analysis to simultaneously estimate the strengths and significance of direct and indirect effects between factors and outcome.

### ***Analysis***

Revisions to the model were made based on results of exploratory factor analysis. Once a measurement model was established, model fit was evaluated in confirmatory factor analysis. This was also used to evaluate construct validity by examining the strength and significance of association between indicators and their underlying latent factor. In SEM, model specification was performed *a priori* based on the theorized relationship between latent and observed variables. The resulting coefficients were then used to evaluate the strength and significance of

associations between latent factors and the self-reported behavioral outcome. This set of analyses provides further evidence of the validity and use of the TPB as a model to explain healthcare providers' syphilis screening intention and behavior.

### ***Summary***

Through the use of SEM analysis, we were able to model providers' syphilis screening intention and behavior using the latent factors proposed as part of the TPB. Determining which factors were significant in predicting both intention and behavior is a critical step towards the development of future interventions that address these subjective elements. SEM is an analytic method that can provide superior insight into how factors that are presumed to represent latent constructs function to produce observed outcomes. This methodology was well suited to address the research question posed under this analysis and the findings present clear evidence that providers' syphilis screening behavior in MSM patients is subject to the variance in specific TPB factors.

### ***Conclusion***

This research represents an important first attempt at understanding a well-known health disparity, but from a new theoretical perspective. It further attempts to bring together two fields of behavioral science and public health research in an effort to improve the health and wellbeing of MSM on a population level. Reducing syphilis prevalence in MSM populations has been a persistent public health challenge. Many efforts have been made to address this burden, each contributing vital new knowledge. Though as is often the case with health outcomes that are driven primarily by individual behavior, coordinated efforts to control this syphilis epidemic have been largely ineffective and have struggled to extend beyond the periphery of the issue and

into the crux of what is driving this disparity. Somewhat inexplicably, the uncontested and voluminous evidence base suggesting that increased screening in this population would result in significant reduction in syphilis transmission and prevalence has not been effectively brought to bear in clinical practice. This evidence-practice gap is similar to those that have been observed in other clinical health outcomes (Muche-Borowski, Nothacker, & Kopp, 2015). This research is the first attempt to close that gap through the application of established behavioral theory. By taking these first critical steps in demonstrating how theory can be used to predict healthcare providers' behavior and intentions to screen MSM for syphilis, a more focused effort can be made in promoting this behavior to ultimately benefit the health and wellbeing of their MSM patients.

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## CHAPTER 2: MANUSCRIPT 1

### *Opportunities to Enhance Provider and Clinic-based Interventions to Increase Syphilis Screening Among MSM Through the Application of Behavioral Theory: A Scoping Review of Reviews and Synthesis*

Background: In June of 2016, the US Preventive Services Task Force published updated guidelines for syphilis screening in non-pregnant adults and adolescents, which recommends increased screening intervals for populations known to be at elevated risk, such as sexually active men who have sex with men (MSM) and persons living with HIV. Since the release of these guidelines, few investigations have examined their rate of compliance in clinical practice and none have examined the role that social and cognitive factors at the provider level play in adhering to these practice guidelines. To this end, a systematic review of reviews of both the syphilis screening literature and the literature documenting the application of behavioral theory to assess healthcare professionals' clinical behavior was undertaken in an effort to identify opportunities for synthesis between these two research areas.

Method: Cochrane Archives, PubMed, EMBASE and EbscoHost were searched for review articles compiling original studies of both interventions targeted to clinics and providers to enhance syphilis screening, and studies on the application of behavioral theory to a broad range of healthcare provider behavior and behavioral intentions. Reviews were included for analysis if they were published in English and included detailed description of the original articles. Reviews of behavioral theory were included if they contained studies of healthcare providers. Reviews of the syphilis screening literature were included if they contained studies that described interventions implemented at the clinic or provider level.

Results: Five review articles met the inclusion criteria: three focused on application of behavioral theory to clinician behavior and two focused on syphilis screening. From these reviews, 82 original articles were extracted; 70 from the theory literature and 12 from the syphilis literature. The syphilis screening literature consisted primarily of cross-sectional studies examining the rates of syphilis screening among MSM prior to and following updates to clinical guidelines. The theory literature assessed a broad range of clinician behaviors and provide evidence that these behaviors may be predicted using theoretical models. Reviewing both the theory literature and the syphilis screening literature provides insight into how these two areas of research may be synthesized, in the interest of enhancing provider-level interventions that result in increased adherence to screening guidelines.

### ***Background***

Syphilis remains an enduring public health challenge that has undergone a resurgence in the last decade. Particularly in the US, where syphilis has reached endemic levels within geographically defined populations of men who have sex with men (MSM),(Seña, Torrone, Leone, Foust, & Hightow-Weidman, 2008) prevalence has steadily increased from a historic nadir of 2.1 per 100,000 primary and secondary (P&S) syphilis cases in 2000, to 10.8 per 100,000 in 2018; a greater than fivefold increase.(Centers for Disease Control and Prevention, 2019a) It is against the backdrop of these findings that the US Preventive Services Task Force (USPSTF) revised their guidelines for screening for syphilis infection in non-pregnant adults and adolescents. In their report, the USPSTF cites research to suggest that MSM and people living with HIV may benefit from more frequent screening.(A. Cantor et al., 2016) A screening interval of three months has been proposed as the optimal frequency to detect asymptomatic syphilis cases in these populations.(Bibbins-Domingo et al., 2016) This recommendation has received

further support through independent research, which determined the three month screening interval provides superior detection and results in greater prevention of new cases in both cost-effectiveness and mathematical modeling analyses. (Chesson et al., 2016; Gray et al., 2010; Tuite et al., 2013, 2018)

Implementing these research findings and guidelines in clinical practice presents a challenge of some urgency. As we near the end of the first decade of wide-scale pre-exposure prophylaxis utilization among MSM and are well into the third decade of effective antiretroviral therapy for HIV, the healthcare infrastructure that has been erected to combat HIV and other sexually transmitted infections, particularly among MSM, has become highly specialized. Modifications to patient care in these settings are likely to encounter barriers related to material support, training, and the inertia of prior practice. Additionally, more generalized healthcare settings may encounter their own unique barriers such as the perceived lower priority of syphilis testing or lower perceived behavioral control. A well-researched approach used to assess the provider-level determinants of clinical behavior has been the application of behavioral theory. Similar to how the health-related behavior of patients has long been understood to be the product of extrinsic constraining and enabling forces as well as internal motivational states and dispositions, the clinical behavior and intentions of health care professionals has been demonstrated to fit a comparable model. (Bandura, 1998) In fact, a protocol for developing theory-based behavior change interventions, *intervention mapping*, has found limited but effective use among healthcare providers. Durks et al. reviewed seventeen such protocols aimed at healthcare practices ranging from physical therapists' use and adherence to guidelines for managing back pain in patients (Rutten et al., 2014) to physicians' and pharmacists' referral to and delivery of breast and cervical cancer screening services for women over 50. (Durks et al.,

2017; Fernández, Gonzales, Partida, & Bartholomew, 2005) Based on their review, they conclude that extensive intervention planning at the outset, which seeks to delineate the determinants of various practice outcomes, is crucial to inform the type and content of behavioral change interventions for healthcare providers.(Durks et al., 2017) They further conclude that, although deemed to be a vital component, the behavioral theories that form the bases of these interventions were often poorly described. This shortcoming affects the rationale upon which *a priori* decisions regarding which determinants to prioritize in an intervention are based; potentially limiting their adaptability and translation into practice.

To avoid any *post hoc* determinism in applying behavioral cognitive theory to the issue of provider adherence to syphilis testing guidelines, we have compiled a review of both the theory literature as it pertains to healthcare provider behavior and intentions, and the syphilis screening intervention literature. By doing so, we intend to create a foundation upon which future theory-based interventions may be constructed.

## ***Methods***

Between August 2020 and January 2021, the following electronic databases were searched: PubMed, Embase, Ebscohost and Cochrane Archives. Separate search strategies were used for both the theory literature and the syphilis screening literature. Both searches only included articles that were reviews (scoping, systematic, mapping, meta-analyses, etc.) and published in English. Terms that were searched to identify theory research records included those limiting articles assessing healthcare professionals (doctor, physician, clinician, nurse, professional, etc.) and those that assessed practice outcomes (guideline\*, adherence, intention, behavior\*, etc.). Terms that were searched to identify syphilis screening intervention records included terms to limit articles to provider and clinic-level interventions (provider, clinic\*,

screening, guideline\*, etc.) and those that included screening in MSM and HIV affected populations (gay, homosexual, MSM, people living with HIV [PLWH], sexual minority, etc.) (See Appendix 2 for search strategy).

## ***Results***

Five review articles met criteria for inclusion: three from the theory literature (Eccles et al., 2006; Godin, Bélanger-Gravel, Eccles, & Grimshaw, 2008; Perkins et al., 2007) and two from the syphilis screening intervention literature (Ong, Fu, Smith, & Tucker, 2018a; Zou et al., 2012). The original articles contained in each review were extracted and compared to assess overlap. From the theory reviews, 70 original articles were extracted once duplicates were removed (Beatty & Beatty, 2004; Bernaix, 2000; Bie et al., 2012; Bolman et al., 2002; Bonetti et al., 2005, 2006; C. A. O. Boyle, 2001; Bunce, 1998; C. L. Pessoa-Silva, K. Posfay-Barbe, R. Pfister, S. Touveneau, T. V. Perneger, 2005; Caroline A. Gaither, Richard P. Bagozzi, 1996; Cassista, Payne-Gagnon, Martel, & Gagnon, 2014; Chau & Hu, 2001; Comtois, 1999; Conner, 2007; Crawford, 1998; Croteau & Vieru, 2002; Daneault, Beaudry, & Godin, 2004; Durks et al., 2017; Eccles et al., 2007; Edwards, Nash, & Jake, 2001; Farris & Schop, 1999; Faulkner & Biddle, 2001; Jui-ying Feng & Wu, 2005; Foy et al., 2007, 2005; M. Gagnon et al., 2003; M. P. Gagnon, Sánchez, & Pons, 2006; Gina, 1999; Godin, 1999; Godin, Beaulieu, & Touchette, 2010; Godin, Boyer, Duval, & Fortin, 2021; Godin et al., 2021, 2000; Graham & Connor, 2007; K. E. Herbert et al., 2006; M. Herbert, 1994; Hu et al., 2015; Jenner et al., 2010; Jones, Lee W; Courneya, Kerry S; Peddle, Carolyn; Mackey, 2005; Jurgens, 1996; Lambert, Salmon, Gilomen-study, & Valuck, 1997; Laschinger & Goldenberg, 1993; Legare et al., 2005; Levin, 1999; Liabsuetrakul & Chongsuvivatwong, 2003; Licensors et al., 1997; C Limbert & Lamb, 2010; Lisa, Kelly, & Hall, 2006; Mashburn, 2003; Mason, 1983; Maue, Segal, & Kimberlin, 2004;

Maue, Segal, Kimberlin, & Lipowski, 2004; Mckinlay, Ma, & Afbps, 2001; Meissen, Mason, & Gleason, 1991; Millstein, 1996; Nash, Rm, Dipappsa, & Frcna, 1993; Payant, Davies, Graham, Peterson, & Clinch, 2008; Pessoa-silva et al., 2005; Puffer, 2004; Renfroe, D. H., O'Sullivan, P. S., & McGee, 1990; Ross, 2013; Ryu, Hee, & Han, 2003; Sauls, 2007; Schottle, 1999; Spence et al., 1995; Tessaro & Highriter, 1987; Vermette & Gdoin, 1994; Vermette & Godin, 2010; Vessey, 2001; A. E. Walker, Grimshaw, & Armstrong, 2001; A. Walker, Watson, Grimshaw, & Bond, 2004; Wallace, Kathleen G., Kathleen Koepfel, Alice Senko, Karen Stawiaz, Carolyn Thomas, 1997; Walsh et al., 2005; Watson & Myers, 2010; Werner, 2001). Five articles contained in these reviews were excluded: four dissertation manuscripts, whose online records were no longer available, and one original study published prior to 1980. Nine original studies were extracted from the syphilis intervention reviews (Bissessor, Fairley, Leslie, & Chen, 2011b; Bissessor et al., 2010b; Botes, Mcallister, Ribbons, & Fengyi, 2016; Callander et al., 2013; Chow et al., 2017; Cohen et al., 2005; Hotton, Gratzner, Pohl, & Bs, 2011; Men, Cities, An, Wejnert, & Bernstein, 2017; Snow et al., 2013). Additional hand searching was performed to insure inclusion of the most recent studies. This yielded an additional three individual articles bringing the total number of syphilis screening studies included for analysis to 12 (Ryder, Bourne, & Rohrsheim, 2005; Trubiano & Hoy, 2015; Venegas et al., 2020).



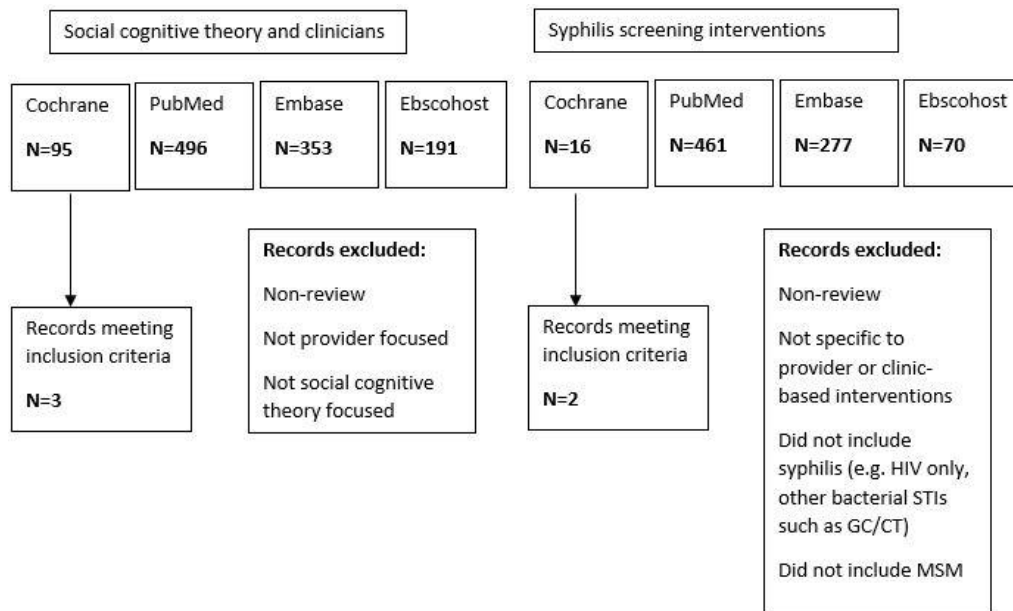


Figure 3. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) inclusion flow-chart diagram

The theory literature articles included in this review and analysis are summarized in Table 2. Articles were assessed based on the target population (ie. physicians, nurses, pharmacists, etc.), the theory employed (ie. Theory of Planned Behavior [TPB], Theory of Reasoned Action [TRA], Theory of Interpersonal Behavior [TIB], etc.), the target practice behavior and/or behavioral intention, and any reported effects, correlations and associations observed between theory implied constructs and the outcome(s) of interest. Table 3 summarizes the 12 articles extracted from the syphilis screening intervention literature. These were assessed based on their target population (MSM, people living with HIV [PLWH], etc.), the type of study or intervention modality (pre-post analysis following guideline implementation, electronic medical record [EMR]-based prompt, enhanced screening algorithm, etc.), and results pertaining to the change in number and percentage of patients screened or number of new infections detected. A descriptive summary of all records contained in this review is presented in Table 4.

**Table 2. Summary of Behavioral Theory Studies**

<b>Title, Author(s)</b>	<b>Year</b>	<b>Target pop.</b>	<b>Sample size</b>	<b>Behavioral Theory</b>	<b>Target Behavior</b>	<b>Summary of relevant findings</b>
<b>An adaptation of the theory of interpersonal behavior to the study of telemedicine adoption by physicians- M.-P. Gagnon, G. Godin, C. Gagné, J.-P. Fortina, L. Lamoth, D. Reinharz, A. Cloutier</b>	2003	Physicians	20	TIB	Intention to use telemedicine in clinical practice	Intention was predicted by social norms and self-identity, these formed a composite factor that demonstrated a main effect. Physicians whose professional and social responsibilities were perceived to be stronger had stronger intention to use telemedicine.
<b>Factors Associated with Antibiotic Prescribing in a managed care setting: An exploratory investigation- B. L. Lambert , J. W. Salmon, J. Stubbings, G. Gilomen-Study, R. J. Valuck, K. Kezlarian</b>	1997	Physicians	25	TRA	Intention to prescribe oral antibiotics and ambulatory patients	Intention was significantly associated ( $P < 0.05$ ) with both attitudes and subjective norms. However, attitudes, subjective norms and intentions were not predictive of actual prescribing behavior. Behavior may be more influenced by patient-specific beliefs rather than general beliefs about antibiotics.
<b>Nurses' Attitudes Toward Provision of Care and Related Health Outcomes- D. J. Sauls</b>	2007	Nurses	39	TPB	Intentions to provide professional labor support (PLS) to parturient women	TPB variables explained 70% of the variance in nurses' intentions to provide PLS. Behavioral intent ( $\beta = 0.08$ , $P = .677$ ) had no statistically significant impact on duration of labor
<b>Using Attitudes and Subjective norms to predict pharmacists counseling behaviors- H. L. Mason</b>	1983	Pharmacists	40	TRA	Intention to provide medication counseling	Attitudes and subjective norms significantly predicted intention to provide verbal instruction and the length of encounter time.
<b>Obstetrical Nurses' Intentions Toward Collaborating With Midwives- N. K. Schottle</b>	1999	Nurses	45	TPB	Intention to collaborate with midwives	Attitude and perceived behavioral control, were related to intention scores ( $r = .67$ , $pc.001$ ; $r = .65$ , $P < .001$ ). Subjective norms were not significantly related to intention ( $r = -.42$ , ns). Attitudes also accounted for a significant amount of the variance in intention scores ( $F(1, 25) = 23.91$ , $pc.001$ ); however, subjective norm scores did not contribute. Due to high correlation with behavioral attitude scores, perceived behavioral control was not included in regression analysis.

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>Practice nurses' intentions to use clinical guidelines- S. Puffer &amp; A. Rashidian</b>	2004	Nurses	48	TPB	Intention to offer smoking cessation advice in accordance with coronary heart disease guidelines.	TPB variables explained up to 40% of variance in intentions to offer smoking cessation advice. Attitudes and perceived behavioral control were the most important predictors of intention.
<b>Obstetricians' attitudes, subjective norms, perceived controls, and intentions on antibiotic prophylaxis in caesarean section- T. Liabsuetrakul, V. Chongsuvivatwong, P. Lumbiganon, G. Lindmark</b>	2003	Obstetricians	50	TPB	Intentions to use antibiotic prophylaxis in caesarean section	Although overall intention to use antibiotic prophylaxis was low, the strongest determinant of intentions was subjective norms ( $\beta=0.22$ ).
<b>Fever management: pediatric nurses' knowledge, attitudes and influencing factors- A.M. Walsh , H. E. Edwards, Courtney, J.E. Wilson &amp; S. J. Monaghan</b>	2004	Pediatric nurses	51	TPB	Intention to administer paracetamol to a febrile child	Attitudes, subjective norms, indirect and direct control beliefs significant explained variance in intention ( $R^2=0.25$ , $P = 0.05$ ).
<b>Nurses' Attitudes, Subjective Norms, and Behavioral Intentions Toward Support of Breastfeeding Mothers- L. W. Bernaix</b>	2000	Nurses	52	TRA	Support for mothers to encourage breastfeeding	Nurses' supportive behavior was best predicted by their breast feeding knowledge and attitudes. The nurses' intentions to provide support did not influence their actual behavior
<b>Addressing mental health problems with the theory of planned behavior- M. Conner &amp; S. Heywood-Everett</b>	1998	General Practitioners	65	TPB	Intention to refer Asian and non-Asian patients to mental health services	For Asian patients, the significant predictors of intentions were normative beliefs, motivation to comply and their interaction. For non-Asian patients, the only significant impact on intentions were outcome beliefs.
<b>Nurses' behavioral intentions towards self-poisoning patients: a theory of reasoned action, comparison of attitudes and subjective norms as predictive variables- A. McKinlay, M. Couston &amp; S. Cowan</b>	2001	Nurses	74	TRA	Negative and positive behavioral intentions towards self-poisoning patients as represented in two case vignettes	Attitudes ( $\beta= 0.784$ , $P < 0.01$ ), and subjective norms ( $\beta= 0.144$ , $P < 0.05$ ) predicted behavioral intentions towards self-poisoning patients.
<b>Applying the theory of planned behavior to pharmacists' beliefs and intentions about the treatment of vaginal candidiasis with non-prescription medicines- A. Walker, M. Watson, J. Grimshaw &amp; C. Bond</b>	2004	Pharmacists	76	TPB	Intention to sell non-prescription antifungals to women with vulvovaginal candidiasis symptoms	TPB components accounted for 14–19% of the variance in behavioral intention. Pharmacist behavior was influenced more by behavioral control than perceived social pressure/norms

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>Factors determining cardiac nurses' intentions to continue using a smoking cessation protocol- C. Bolman, H. de Vries &amp; I. Mesters</b>	2002	Nurses	85	ASE	Use of a smoking cessation protocol	Perceived simplicity and advantages of the protocol were most predictive of intentions to continue using the protocol. Perceived social influences and self-efficacy were not. Level of experience using the protocol and the nurses' own smoking behavior was mediated by attitudes regarding the smoking cessation protocol.
<b>Effect of attitudes and subjective norms on intention to provide oral care to patients receiving antineoplastic chemotherapy- K. G. Wallace, K. Koepfel, A. Senko, K. Stawiaz, C. Thomas &amp; K. Kosar</b>	1997	Oncology nurses	85	TRA	Intention to provide oral care for patients receiving chemotherapy	Both attitudes and subjective norms significantly predicted behavioral intention, predicting 39% of the variance in intention.
<b>From recommendation to action: psychosocial factors influencing physician intention to use Health Technology Assessment (HTA) recommendations- M.-P. Gagnon, E. Sánchez &amp; J. M. V. Pons</b>	2006	Ophthalmologists and orthopedic surgeons	96	TIB	Intention to use health technology assessments (HTAs) within specialty medical practices	Among ophthalmologists, intention to use prioritization system for patients on waiting lists for cataract surgery was associated with attitudes, social norms, and normative beliefs. Among orthopedic surgeons, intention to use HTA recommendations for patient prioritization for hip and knee replacement was associated with perceptions, personal normative beliefs, and prior experience using HTAs.
<b>Using the Theory of Reasoned Action to Explain Physician Intention to Prescribe Emergency Contraception- M. R. Sable, L. R. Schwartz, P. J. Kelly, E. Lisbon &amp; M. A. Hall</b>	2006	Physicians	96	TRA	Intention to prescribe emergency contraception	Attitude and the indirect measure of subjective norms predicted physician intention to prescribe ( $\beta=1.39$ , $p<.001$ ). Greater perceived social norms among specific professional referents also predicted greater intention ( $\beta=0.05$ , $p<.05$ )
<b>Nurses' Intentions to Provide Continuous Labor Support to Women- L. Payant, B. Davies, I. D. Graham, W. E. Peterson &amp; J. Clinch</b>	2008	Nurses	97	TPB	Intention to provide continuous labor support to women with and without epidural analgesia	Previous labor support courses, subjective norms, and perceived behavioral control explained 55% of the variance in nurses' intentions for patients without epidurals, and 88% of the intention of those patient with epidurals.

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>Effect of attitudes, subjective norms and perceived control on nurses' intention to assess patients' pain- R. Nash, H. Edwards, M. Nebauer</b>	1993	Nurses	100	TPB;TRA	Intention to conduct pain assessment	Attitudes, subjective norms and perceived behavior control accounted for 21% of the variance in intention to conduct pain assessments.
<b>Nurses' intentions to provide home care: The impact of AIDS and homosexuality- L. Vermette &amp; G. Godin</b>	2010	Nurses	102	TPB	Intention to provide home care to homosexual or heterosexual AIDS or leukemia patients	Sexual orientation of the patient mediated personal normative beliefs ( $p < 0.05$ ). Disease type was significantly associated with perceived social norms ( $p < 0.05$ ). All TPB variables explained a significant proportion of the variance in intention ( $R^2 = 0.48$ ( $p < 0.0001$ ), with perceived behavioral control, normative beliefs, attitudes and degree of homophobia being the most significant predictors.
<b>Which cognitive factors predict clinical glove use amongst nurses? - P. W. B. Watson &amp; L. B. Myers</b>	2001	Nurses	103	TPB	Intention to wear gloves	45% of the variance in intention and 61% of the variance in behavior was explained by TPB variables. Attitudes, perceived behavioral control and the amount of anticipated contact with blood were most predictive of intention. Intention and perceived time availability to wear gloves were significant predictors of behavior.
<b>Explaining hand hygiene practice: An extended application of the Theory of Planned Behavior- E. A. Jenner , P. W. B. Watson , L. Miller , F. Jones &amp; G. M. Scott</b>	2002	Health care workers	104		Health care workers' hand hygiene behavior	Intention was strongly associated with behavior. Addition of perceived behavioral control to the predictive model did not contribute further to the explanation of behavior, but barriers contributed an additional 10%.
<b>Predicting Physician Guideline Compliance: An Assessment of Motivators and Perceived Barriers- S. K. Maue, R. Segal, C. L. Kimberlin &amp; Earlene E. Lipowski</b>	2004	Health care providers	106	TPB;TRA	Self-reported compliance with guidelines and actual compliance assessed through chart review	Mean self-reported compliance behavior was 65%; compliance as assessed objectively by chart review was 54%. Physician attitudes were most associated with self-reported guideline compliance. Self-reported compliance was in-turn significantly associated with behavioral intentions to utilize guidelines. Model-implied variables accounted for 68% of the variance in physician's behavioral intention.

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<p><b>A Reasoned Action Approach to Physicians' Utilization of Drug Information Sources- C. A. Gaither, R. P. Bagozzi, F. J. Ascione &amp; D. M. Kirking</b></p>	<p>1996</p>	<p>Physicians and pharmacists</p>	<p>108</p>	<p>TPB</p>	<p>Intention to use seven drug information sources</p>	<p>Among physicians, attitudes had the greatest effect on intention (<math>b \geq .40</math>) Among pharmacists, subjective norms were the strongest predictor (<math>b = .31</math>). Past behavior directly influenced intention to use the physicians' desk reference (<math>b = .27</math>), and pharmaceutical manufacturers' literature (<math>b = .26</math>). The effects of attitude and subjective norms on intention to use non-commercial drug information sources were moderated by the type of medical practice.</p>
<p><b>The Relationship of Attitude, Subjective Norm, and Behavioral Intent to the Documentation Behavior of Nurses- D. H. Renfro, P. S. O'Sullivan &amp; G. W. McGee</b></p>	<p>1990</p>	<p>Nurses</p>	<p>108</p>	<p>TRA</p>	<p>Intention to perform documentation behavior</p>	<p>Intentions had a significant effect on objective behavior, accounting for 15.2% of the variance. Attitude toward documentation was not significantly associated intention. Subjective norms had a significant effect on behavioral intent. Attitude and subjective norms together accounted for 46% of the variance in intention.</p>
<p><b>Anesthetists' intentions to violate safety guidelines-P. C. W. Beatty &amp; S. F. Beatty</b></p>	<p>2004</p>	<p>Anesthetists</p>	<p>114</p>	<p>TPB</p>	<p>Violations of safety guidelines, adherence to safety guidelines</p>	<p>Three safety violations were assessed: failing to visit patients before surgery, failure to perform pre-anesthetic equipment checks and the silencing of alarms during anesthesia. Results indicate that greater belief that violations were important, resulted in less likelihood to violate, except for the case of alarm silencing. This suggests that lack of confidence in the reliability of audible alarms undermines their utility. TPB model implied variables accounted for 45% of the variance in intention and 25% of the variance in reported behavior.</p>

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>The theory of reasoned action and theory of planned behavior as a function of job control- D. Buncu &amp; K. S. Birdie</b>	1998	Doctors with low and high occupational control	118	TRA;TPB	Intention to request hospital autopsy	Among lower job control, perceived behavioral control predicted intentions/ Among higher job control doctors the association was weaker. Past behavior independently predicted intentions among higher control doctors
<b>Understanding adherence to hand hygiene recommendations: The theory of planned behavior-C. A. O'Boyle, S. J. Henly, E. Larson</b>	2001	Nurses	120	TPB	Intention to follow and self-report of adherence to hand hygiene recommendations	Correlation between self-reported and observed adherence to handwashing recommendations was low ( $r = 0.21$ ). TPB factors were associated with intention and self-reported hand hygiene adherence but not with observed hand hygiene adherence. In SEM analysis, control beliefs, outcome beliefs and norm beliefs were all significantly associated with TPB variables. Among TPB variables, subjective norms exhibited a significant effect on intention; and intention produced a significant, positive effect on self-reported behavior.
<b>Prediction of health professionals' intention to screen for decisional conflict in clinical practice- F. Le'gare, I. D. Graham,A. C. O'Connor, M. Aubin, L. Baillargeon , Y. Leduc &amp; J. Maziade</b>	2007	Health professionals	122	TPB	Intention to screen for decisional conflict in clinical practice at both entry and exit	Upon entry, intentions were predicted by: attitudes ( $P < 0.001$ ), subjective norms ( $P < 0.001$ ), perceived behavioral control ( $P < 0.001$ ) and clinical site ( $P < 0.05$ ). On exit: subjective norms ( $P < 0.001$ ), perceived behavioral control ( $P < 0.001$ ), clinical site ( $P < 0.05$ ) Continuing Medical Education (CME) involvement at the national level ( $P < 0.05$ ), other diplomas obtained ( $P < 0.05$ ) and intervention ( $P < 0.05$ ) were the strongest predictors.
<b>Attitudes of Practicing Nurses as Predictors of Intended Care Behavior with Persons Who Are HIV Positive: Testing the Ajzen-Fishbein Theory of Reasoned Action- H. K. S. Laschinger and D.Goldenberg</b>	1993	Nurses	141	TRA	Intentions to care for patients who are HIV positive	Attitudes and subjective norms were the only significant predictors of intention ( $R^2 = 0.27$ ). Behavior was not assessed.

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>Community Health Nurses' HIV Care Behavior- H. K. S. Laschinger, D. Goldenberg &amp; D. Dal Bello</b>	2009	Nurses	145	TRA	Intentions to care for patients who are HIV positive	Attitudes and subjective norms significantly predicted intentions to provide care HIV patients ( $R^2 = .15$ ). Personal beliefs predicted intenders vs. non-intenders. Attitudes were related consequences for self, family, and friends, but not job-related consequences
<b>Nurses' intentions to administer morphine for post-operative pain: An Application of Azjen's Theory of Planned Behavior- D. W. Jurgens</b>	1996	Nurses	149	TPB	Intention to administer post-operative morphine for pain	Combining attitude and perceived behavioral control was determined to be the strongest predictor of behavioral intention. In total, TPB variables explained more than 50% of the variance in intention.
<b>Theory-based identification of barriers to quality improvement: induced abortion care- R. Foy, A. Walker, C. Ramsay, G. Penney, J. Grimshaw, J. Francis</b>	2005	Gynecologists and obstetricians	151	TPB	Guideline compliance (offering an assessment and provision of contraceptives) as assessed by case notes	TPB variables accounted for 27% of the variation in intentions; subjective norms were the strongest predictor. Intention and perceived behavioral control best explained compliance with guidelines (15%). For contraceptive supplies, the TPB accounted for 34% of the variation in intentions, with perceived behavioral control being the strongest predictor.
<b>Adopting information technology in hospitals: the relationship between attitudes/expectations and behavior- M. Hebert &amp; I. Benbasat</b>	1994	Nurses	151	TRA; DI	Intention and use of hospital information-technology	Three attitude factors (compatibility, relative advantage, and result demonstrability) and one subjective norm factor (director of nursing) were the strongest predictors of intention to use hospital IT.
<b>Determinants of nurses' adherence to Universal Precautions for venipunctures- G. Godin, H. Naccache, S. Morel, M.-F. Ébacher</b>	2000	Nurses	156	TPB	Adherence with universal precaution (UP) procedures when performing venipuncture	Perceived barriers ( $\beta = .62, P < .001$ ), social norm ( $\beta = .17, p < .01$ ), and personal normative belief significantly predicted intention to adhere to UP procedures. At follow-up, this intention explained 28% of the variance in actual adherence.
<b>Intentions to Select a Given Level of Care When Confronted With an Ethical Issue: The Impact of a Living Will- M. Lavoie</b>	1999	Nurses	164	TIB	Intended level of care for patient with and without a living will	Intention to observe the wishes expressed in a living will was high. 86% of the variance in intention was determined by attitude and perceived professional norms ( $p < .0001$ ).



**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>Understanding the Attitudes and Intentions of Future Professionals Toward Self-Help- G. J. Meissen, W. C. Mason &amp; D. F. Gleason</b>	1991	Graduate psychology and social work students	168	TRA	Attitudes, beliefs and intentions towards self-help groups	Positive attitudes, beliefs, and perceptions among students was associated with higher intention to collaborate with self-help groups. Students who participated in self-help groups themselves had significantly greater intentions to collaborate and had more positive beliefs vs. nonmembers
<b>Applying Theory to Understand and Modify Nurse Intention to Adhere to Recommendations regarding the Use of Filter Needles: An Intervention Mapping Approach- J. Cassista, J. Payne-Gagnon, B. Martel and M.-P. Gagnon</b>	2014	Nurses	169	TPB	Intention to use filter needles per recommendations	Attitude and perceived behavioral control significantly predicted intention and increased significantly post-intervention; only perceived behavioral control remained a predictor of intention. Together, TPB variables accounted for 32.5% of the variance in behavioral intention.
<b>Predicting health professionals' management of obesity- C. R. G. Hoppe</b>	1999	Nurses	172	TPB;SRT	Intention to raise issue of managing obesity with patients	Raising the issue of weight loss was significantly associated with intentions to raise the issue ( $r= 0.56, p <.0 01$ ), self-efficacy( $r= 0.64, p <.001$ ), subjective norms ( $r= 0.4 1, p<. 001$ ), attitudes ( $r= 0.32, p<. 001$ ), behavioral beliefs ( $r= 0.34, p<. 001$ ), control beliefs ( $r= 0.22, p<. 01$ ) and self-identity ( $r= 0.26, p<. 01$ ). Past behavior significantly correlated with behavior ( $r= 0.48, p <.0 01$ )
<b>Using The Theory of Planned Behavior to Predict Texas Community Pharmacists' Willingness to provide sterile syringes to known or suspected intravenous drug users- J. H. Mashburn</b>	2002	Pharmacists	174	TPB	Intention to provide sterile syringes to known or suspected intravenous drug users	Attitude and subjective norms were the strongest predictors of willingness. Attitude, subjective norm and recent past behavior were significant predictors when recent past behavior was also analyzed in regression models.
<b>Salient beliefs and intentions to prescribe antibiotics for patients with a sore throat- A. E. Walker, J. M. Grimshaw &amp; E. M. Armstrong</b>	2001	General practitioners	185	TPB	Intention to prescribe antibiotics for sore throat	TPB variables predicted 48% of the variance in intention, with past behavior adding a further 15%.

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>Prediction of pharmacist intention to provide Medicare medication therapy management services using the theory of planned behavior- K. E. Herbert J. M. Urmie, B. A. Newland &amp; K. B. Farris,</b>	2006	Pharmacists	203	TPB	Intention of pharmacists to provide Medicare medication therapy management services (MTMS)	TPB variables explained 63.2% of the variance in intention. No demographic or practice setting variables were significant at $P < .05$ , but past participation in care-based services approached significance ( $P = .06$ ),
<b>Applying psychological theory to evidence-based clinical practice: Identifying factors predictive of taking intra-oral radiographs- D. Bonetti, N. B. Pitts, M. Eccles, J. Grimshaw, Marie Johnston, Nick Steen, Liz Glidewell, Ruth Thomas, Graeme MacLennan, Jan E. Clarkson, Anne Walker</b>	2006	General Dental Practitioners	214	TPB;SCT	Number of intra-oral radiographs taken per course of treatment	The Theory of Planned Behavior explained 13% variance in the number of radiographs taken; Social Cognitive Theory explained 7%. Perceived behavioral control, action planning and risk perception explained 16% of the variance in number of radiographs taken. Knowledge did not predict the number of radiographs taken.
<b>Applying psychological theories to evidence-based clinical practice: Identifying factors predictive of managing upper respiratory tract infections without antibiotics- M. P. Eccles, J. M. Grimshaw, M. Johnston, N. Steen, N. B. Pitts, R. Thomas, E. Glidewell, G. MacLennan, D. Bonetti &amp; A. Walker</b>	2007	General Practitioners	230	TPB;SCT; OLT	Behavior to manage upper respiratory infections without antibiotics through both chart review (actual behavior proxy) and scenario-based simulation (behavioral intention)	Operant Learning Theory (OLT) explained 6% of the variance in behavior. When predicting intention using behavioral simulation the proportion of variance explained was: TPB, 31%; SCT, 26%; OLT, 24%
<b>Between intention and behavior: an application of community pharmacists' assessment of pharmaceutical care- K. B. Farris, D. P. Schopflocher</b>	1999	Pharmacists	230	N.S.	Intention to engage in and actual engagement in pharmaceutical care	In a causal model predicting pharmaceutical care behavior(s) based on pharmacists' self-efficacy, beliefs, evaluations and behavioral control, only self-efficacy was a direct predictor of behavior.
<b>Knowledge sharing behavior of physicians in hospitals- S. Ryua, S. H. Hob &amp; I. Han</b>	2003	Physicians	238	TRA;TPB	Intention to share knowledge	Subjective norms had the strongest total effect on behavioral intentions through direct and indirect path by attitude. Attitude had the second strongest effect on intentions. Perceived behavioral control was also found to affect intention, though to a lesser degree than subjective norms or attitudes

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>Factors influencing critical care nurses' involvement with families in the intensive care unit- B. Hetland, R. Hickman, N. McAndrew &amp; B. Daly,</b>	1998	Critical care nurses	265	TPB	Intention to provide family-focused care in ICU settings	The three primary determinants of nurses' intent to provide family-focused care were: Attitude, subjective norm, and perceived behavioral control
<b>Nursing staff members' intentions to use physical restraints with older people: testing the theory of reasoned action- P. Werner &amp; G. Mendelsson</b>	2001	Nurses	303	TRA	Intention to use physical restraints	Attitudes, subjective norms and moral considerations were significantly associated to intention. The TRA variables explained 48% of the variance in nurses' intentions.
<b>HIV and the Work Intentions of Public Health Nurses- I.Tessaro &amp; M. Highriter</b>	1994	Nurses	311	TRA	Intentions to work with HIV infected persons	Attitudes were the strongest predictor of intent in both mediation and stratified analysis. Social norms in the form of perceived positive attitudes towards working with HIV patients from important personal and professional referents was found to be the next strongest contributor to intention.
<b>Neuroscience nurses' intentions to care for persons with HIV/AIDS- C. DiIorio</b>	1997	Nurses belonging to a neuroscience society	368	TPB	Intention to care for patients with HIV/AIDS	Hierarchical regression analysis found attitudes accounted for a significant percent of variance, and perceived behavioralcontrol accounted for a significant increase in variance when entered at the second step. In the final model, only perceived behavioralcontrol contributed significantly to the prediction of intention
<b>Telemedicine Adoption by Different Groups of Physicians- A.-M. Croteau &amp; D. Vieru</b>	2002	Physicians from both large urban and small rural healthcare settings	390	TAM	Intention to adopt telemedicine	Among both urban and rural physicians, perception of usefulness of telemedicine was positively related to their intention to adopt it. Other associations were found to be significant and varied between rural and urban practitioners including background and environment.
<b>Predicting Physical Activity Promotion in Health Care Settings- G. Faulkner &amp; S. Biddle</b>	2001	Mental Health Professionals	394	TPB	Intention and stage of change of physical activity promotion	Attitude, subjective norms, perceived behavioral control, and intention predicted the stage of change of physical activity promotion in a health care setting. Promoting physical activity in the past had a sizable effect on predicting subsequent promotion.

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>Nurses' Attitudes Concerning the Delivery of Brief Cessation Advice to Hospitalized Smokers- M. C. McCarty, D. J. Hennrikus, H. A. Lando &amp; J. T. Vessey</b>	2001	Nurses	398	TPB	Intention to offer brief smoking cessation advice	Intention was most strongly correlated with attitudes, perceived behavioral control and which type of medical unit.
<b>Which factors explain variation in intention to disclose a diagnosis of dementia? A theory-based survey of mental health professionals - R. Foy, C. Bamford, J. J. Francis, M. Johnston, J. Lecouturier, M. Eccles, N. Steen &amp; J. Grimshaw</b>	2007	Professionals working on mental health teams (MHTs)	399	TPB;SCT	Intention to perform three distinct behaviors related to disclosing a diagnosis of dementia	Subjective norms, perceived behavioral control and attitudes explained 29.4% of the variance in intention to determine what patients already know about dementia. For intention to use explicit terminology in reference to dementia, the same variables explained 53.7% of intention. For exploring what the diagnosis means to patients, subjective norm and perceived behavioral control explained 48.6% of intention
<b>Information Technology Acceptance by Individual Professionals: A Model Comparison Approach- P. Chau &amp; P. J. -H. Hu</b>	2001	Physicians	400	TPB;TAM	Acceptance of telemedicine technology	The most significant direct and indirect (via attitude) effect on behavioral intention was perceived usefulness of technology.
<b>Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology-P. J. Hu, P. Y. K. Chau, O. R. L. Sheng &amp; K. Y. Tam</b>	1999	Physicians	421	TAM	Decision to accept telemedicine technology	Perceived usefulness was significantly predicted attitudes and intention but perceived ease did not. Perceived usefulness and perceived ease explained 37 percent of the variances observed physicians' attitudes toward telemedicine technology.
<b>Determinants of nurses' intention to administer opioids for pain relief- H. E. Edwards, R. E. Nash, J. M. Najman, P.M.Yates, B. J.Fentiman, A. Dewar, A. M.Walsh, J. K. McDowell &amp; H. M. Skerman</b>	2001	Nurses	446	TPB	Intention to administer opioids to patients with pain	Variance in intention to administer opioids for pain was explained (40%) by beliefs, attitudes, subjective norms, and perceived behavioral control.
<b>Test of the Fishbein and Ajzen Models as Predictors of Health Care Workers' Glove Use- P. F. Levin</b>	1999	Nurses and medical laboratory workers	527	TPB; TRA	health care workers' glove use when there is a potential for blood exposure	Perceived control and attitude significantly predicted intention. The theory of reasoned action was the most parsimonious model, explaining 70% of the variance in behavior. The extension of the theory of planned behavior was a viable model to study behavior related to glove use.

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>Determinants of Oncologist-based Exercise Recommendations: An Application of the Theory of Planned Behavior- L. W. Jones, K. S. Courneya, C. Peddle &amp; J. R. Mackey</b>	2005	Oncologists	610	TPB	Intention and actual recommendation of exercise	Intention was found to be the only significant predictor of actual recommendation behavior, explaining 28% of the variance. Attitude, subjective norms and perceived behavior control were independent predictors of intention, explaining 22% of the variance.
<b>Why Healthcare Workers Don't Wash Their Hands: A Behavioral Explanation- M. Whitby , M.-L. McLaws &amp; M. W. Ross</b>	2006	Nurses	745	TPB	Intent to wash hands (inherently and electively)	TPB variables explained 64% of the variance in inherent handwashing and 76% of elective handwashing. Intent was further predicted by beliefs in the benefits of in-hospital hand washing.
<b>Utility of the Theories of Reasoned Action and Planned Behavior for Predicting Physician Behavior: A Prospective Analysis- S. G. Millstein</b>	1996	Physicians	765	TRA;TPB	Self-reported intention to educate adolescent patients about STIs	TPB constructs explained 52% of the variance in intention to educate adolescents about sexually transmitted disease transmission (P < .001). The TPB was found to be an improvement on the TRA through the addition of perceived behavioral control.
<b>Understanding the intention of dentists to provide dental care to HIV+ AIDS patients- G.Godin, H. Naccache, J.-M. Brodeur &amp; M. Alary</b>	1999	Dentists	791	TPB	Intention to provide dental care to HIV+/AIDS patients	Overall, intention was high. The main factors explaining 71% of the variance in intention were perceived behavioral control ( $\beta=0.52$ , $P=0.0001$ ), personal normative, belief ( $\beta=0.33$ , $P=0.0001$ ) and habit of treating HIV <sup>1</sup> /AIDS patients ( $\beta=0.12$ , $P=0.0001$ )
<b>Guiding the design and selection of interventions to influence the implementation of evidence-based practice: an experimental simulation of a complex intervention trial- D. Bonetti, M. Eccles, M. Johnston, N. Steen, J.Grimshaw, R. Baker, A. Walker &amp; N. Pitts</b>	2005	General Practitioners	798	TPB;SCT	Decision to refer patient for lumbar spine x-ray	Predictors were attitude, subjective norm, perceived behavioral control, self-efficacy, and decision difficulty. All theoretically derived cognitions significantly predicted simulated behavior. Only subjective norm was not predictive of behavioral intention
<b>Understanding Physicians' Decision to Perform a Clinical Examination on an HIV Seropositive Patient- G. Godin, R. Boyer, B. Duval, C. Fortin &amp; D. Nadeau</b>	1992	Physicians	879	TPB;TIB	Intention to perform a clinical (physical) examination of an HIV seropositive patient.	Intention was significantly explained by all variables of the TPB (adjusted R <sup>2</sup> = .499.) The greatest association with intention to perform clinical exam was with perceived norm.

**Table 2. Summary of Behavioral Theory Studies (cotd.)**

<b>Variation in the psychosocial determinants of the intention to prescribe hormone therapy prior to the release of the Women's Health Initiative trial: a survey of general practitioners and gynecologists in France and Quebec- F. Legare, G. Godin, V. Ringa, S. Dodin, L. Turcot &amp; J. Norton</b>	2005	Physicians	1,601	TPB	Intention to prescribe hormone therapy	Power and control beliefs, moral norm and role belief were significantly associated with intention ( $p < 0.0001$ ).
<b>Nurses' Intention to Report Child Abuse in Taiwan: A Test of the Theory of Planned Behavior- J.-Y. Feng, Y.-W. B. Wu</b>	2005	Nurses	1,617	TPB	Intention to report child abuse in case study vignettes	In structural equation modeling attitudes, perceived behavioral control, subjective norms, and knowledge explained 85% to 91% of the variance in nurses' intention to report child abuse for the less severe and severe child abuse cases.
<b>Psychosocial Determinants of the Intention of Nurses and Dietitians to Recommend Breastfeeding-S. Daneault, M. Beaudry, G. Godin</b>	2004	Nurses and dietitians	124 nurses, 27 dietitians	TPB	Intention to recommend breastfeeding	The main determinants were perceived behavioral control and perceived professional norm; explaining 69% of the variance in intention. All salient beliefs underlying the perceived behavioral control were significantly associated with intention.
<b>Doctors' use of clinical guidelines: Two applications of the Theory of Planned Behavior- C. Limbert &amp; R. Lamb</b>	2002	Doctors, surgeons and junior doctors	285 doctors, 367 junior doctors	TPB	Intention to use guidelines for the management of acute asthma, Intention to use guidelines in prescribing antibiotics	In both studies, intentions correlated more strongly with perceived usefulness and beliefs about the evidential basis than with beliefs about whether the guideline undermines the individuality of the patient. The intentions of junior doctors to use guidelines compared to senior doctors were more influenced by subjective norm, perceived behavioral control and their belief in the strength of the evidence on which the guideline is based. Overall the TPB variables were found to account for 58% of the variance in intention to use guidelines.

**Table 2. Summary of Behavioral Theory Studies (contd.)**

<b>Attitudes and perceptions toward hand hygiene among healthcare workers caring for critically ill neonates- C. L. Pessoa-Silva, K. Posfay-Barbe, R. Pfister, S.Touveneau, T. V. Perneger, D. Pittet</b>	2005	Nurses and physicians	49 nurses, 12 physicians	TPB	Intention to comply with hand hygiene protocol	Intention to comply was associated with perceived behavioral control (OR, 3.12; CI95, 1.12 to 8.70; P = .030) and social norms (OR, 2.89; CI95, 1.08 to 7.77; P = .035)
<b>Intention to Encourage Complementary and Alternative Medicine Among General Practitioners and Medical Students- G. Godin, D. Beaulieu, J.-S. Touchette, L.-D. Lambert &amp; S. Dodin</b>	2010	General Practitioners and medical students	500 GPs, 904 medical students	TPB	Intention to encourage a patient to follow complementary and alternative medicine (CAM)	The TPB variables explaining 75% of the variance of intention were: moral norms, $\beta = 0.34$ , $p < .0001$ ; perceived behavioral control, $\beta = 0.29$ , $p < .0001$ ; attitudes, $\beta = 0.22$ , $p < .0001$ . Other variable included: descriptive norms, $\beta = 0.13$ , $p < .0001$ ; and professional status, (GPs, $\beta = -0.07$ , $p < .0001$ ; residents, $\beta = -0.07$ , $p < .0001$ ).
<b>Inhibiting Factors in the Prevention of Overweight in Infants: An Explorative Qualitative Study among Child Healthcare Practitioners in the Netherlands- E. Dera d Bie , M. Jansen &amp; W. Jan Gerver</b>	2012	Pediatric nurses and physicians	6 nurses, 6 physicians	N.S.	Intention to provide intervention to prevent overweight in infants	Qualitative findings indicated lack of knowledge, lack of self-efficacy and lack of ability to implement overweight prevention protocols (behavioral control) were found to be the most inhibitory for the intention to intervene on infants at risk for overweight.

**Table 3. Summary of Syphilis Screening Studies**

<b>Title, Author(s)</b>	<b>Year</b>	<b>Target Pop.</b>	<b>Country</b>	<b>Intervention Modality</b>	<b>Results</b>
<b>Frequent Screening for Syphilis as Part of HIV Monitoring Increases the Detection of Early Asymptomatic Syphilis Among HIV-Positive Homosexual Men- M. Bissessor, C. K. Fairley, D. Leslie, K. Howley &amp; M. Y. Chen</b>	2010	HIV positive MSM	Australia	Routine inclusion of syphilis serology with every blood test required as part of HIV monitoring	Comparing pre-intervention (time 1) and post-intervention (time 2): The proportion of MSM diagnosed with early syphilis who were asymptomatic was 21% (3 of 14) at time 1 and 85% (41 of 48) at time 2 (P = 0.006). The time between the midpoint since last syphilis serology and diagnosis of syphilis was a median of 107 days (range 9–362) at time 1 and 45 days (range 23–325) at time 2 (P = 0.018)
<b>Use of a Computer Alert Increases Detection of Early, Asymptomatic Syphilis Among Higher-Risk Men Who Have Sex With Men - M. Bissessor, C. K. Fairley, D. Leslie &amp; M. Y. Chen</b>	2011	MSM at increased syphilis risk	Australia	Automated computer EMR alert to test MSM at high risk for syphilis	Percentage of high-risk men who have sex with men who were tested for syphilis increased from 77% to 89% (P < .001). The percentage of asymptomatic syphilis infection detected increased from 16% to 53% (P < .001).
<b>Significant increase in testing rates for sexually transmissible infections following the introduction of an anal cytological screening program, targeting HIV-positive men who have sex with men- L. P. Botes, J. McAllister, E. Ribbons, F. Jin &amp; R. J. Hillman</b>	2016	HIV positive MSM	Australia	Introduction of anal cytology and STI screening program for HIV positive MSM	The number of men undergoing STI testing increased significantly from 67 (20.4%) to 123 (34.8%) (relative risk 1.7, 95% confidence interval (CI) 1.40–2.07), but the increase in the total number of patients with any STI did not achieve significance (from 7 to 11, prevalence ratio 0.86, 95% CI 0.33–2.21). Rates of STI diagnosed in men participating in the ACSP were no different (11.3% v. 7.7%, P = 0.557) from those men declining screening.
<b>Increased Syphilis Testing of Men Who Have Sex With Men: Greater Detection of Asymptomatic Early Syphilis and Relative Reduction in Secondary Syphilis- E.P. F. Chow, D. Callander, C. K. Fairley, L. Zhang, Donovan, R. Guy, D. A. Lewis, M. Hellard, P. Read, A. Ward &amp; M.Y. Chen</b>	2017	HIV negative and HIV positive MSM	Australia	Natural observation of syphilis testing rates among MSM following national screening guidelines update	The proportion of MSM serologically tested for syphilis annually increased in HIV negative (48% to 91%; P <sub>trend</sub> < .0001) and HIV-positive MSM (42% to 77%; P <sub>trend</sub> < .0001). The mean number of tests per man per year increased from 1.3 to 1.6 in HIV-negative MSM (P <sub>trend</sub> < .0001) and from 1.6 to 2.3 in HIV-positive MSM (P <sub>trend</sub> < .0001). 2799 and 1032 syphilis cases were detected in HIV-negative and HIV-positive MSM, respectively. Among HIV-negative MSM, the proportion of infections that were early latent (EL) increased from 27% to 44% (P <sub>trend</sub> < .0001), while the proportion that were secondary decreased from 24% to 19% (P <sub>trend</sub> = .030). Among HIV-positive MSM, EL infections increased from 23% to 45% (P <sub>trend</sub> < .0001), while secondary infections decreased from 45% to 26% (P <sub>trend</sub> = .0003). Among HIV-positive MSM, reduction in secondary syphilis correlated with increasing testing coverage (r = -0.87; P = .005) or frequency (r = -0.93; P = .001).



**Table 3. Summary of Syphilis Screening Studies (cotd.)**

<b>Increasing detection of asymptomatic syphilis in HIV patients- C. E. Cohen, A. Winston, D. Asboe, F. Boag, S. Mandalia, B. Azadian, D. A. Hawkins</b>	2005	HIV positive MSM	UK	Routine inclusion of syphilis serology with every blood test required as part of HIV monitoring	2655 patients had at least one CD4 count performed alongside 2389 (90%) syphilis serologic tests compared to 3% before routine screening introduction and 85% in the first year of use. The median time since most recent syphilis serology was 3 months (IQR 1.7–4.3) compared to 6 months in the pre-implementation study period.
<b>Including Syphilis Testing as Part of Standard HIV Management Checks and Improved Syphilis Screening in Primary Care- D. Callander, D. Baker, M. Chen &amp; R. Guy</b>	2015	HIV positive MSM	Australia	Introduction of routine opt-out syphilis testing with HIV monitoring	The mean number of syphilis tests per individual rose from 1.14 in 2005 to 2.32 in 2007 (P > 0.001). In the following years, the mean number of tests remained consistent through 2008 (2.30), 2009 (2.30), and 2010 (2.45). The proportion of participants who met the testing target of 3 or more tests in a year rose significantly from 10% in 2005 to 41% in 2007 (P > 0.001)
<b>Factors Associated With Repeat Syphilis Testing at a Large Urban LGBT Health Clinic: Chicago, IL 2002–2008- A.L. Hotton, B. Gratz, D. Pohl &amp; S. D. Mehta</b>	2011	MSM	US	Retrospective cohort study assessing timely follow-up (return clinic visit within 6 months of initial syphilis diagnosis) comparing pre- and post-implementation of a Disease Intervention Specialist (DIS) and enhanced EMR system	5788 tests for syphilis were performed; 256 (4.4%) cases of early syphilis were detected among 225 men. Of 225 134 (59.6%) had timely follow-up. After implementation of electronic medical records and enhanced DIS follow-up, timely follow-up increased from 53% to 76% and rescreening increased from 64% to 81%.
<b>Clinical audit: adherence to sexually transmitted infection screening guidelines for men who have sex with men- N. Ryder, C. Bourne &amp; R. Rohrsheim</b>	2005	MSM	Australia	Natural observation of syphilis testing rates among MSM following screening guidelines update in Sydney, Australia	Comparing the pre- and post- guideline implementation period: rates of complete STI screening (inclusive of syphilis serology) increased from 46% to 61% (P<0.05). Syphilis specifically increased from 64% to 77%.
<b>Introduction of a sexual health practice nurse is associated with increased STI testing of men who have sex with men in primary care - A. F. Snow, L. A. Vodstreil, C. K. Fairley, C. El-Hayek, R.Cummings, L. Owen, N. Roth, M. E. Hellard &amp; M. Y. Chen</b>	2013	MSM	Australia	Introduction of a sexual health practice nurse to a general practice that specializes in gay men’s health	After the nurse was introduced, STI and HIV screening among HIV negative men increased from 41% to 47% (P<0.01). Among HIV positive men, complete STI testing increased from 27% to 43% (p < 0.001).

**Table 3. Summary of Syphilis Screening Studies (contd.)**

<p><b>Syphilis Screening and Diagnosis Among Men Who Have Sex With Men, 2008–2014, 20 U.S. Cities- Q. An, C. Wejnert, K. Bernstein &amp; G. Paz-Bailey</b></p>	2017	MSM	US	<p>Assessment of self-reported syphilis screening and diagnosis trends among sexually active MSM from 2008 to 2014 in the United States by selected characteristics.</p>	<p>49% MSM reported syphilis screening in 2014, a significant increase from 40% in 2011 and 38% in 2008 (PR 1.13, 95% CI: 1.11 to 1.16). The largest increases in syphilis screening between 2008 and 2014 were among MSM aged 30–39 years and MSM who reported &gt;10 sex partners. The largest increases in syphilis diagnosis among those screened were observed among MSM who were aged 25–29 years, black, HIV positive, and reported &gt;10 sexual partners.</p>
<p><b>Taming the great: enhanced syphilis screening in HIV-positive men who have sex with men in a hospital clinic setting- J. A. Trubiano &amp; J. F. Hoy</b></p>	2015	HIV positive MSM	Australia	<p>Routine inclusion of syphilis serology with every HIV viral load (VL) test regardless of sexual activity</p>	<p>23% of HIV VL tests were accompanied by a syphilis test in the pre-enhanced testing period, compared with 56% during the enhanced testing period (P &lt; 0.0001). The number of new syphilis diagnoses from total syphilis tests was four in the pre-enhanced and 18 in the enhanced testing period (pre-enhanced period positivity rate: 2.3%; enhanced period positivity rate: 4.3%; P = 0.34). The rate of new syphilis diagnosis for total patients tested was 0.7% for the pre-enhancement period and 3.1% for the enhanced testing period (P = 0.003).</p>
<p><b>Enhancing the Routine Screening Infrastructure to Address a Syphilis Epidemic in Miami-Dade County- A. L. Venegas, H. M. Melbourne, I. A. Castillo, K. Spell, W. Duquette, K. Villamizar, G. Gallo, D. Parris &amp; L. M. Rojas</b></p>	2020	<p>Male and female patients identified to be at increased syphilis risk (89% female)</p>	US	<p>Enhancing existing HIV/HCV “opt-out” with syphilis smart screening algorithm</p>	<p>Smart screening algorithm triggered 4806 syphilis tests: 122 patients tested positive (2.5% seropositivity). After confirmatory testing, 59 patients were positive for syphilis, of which 27 were pregnant.</p>

**Table 4. Descriptive overview of included records**

Characteristic	Total	Theory Literature N=70	Syphilis Screening Literature N=12
<b>Publication Year</b>			
1990-2000	25	25	-
2001-2005	33	31	2
2006-2010	14	12	2
2011-2015	7	2	5
2016-2020	3	0	3
<b>Continent</b>			
Africa	0	0	0
Asia	6	6	0
Australia	12	4	8
Europe	22	21	1
North America	42	39	3
South America	0	0	0
<b>Sample Size</b>			
1-100	20	20	0
101-500	42	40	2
501-1000	8	7	1
>1000	12	3	9 <sup>†</sup>

<sup>†</sup>Some studies report observations as number of tests, not number of patients in sample size calculations

### *Theory-based Literature*

Broadly defined, behavioral theories that have been used to explain health care providers' behaviors and intentions have sought to account for the social, cognitive and dispositional underpinnings of said behaviors. For example, perhaps the most widely used theory in this domain- the Theory of Planned Behavior (TPB) - employs a model that includes attitudes, perceived behavioral control, and social norms as the predictors of behavioral intention. This intention then functions as a predictor of actual behavior (Ajzen, 1991). The constructs of attitudes, perceived behavioral control and social norms are theorized to function aggregately to produce a stronger or weaker intention to perform the behavior. Attitudes may refer to the general favorable or unfavorable dispositions towards a behavior, such as whether the behavior is

helpful or harmful, easy or difficult, etc. Perceived behavioral control refers to the cumulative assessment of one's power and control beliefs relative to performing a particular action or behavior. Subjective norms refers to the beliefs about the societal consensus of a given behavior, its benefits, importance, value, etc. Common to most theories assessed here is the notion that intention to perform a behavior and the actual enactment of said behavior are strongly correlated; a supposition that has been borne out in multiple studies across varying populations (Ajzen, 1991; Eccles et al., 2006; Jaccard & Wood, 1986; Topa & Moriano, 2010).

### ***Healthcare Providers***

The three reviews that were identified from the theory literature had distinct yet related objectives. Perkins, Jensen, Jaccard, Gollwitzer, et al.(Perkins et al., 2007) sought to identify studies in which theory was applied to understand and/or modify health and mental health clinicians' behavior in accordance with practice guidelines. Godin, Belanger-Gravel, Eccles and Grimshaw (Godin et al., 2008) conducted a similar review but with a greater emphasis on traditional health care professionals' adoption and implementation of clinical research evidence. Eccles, Hrisos, Francis, Kaner, Dickinson et al.(Eccles et al., 2006) sought to answer a specific question in their review: whether clinician's self-reported behavioral intentions predict actual clinical practice. Of the 70 unique studies extracted from these reviews, the majority included nurses (33 studies)(Bie et al., 2012; Bolman et al., 2002; C. A. O. Boyle, 2001; C. L. Pessoa-Silva, K. Posfay-Barbe, R. Pfister, S.Touveneau, T. V. Perneger, 2005; Comtois, 1999; Crawford, 1998; Daneault et al., 2004; Durks et al., 2017; Edwards et al., 2001; Jui-ying Feng & Wu, 2005; Gina, 1999; Godin et al., 2000; Hebert & Benbasat, 1994; Jurgens, 1996; Laschinger & Goldenberg, 1993; Levin, 1999; Licensors et al., 1997; Nash et al., 1993; Payant et al., 2008; Puffer, 2004; Renfroe, D. H., O'Sullivan, P. S., & McGee, 1990; Ross, 2013; Sauls, 2007;

Schottle, 1999; Spence et al., 1995; Tessaro & Highriter, 1987; Vermette & Gdoin, 1994; Vessey, 2001; Wallace, Kathleen G., Kathleen Koepfel, Alice Senko, Karen Stawiaz, Carolyn Thomas, 1997; Walsh et al., 2005; Watson & Myers, 2010; Werner, 2001) and general physicians (19 studies) (Bie et al., 2012; Bonetti et al., 2005; Bunce, 1998; C. L. Pessoa-Silva, K. Posfay-Barbe, R. Pfister, S.Touveneau, T. V. Perneger, 2005; Chau & Hu, 2001; Conner, 2007; Croteau & Vieru, 2002; Eccles et al., 2007; M. Gagnon et al., 2003; Gaither et al., 1996; Godin et al., 2010, 2021; Graham & Connor, 2007; Hu et al., 2015; Lambert et al., 1997; Legare et al., 2005; Caroline Limbert & Lamb, 2002; Lisa et al., 2006; Maue, Segal, & Kimberlin, 2004; Millstein, 1996; Ryu et al., 2003). Other healthcare professionals included pharmacists (6 studies) (Caroline A. Gaither, Richard P. Bagozzi, 1996; Cassista et al., 2014; Farris & Schop, 1999; K. E. Herbert et al., 2006; Mashburn, 2003; Mason, 1983), healthcare students and trainees (3 studies) (Godin et al., 2010; Caroline Limbert & Lamb, 2002; Meissen et al., 1991), mental health workers (2 studies) (Foy et al., 2007; Meissen et al., 1991), obstetricians/gynecologists (3 studies) (Foy et al., 2005; Legare et al., 2005; Liabsuetrakul & Chongsuvivatwong, 2003) and general dental practitioners (2 studies) (Godin, 1999; Godin et al., 2010). These studies were conducted with sample sizes ranging from 12 participants for exploratory, qualitative studies, to over 1,600 participants for studies using sophisticated modeling analyses. Frequently, studies included multiple clinician types to assess the differences in behavioral intention and practice and their strengths of association with various model implied variables.

### ***Theory***

All three theory-based reviews specified in their inclusion criteria that studies must include a description of a theoretical substrate used to model the interaction of social, cognitive, and behavioral mechanisms involved in forming behavioral intention and/or performing a

clinical behavior. Perkins et al. specified at the outset of their review that only studies based on either the Theory of Reasoned Action (TRA) or its extension, the Theory of Planned Behavior (TPB) would be reviewed, whereas the other two reviews applied more general criteria for inclusion. Of the 70 original studies extracted, the TPB was used in 48 (Beatty & Beatty, 2004; Bonetti et al., 2005, 2006; C. A. O. Boyle, 2001; Caroline A. Gaither, Richard P. Bagozzi, 1996; Cassista et al., 2014; Chau & Hu, 2001; Conner, 2007; Crawford, 1998; Daneault et al., 2004; Eccles et al., 2007; Edwards et al., 2001; Faulkner & Biddle, 2001; Jui-ying Feng & Wu, 2005; Foy et al., 2007, 2005; Gina, 1999; Godin, 1999; Godin et al., 2010, 2021, 2000; Graham & Connor, 2007; K. E. Herbert et al., 2006; Jenner et al., 2010; Jones, Lee W; Courneya, Kerry S; Peddle, Carolyn; Mackey, 2005; Jurgens, 1996; Legare et al., 2005; Levin, 1999; Liabsuetrakul & Chongsuvivatwong, 2003; Licensors et al., 1997; C Limbert & Lamb, 2010; Mashburn, 2003; Maue, Segal, & Kimberlin, 2004; Millstein, 1996; Nash et al., 1993; Payant et al., 2008; Pessoa-silva et al., 2005; Puffer, 2004; Ross, 2013; Ryu et al., 2003; Sauls, 2007; Schottle, 1999; Vessey, 2001; A. E. Walker et al., 2001; A. Walker et al., 2004; Walsh et al., 2005; Watson & Myers, 2010) and the TRA was used in 19 (Bernaix, 2000; Bunce, 1998; Hebert, Marilynne; Benbasat, 1994; Lambert et al., 1997; Laschinger & Goldenberg, 1993; Levin, 1999; Lisa et al., 2006; Mason, 1983; Maue, Segal, Kimberlin, et al., 2004; Mckinlay et al., 2001; Meissen et al., 1991; Nash et al., 1993; Renfroe, D. H., O'Sullivan, P. S., & McGee, 1990; Spence et al., 1995; Tessaro & Highriter, 1987; Wallace, Kathleen G., Kathleen Koeppel, Alice Senko, Karen Stawiaz, Carolyn Thomas, 1997; Werner, 2001). Other theories utilized in these studies include the Theory of Interpersonal Behavior (TIB; 4 studies) (Comtois, 1999; M. Gagnon et al., 2003; M. P. Gagnon et al., 2006; Godin et al., 2021), the Social Cognitive Theory (SCT; 4 studies) (Bonetti et al., 2005, 2006; Eccles et al., 2007; Foy et al., 2007), the Technology Acceptance

Model (TAM; 3 studies) (Chau & Jen-Hwa Hu, 2001; Croteau & Vieru, 2002; Hu et al., 2015), the Self-Regulation Theory (SRT; 1 study) (Gina, 1999), the Diffusion of Innovation Theory (DI; 1 study) (M. Herbert, 1994), and the Attitude, Social Intent and Self-Efficacy Theory (ASE; 1 study) (Bolman et al., 2002). Similar to how healthcare professionals were analyzed in these studies, several investigations compared two or more theories when assessing their influence on behavior intention and/or clinical practice. Most frequently, the TBP and TRA were used simultaneously and compared (6 studies) (Bunce, 1998; Levin, 1999; Maue, Segal, Kimberlin, et al., 2004; Millstein, 1996; Nash et al., 1993; Ryu et al., 2003).

### *Clinical Outcomes*

The original articles contained in the three theory-based reviews all identified a target clinician behavior, and/or intention, or a set of behaviors and intentions to assess alongside model and theory-implied variables. Broadly construed, these outcomes consisted of the intention and/or enactment of practice behaviors such as making a referral, prescribing treatment, conducting screening, etc. (53 studies) (Bernaix, 2000; Bie et al., 2012; Bolman et al., 2002; Bonetti et al., 2005, 2006; Bunce, 1998; Caroline A. Gaither, Richard P. Bagozzi, 1996; Comtois, 1999; Conner, 2007; Crawford, 1998; Daneault et al., 2004; Eccles et al., 2007; Edwards et al., 2001; Farris & Schop, 1999; Faulkner & Biddle, 2001; Jui-ying Feng & Wu, 2005; Foy et al., 2007; Gina, 1999; Godin, 1999; Godin et al., 2010, 2021; Graham & Connor, 2007; K. E. Herbert et al., 2006; Jenner et al., 2010; Jones, Lee W; Courneya, Kerry S; Peddle, Carolyn; Mackey, 2005; Jurgens, 1996; Lambert et al., 1997; Laschinger & Goldenberg, 1993; Legare et al., 2005; Liabsuetrakul & Chongsuvivatwong, 2003; Lisa et al., 2006; Mashburn, 2003; Mason, 1983; Mckinlay et al., 2001; Millstein, 1996; Nash et al., 1993; Payant et al., 2008; Puffer, 2004; Renfroe, D. H., O'Sullivan, P. S., & McGee, 1990; Ross, 2013; Sauls, 2007;

Spence et al., 1995; Tessaro & Highriter, 1987; Vermette & Gdoin, 1994; Vermette & Godin, 2010; Vessey, 2001; A. E. Walker et al., 2001; A. Walker et al., 2004; Wallace, Kathleen G., Kathleen Koepfel, Alice Senko, Karen Stawiaz, Carolyn Thomas, 1997; Watson & Myers, 2010; Werner, 2001). Also included were assessments of guideline and recommendation adherence (7 studies) (Beatty & Beatty, 2004; C. A. O. Boyle, 2001; C. L. Pessoa-Silva, K. Posfay-Barbe, R. Pfister, S.Touveneau, T. V. Perneger, 2005; Durks et al., 2017; Godin et al., 2000; Caroline Limbert & Lamb, 2002; Maue, Segal, Kimberlin, et al., 2004), and adoption and use of new technologies (6 studies) (Chau & Hu, 2001; Croteau & Vieru, 2002; M. Gagnon et al., 2003; M. P. Gagnon et al., 2006; Hebert & Benbasat, 1994). Fifty-one studies included intention as a primary outcome (Bie et al., 2012; C. A. O. Boyle, 2001; Bunce, 1998; C. L. Pessoa-Silva, K. Posfay-Barbe, R. Pfister, S.Touveneau, T. V. Perneger, 2005; Caroline A. Gaither, Richard P. Bagozzi, 1996; Cassista et al., 2014; Conner, 2007; Crawford, 1998; Croteau & Vieru, 2002; Daneault et al., 2004; Edwards et al., 2001; Jui-ying Feng & Wu, 2005; Foy et al., 2007; M. Gagnon et al., 2003; M. P. Gagnon et al., 2006; Gina, 1999; Godin, 1999; Godin et al., 2010, 2021; Graham & Connor, 2007; K. E. Herbert et al., 2006; Jurgens, 1996; Lambert et al., 1997; Laschinger & Goldenberg, 1993; Legare et al., 2005; Liabsuetrakul & Chongsuvivatwong, 2003; Licensors et al., 1997; Caroline Limbert & Lamb, 2002; Lisa et al., 2006; Mashburn, 2003; Mason, 1983; Mckinlay et al., 2001; Millstein, 1996; Nash et al., 1993; Payant et al., 2008; Puffer, 2004; Renfroe, D. H., O'Sullivan, P. S., & McGee, 1990; Ross, 2013; Ryu et al., 2003; Sauls, 2007; Schottle, 1999; Spence et al., 1995; Tessaro & Highriter, 1987; Vermette & Gdoin, 1994; Vessey, 2001; A. E. Walker et al., 2001; A. Walker et al., 2004; Wallace, Kathleen G., Kathleen Koepfel, Alice Senko, Karen Stawiaz, Carolyn Thomas, 1997; Walsh et al., 2005; Watson & Myers, 2010; Werner, 2001). In 12 of these studies, the effect of intention on behavior



was assessed. Seven studies used clinical practice behavior as their primary outcome. Eight studies assessed behavior intention subjectively through participants' self-report. Objective methods used to assess behavior included direct observation, documentation review to measure compliance, and behavior reported by patients. Intention was frequently assessed using single intention items utilizing a 7-point scale scored 1-7 or -3 to 3. Other methods used to assess intention included asking clinicians to respond to hypothetical case studies or patient vignettes.

### ***Associations with Behavior and Intention***

Associations between intention and/or behavior and the theory- and model-implied variables used in these studies was most frequently assessed through stratified or hierarchical regression analysis, with intentions and/or behavior regressed on the appropriate predictor(s). This was most often reported using  $R^2$  as the coefficient of determination to illustrate the proportional variance explained by the theory-implied variables. Methodologies varied in terms of how such multiple determination regression models were constructed and included step-wise hierarchical entry of blocks corresponding to theory-derived variables, as well as simultaneous entry of all theory-derived variables into a single model. As such, a range of  $R^2$  and  $R^2$  change values are reported.

In terms of significance, beliefs about capabilities, such as perceived behavioral control variables, were most consistently significant predictors of clinical behavior. Godin et al. (2000) demonstrate this in their analysis of nurses' intention to adhere and actual adherence to universal precautions during venipuncture. Due to their measurement of both reported intention and adherence to actual procedures during the last ten venipunctures performed at a three-month follow-up, they were able to separately assess the significant predictors of either outcome. They found that while perceived barriers ( $p \leq .001$ ), subjective norms ( $p \leq .01$ ) and normative beliefs

( $p \leq .01$ ) significantly predicted *intention* to follow universal precautions, only intention ( $p \leq .001$ ) and perceived behavioral control ( $p \leq .05$ ) significantly predicted actual adherence.

Attitudinal and belief-based variables such as outcome expectancies, social norms and perceived behavioral control were the most consistent significant predictors of behavioral intention, though frequently varied among discrete behaviors and populations. For example, when assessing cardiac nurses' behavioral intentions to provide smoking cessation protocols, Bolman et al. (2002) determined that the perception that the protocol was simple to implement and provided a benefit to patients was strongly associated with the intention to continue using the protocol, however social norms were not. Specifically, when assessed as *intenders* vs. *non-intenders*, they found that means on items that evaluated ease of use ( $p < .001$ ), feasibility in daily practice ( $p < .001$ ), and whether the protocol was perceived to have more advantages than disadvantages ( $p < .01$ ) differed significantly between these two groups. By comparison, Sable et al. (2006) found that intention among primary care physicians to prescribe emergency contraception was predicted by both attitudes ( $p \leq .001$ ) and subjective norms ( $p \leq .001$ ), including how specific professional referents (peers, colleagues, etc.) are perceived to think about prescribing emergency contraception ( $p \leq .01$ ). Consistent with what was reported in the original review articles, when intention and behavior were assessed simultaneously, intention did significantly predict behavior in 50% of said studies. However, as noted in Godin (2006), use of objective measure to assess behavior attenuated this association.

### ***Syphilis screening Intervention Literature***

Screening interventions for syphilis, though few in number, represent an important facet in the effort to control rising syphilis infection rates, particularly among MSM. Though our review only identified 12 clinic-based interventions targeted to MSM, their findings support the

efficacy of increased screening frequency in detecting syphilis cases, particularly those that are asymptomatic. Presumably, the targeted nature of many of the interventions described herein played a significant role in their ability to detect cases. In most instances, these interventions were implemented in clinic settings that predominantly or exclusively see sexual minority male patients or patients living with HIV; two populations for whom increased screening has been recommended by the USPSTF.

### ***Target population***

Our literature search identified two reviews that included studies of syphilis screening interventions implemented at the clinic or provider level that also included MSM. Ong, Fu, Smith and Tucker produced a scoping review of syphilis screening interventions, which included not only clinic-based strategies, but diagnostic innovations such as the use of dried blood spot (DBS) testing. Their review also included key populations beyond MSM, such as people who are incarcerated, and people who use drugs. Based on their review of clinic-based strategies, Ong et al. conclude that interventions that seek to modify clinic procedures may be effective at nudging clinicians towards more frequent screening behavior. They further deduce that these “tweaks” to existing protocols are easy to implement and have been effectively used to screen for and prevent other sexually transmitted infections. This is supported by the findings summarized in the second review by Zou, Fairley, Guy and Chen. Their systematic review compiled investigations of clinic-based interventions aimed at increasing screening of bacterial infections among MSM. Their analysis included targeted interventions specific to syphilis and those that included other bacterial infections such as *chlamydia trachomatis* and *Neisseria gonorrhoeae*. They conclude that screening and detection of STIs in MSM can be improved, and that further development of multifaceted interventions is warranted.

The nine syphilis screening intervention studies extracted from these two reviews, and the three identified through hand searches, all included men at risk for syphilis in their study sample. Six studies specifically included individuals living with HIV. Eleven of the twelve studies targeted MSM specifically. The one study that did not specify MSM as a target population used a syndromic and behavioral surveillance algorithm to identify both male and female patients at high risk for syphilis. Studies that focused specifically on HIV-positive MSM described interventions that took place in HIV outpatient settings. Most interventions were implemented outside the US (8 in Australia, 1 in the UK). In all but one study, within group comparisons were used on a time basis (e.g., pre- post-guideline implementation) and comparisons between patient subgroups, clinic settings or provider types were not used.

#### ***Study Method and Intervention Modality***

Several methods were used prospectively and retrospectively to assess rates of syphilis screening, seropositivity and follow-up care in these studies. Studies that examined testing rates among HIV-positive MSM frequently assessed the change in screening frequency following the routine addition of syphilis serology to all HIV monitoring blood tests on either an automated or “opt-out” basis (Callander et al., 2013). Two studies presented results of observed screening rates prior to and following an update to screening recommendations on a local and national level (Chow et al., 2017; Ryder et al., 2005).

Three studies assessed the effect of a technology-based intervention. Bissessor et al. (2005) assessed the inclusion an EMR based prompt to alert clinicians to screen patients for syphilis if during consultation a male patient reported >10 sexual partners in a 12-month period(Bissessor et al., 2011a). Hotton et al. (2011) described the effects of an EMR based record keeping method to better track patients who had received a syphilis diagnosis to improve

rates of follow-up screening and care and reduce time-to-follow-up(Hotton, Gratzner, Pohl, & Bs, 2011). Finally, Venegas and colleagues (2020) reported the effect of an enhanced screening algorithm derived from retrospective analysis of patients at risk (Venegas et al., 2020). This algorithm assisted with identifying patients at risk for syphilis through a combination of syndromic and behavioral surveillance factors including reason for medical visit (e.g., vaginal bleeding, penile lesions, groin pain), and past positive STI result. Two studies assessed the effect of including a specialist to their clinic personnel (Hotton, Gratzner, Pohl, & Bs, 2011; Snow et al., 2013). One clinic introduced a sexual health nurse to their general practice to increase STI screening in HIV-positive and negative MSM. In addition to their introduction of an EMR prompt, Hotton (2011) also described the effect of introducing a disease intervention specialist (DIS) to assist with identifying patients for whom follow-up syphilis testing and care were indicated.

### ***Screening Results and Associations***

The results from the 12 studies extracted for this review include a range of indicators, including syphilis screening rates, syphilis seropositivity rates and rates of return visits following a syphilis diagnosis. In settings where syphilis testing was paired with HIV diagnostic and monitoring laboratory procedures for MSM, the number of syphilis screening tests ordered were often compared pre- and post-routinization of ordering those tests together. One such study conducted this comparison by assessing the median number of tests per man per year and found that in the 18 months post implementation, the median rose from 1 to 2 tests per year(Callander et al., 2013). When a routine “opt-out” syphilis screening was added to HIV monitoring, the mean number of syphilis tests per year per individual rose from 1.14 to 2.32 in a 24 month period. This increase in screening remained consistent during each subsequent 12-month period

over the course of 36 months(Callander et al., 2013). Similarly, Botes et al. (2016) found the proportion of men undergoing STI testing increased from 20.4% to 34.8% ( $p<.01$ ) when paired with HIV monitoring and anal cytology screening(Botes et al., 2016). Syphilis prevalence was also compared pre- and post-implementation. When combining syphilis screening with routine HIV monitoring, Bissessor et al. (2010) found diagnoses of early, asymptomatic syphilis increased from 21% to 85% ( $p<.001$ ). The use of EMR alerts resulted in similar changes to screening frequency and detection. Altering clinicians to screen MSM with >10 sexual partners in a 12-month period increased the proportion of tests from 77% of patients to 89% ( $p<.001$ ) and further resulted in an increase in detection of asymptomatic cases from 16% to 53% ( $p<.001$ ) (Bissessor et al., 2011a).

Hotton et al. (2011) found that when implementing an EMR based system to track patients with prior syphilis diagnoses, timely follow-up increased from 53% of cases to 76%, and the proportion of patients who were re-screened increased from 64% to 81%. The change in screening and diagnosis rates was also assessed relative to the implementation of updated syphilis screening guidelines. Similarly, Ryder, Bourne & Rohrsheim (2005) found that prior to guideline implementation, the proportion of patients screened for all STIs was 46% in a 12-month period and increased to 61% post-implementation ( $p<.001$ ). Screening for syphilis specifically increased from 64% to 77% ( $p<.001$ ). In another study, the effects of guideline implementation on both HIV-negative and HIV-positive MSM screening were examined. The proportion of HIV-negative MSM receiving serologic syphilis screening increased from 49% to 91% ( $p<.001$ ) and among HIV-positive MSM from 24% to 77% ( $p<.001$ )(Chow et al., 2017). The proportion of diagnoses of early latent syphilis infection increased from 27% to 44% among HIV-negative MSM. This was found to be correlated with an observed decrease in the proportion

of secondary infections (from 24% to 19%). This trend was seen among HIV-positive MSM as well, wherein serologic screening increased from 42% to 77%, early latent diagnoses increased from 23% to 45%, and secondary infections decreased from 45% to 26% (Chow et al., 2017). Venegas et al.'s assessment of an enhanced screening algorithm's effect on clinic workflow and its ability to automatically identify patients at risk for syphilis found that of the 4,806 tests triggered, 122 resulted positive (2.5% seropositivity rate). After reflexing to confirmatory testing, 59 of those screening tests were confirmed positive for incident syphilis infection (Venegas et al., 2020).

### ***Discussion***

The intention of this scoping review of reviews was to summarize and synthesize two research areas. By compiling both the behavioral theory and syphilis screening literature, we hope to provide a foundation and justification for applying behavioral cognitive theories to the study of clinicians' intention to screen MSM for syphilis infection in compliance with clinical guidelines. It has been well established that there exists a gap between research evidence and the implementation of research findings into clinical practice. As past reviews have demonstrated, and our review affirms, some of this gap between evidence and practice can be explained by cognitive mechanisms underlying clinical decision-making. There is a tendency to view healthcare professionals as perfectly objective rational actors, whose clinical decision making is based on neutral criteria and is immune to dispositional, attitudinal and belief states and subjective norms. However, this is not the case, as evidence from these reviews demonstrates. The inability for healthcare professionals to meet this impossible standard does not represent a shortcoming, it simply necessitates a thorough accounting of the factors that mediate the process

that begins with knowledge and awareness of guidelines, leading to the intention to implement guidelines, and ideally resulting in actual practice behavior.

The question “why don’t physicians follow clinical practice guidelines?” was posed by Cabana and colleagues in their review published in JAMA (Cabana et al., 1999). They identify several distinct factors that inhibit physicians’ use and adherence to guidelines including lack of self-efficacy, lack of positive outcome expectancies, and an inability to overcome the inertia of prior practice. They conclude that a theoretical approach is likely needed to address these varied and multiple factors. This conclusion is supported by the findings of this review.

Neither the problems of clinical guideline adherence nor syphilis infection among MSM are particularly novel or emergent. And yet, our review confirms that no attempt has been made to evaluate whether provider adherence to syphilis screening guidelines can be accounted for using theoretical constructs. Though many of the original studies comprising the reviews contained in this analysis predate the release of the USPSTF’s updated syphilis screening guidelines, they still provide a robust evidence base that clinicians’ behaviors and behavioral intentions are determined largely or in part by social cognitive factors. Our review of reviews identified seven original studies that assessed clinical guideline and recommendation adherence specifically, (Beatty & Beatty, 2004; C. A. Boyle, Henly, & Larson, 2001; C. L. Pessoa-Silva, K. Posfay-Barbe, R. Pfister, S. Touveneau, T. V. Perneger, 2005; Cassista et al., 2014; Foy et al., 2005; Godin et al., 2000; Maue, Segal, Kimberlin, et al., 2004) but none that looked at theoretical constructs as a way to associate behavior with outcomes, indicating a research gap.

The Theory of Planned Behavior was the overwhelmingly preferred model to explain the variance in behavioral intention and actual behavior in studies related to clinician behavior. The proportion of variance accounted for by the TPB ranged from 27%, to 68% among a range of



guidelines measured both by physician self-report and through chart review, where the strength of association was greater when intention and practice behavior were self-reported.(Foy et al., 2005; Maue, Segal, Kimberlin, et al., 2004) This suggests both that the TPB is preferred for predicting clinicians' adherence to guidelines, and that the method used to assess behavioral outcomes, whether objective or subjective, affects the strength of the associations observed. These are important considerations to note in context with the results of the syphilis screening studies presented in this review.

Our review of the syphilis screening literature identified two observational studies that assessed MSM's syphilis screening intervals prior to and following updated clinic guidelines. In both instances, screening frequency increased as measured by lab order and patient chart review. However, neither study provides information on how providers were informed and educated regarding the change in screening guidelines. Additionally, both studies focused on clinical networks that specialize in sexual health and in MSM healthcare in particular. Thus, the extent to which similar guideline implementation would result in comparable screening improvement in non-specialized settings remains an open question. The problem of screening MSM at risk for syphilis at recommended frequencies is more than just a guideline implementation issue, however. Screening for disease is a clinical behavior in and of itself, and one that intuitively varies according to providers' social and cognitive orientation towards the behavior. Discrete clinical behaviors were the most frequent target of the social behavioral studies identified in the reviews we assessed.

Again, the most consistently used theory was the TPB. A defining feature of the TPB is its estimation of individuals' perceived behavioral control. This was revealed to be a highly influential factor in many of the studies describing clinicians' practice behavior. One example of

this was described by Millstein, who sought to compare the TRA and TPB's utility in predicting physicians' intention to educate adolescents about STIs (Millstein, 1996). She found that the addition of perceived behavioral control through the application of the TPB was a significant improvement over the TRA in predicting this behavioral outcome. Perceived behavioral control is a concept that has logical application to the question of why healthcare providers do and do not screen MSM for syphilis at recommended frequencies. Ajzen defines perceived behavioral control simply as the perceived ease or difficulty of performing an action (Ajzen, 2002). This could apply to several discrete behaviors involved in the larger decision to screen MSM for syphilis, including conducting a sexual history with patients, ordering the correct laboratory procedures, correctly interpreting laboratory results, and providing correct and effective treatment. Taking a sexual history has been specifically noted as a barrier to physicians conducting STI screening, as Barbee et al. discovered in their survey of providers treating HIV-positive MSM (Barbee et al., 2015). Their findings demonstrate that a range of behaviors, that are likely subject to control beliefs, may inhibit provider engagement in STI screening. In addition to sexual history taking, these behaviors included convincing patients to undergo screening, identifying the proper treatment, and comfort with performing a genital exam. The interventions comprising our literature review tended to forgo addressing these practice level factors. Instead, the syphilis screening interventions that we identified were most often designed around some innovation either in medical record keeping, or in delegating responsibility to individuals with specialized training. This lack of attention to behavioral or social-cognitive beliefs is a gap in research.

Regarding technology-based interventions, our review of the behavioral literature shows that theory has been effectively used to predict their uptake and use as well. Among the six

studies that were identified as having technology use or acceptance as their main outcome, theories such as the technology acceptance model and the theory of intentional behavior were commonly used. Application of these theories demonstrate that several cognitive factors, such as the perceived usefulness of technology, significantly predicted uptake in many instances.(Chau & Hu, 2001; Croteau & Vieru, 2002; Hebert & Benbasat, 1994) Our review of the screening intervention literature identified two studies of EMR-based innovations to improve both screening and follow-up care for syphilis. In both instances, the technology-based interventions resulted in significant improvements (Bissessor et al., 2011a; Hotton, Gratzner, Pohl, & Mehta, 2011). However, whether or not EMR-based provider interventions produce durable change in practice behavior remains uncertain. The declining efficacy of EMR alerts over time, a phenomenon known as “click fatigue” has been well documented (Collier, 2018; Embi & Leonard, 2012). Though it stands to reason that efforts to attend to physicians’ beliefs and attitudes towards these EMR interventions, such as their perceived ease of use and usefulness, may only support their efficacy and therefore provides another opportunity to apply behavioral theory.

Interventions that are designed around delegating responsibilities to a specialist may also present opportunities for enhancement through the application of theory. Notably, the original studies extracted from the theory literature include a wide cross-section of providers of different types and specialties. In instances where more than one provider type was included, either in terms of specialty or training level, significant differences were observed, indicating that providers’ role, training and specialty are associated with the cognitive and behavioral dimensions of their clinical practice(M. P. Gagnon et al., 2006; Gaither et al., 1996; Caroline Limbert & Lamb, 2002). Role confusion among providers may be particularly relevant to the

issue of syphilis screening among MSM. As a result of the increasingly specialized care that is provided to MSM both at risk for and living with HIV, the delivery of said care is often complicated by a phenomenon referred to as the *purview paradox*. The term is used primarily to describe the confusion among providers as to whose responsibility it is to prescribe HIV pre-exposure prophylaxis (PrEP) to MSM patients (Hoffman et al., 2016; Lee & Petersen, 2018). However, this same uncertainty may affect the provision of syphilis screening to MSM, especially when considering increasing specialization and “silo”-ing of sexual health services. The two studies included in our syphilis intervention review that described delegating some aspect of syphilis screening to a specialist found that screening significantly increased as a result. (Hotton, Gratzner, Pohl, & Mehta, 2011; Snow et al., 2013) However, the extent to which these successes observed in a single clinic can be emulated or reproduced at scale is not clear.

### ***Limitations***

This review of reviews has several limitations that must be noted. First, the fact that the initial search strategy was limited to review articles likely resulted in studies that were not included in those original reviews being excluded. With regard to the syphilis screening literature, this was addressed through hand searching, which resulted in additional records being included. The theory literature review search, though affected by this limitation, still produced a large quantity of original studies. Second, only articles available in English were included. Third, meta-analytical data that may have been presented in the original review articles was not included as part of this scoping review of reviews. This was deliberate in order to focus the discussion of these two fields of inquiry on areas where greater synthesis could be achieved; namely, their target populations, methodologies, and theoretical foundations.

## **Conclusion**

Overall, several promising intervention modalities have been piloted to increase syphilis screening among high-risk MSM, though much work remains to be done. Syphilis infection represents an immediate and serious threat to the health of MSM, and one that requires prompt and sustainable changes to the way healthcare is delivered to this population. However, expediency toward this goal should not be at the expense of sound and theoretically supported methods, especially those that have been specifically developed to account for healthcare providers' clinical behavior. Developing provider-based interventions that are firmly grounded in established behavioral theories is one possible way to ensure that programs aimed to increase screening are effective and sustainable. This review and synthesis represents a first step towards that ultimate goal.

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## CHAPTER 3: MANUSCRIPT 2

### *Use of Behavioral Theory to Explain Providers' Intention and Behavior to Screen MSM Patients for Syphilis Infection*

Background: Men who have sex with men (MSM) experience a disproportionate burden of syphilis cases in the United States. Guidelines for screening MSM deemed to be at high risk for syphilis infection are inconsistent and provider adherence to these guidelines has been revealed to be suboptimal. Despite this, studies have consistently indicated that a three month screening interval provides superior detection, particularly for asymptomatic syphilis cases. In order to identify opportunities to increase provider compliance with this recommended screening practice, a theory-driven assessment of providers' internal and external motivational factors and potential external constraining factors is likely needed. To this end, a survey based on the principles of the Theory of Planned Behavior (TPB) was administered to a national sample of healthcare providers who provide clinical services to MSM patients.

Method: An online survey was developed to ascertain providers' attitudes, social norms, perceived behavioral control and intentions to screen MSM patients at risk for syphilis infection in accordance with the principles of the TPB. In addition, providers' knowledge of syphilis and other constraining variables that may inhibit syphilis screening in this population were assessed. The survey was distributed both passively and actively through social media and online interest groups, as well as through direct email and provider LISTERVs. Variables comprising the TPB, provider knowledge, and control variables were first subjected to descriptive analyses to evaluate the distribution across factors of interest. Associations between these factors and both intention to screen -assessed through a series of brief case vignettes- and self-reported screening behavior -assessed as the percentage of MSM patients actually screened following recommendation- were conducted through the use of independent samples T-Test.



Results: Survey responses were submitted by 167 individuals, 74% of which were complete (N=123). Respondents were mostly female (70.7%), White/Caucasian (78.9%), practiced in academic (42.3%) and public hospital (20.3%) settings. Most identified Infectious Disease (41.5%) and Family Medicine (17.9%) as their medical specialty. The median knowledge score for the total sample was 3 out of possible 6. In the final analysis, attitudes, social norms, control beliefs, and behavioral control were associated to varying degrees with intention to screen MSM patients for syphilis infection at recommended 3 month intervals. Additionally, attitudes, social norms, and control beliefs were all associated with self-reported screening behavior.

Conclusion: Results from this survey provide evidence that TPB variables are associated with both providers' intention to screen MSM at risk for syphilis and their actual screening behavior. Further, the finding that attitudes, social norms, control beliefs and behavioral control vary according to patient-provider factors suggests that recommendations that are intended to be universally applied to all at-risk MSM are not being applied by all providers. This provides additional justification and rationale for further study of the provider-level behavioral factors that may be addressed in an effort to increase compliance with screening guidelines and ultimately reduce syphilis prevalence in this population.

### ***Background***

Screening for syphilis infection is an important control measure and one that has been identified as vital for reducing syphilis prevalence among men who have sex with men (MSM), as results from both mathematical modeling studies and cost-effectiveness analysis have suggested (Chesson et al., 2016; Tuite et al., 2013). MSM are a population that is disproportionately affected by syphilis, accounting for 53.5% of all primary and secondary syphilis cases in the US in 2018, and are thus considered to be a population at elevated risk

(Centers for Disease Control and Prevention, 2019b). Consistently, an increased screening frequency among populations known to be at elevated risk has been shown to result in increased detection, particularly of asymptomatic syphilis cases, which may function as an infection reservoir not amenable to syndromic surveillance. The United States Preventive Services Task Force (USPSTF) has stipulated in its guidelines that a 3 month screening interval in populations known to be at high risk, such as MSM and people living with HIV (PLWHIV), provides superior benefit for both detecting cases and reducing transmission of syphilis (US Preventive Services Task Force, 2016). Despite this, healthcare providers may be exposed to contradictory guidelines, such as from the Centers for Disease Control and Prevention (CDC), whose recommendations state that MSM who are sexually active be screened at least annually, with the proviso that those who are at “increased risk” be screened at 3-6 month intervals (kimberly A. Workowski & Bolan, 2015). Independent of the potential confusion surrounding guidelines, providers themselves may be disinclined to screen MSM for syphilis at recommended intervals for a range of attitudinal, social, behavioral and practical reasons that have not been investigated.

The use of behavioral theory may provide critical insight into the underlying factors that predispose providers to screen their MSM patients for syphilis infection at frequencies that offer the maximum benefit. One such theory that has been used in similar studies of provider behavior (Eccles et al., 2007, 2006; Godin et al., 2008) is the Theory of Planned Behavior (TPB) (Ajzen, 1991). The TPB is comprised of four main components: attitudes, perceived behavioral control, social norms, and intention. As previous studies have demonstrated, these factors may influence providers’ clinical behaviors in multiple ways. Attitudes may encompass a range of dispositional and belief states that lead to either negative or positive evaluations of the behavior in question (Gurses et al., 2010). Social or subjective norms may include the perceived expectations of

important social or professional referents to perform a behavior or not (Rich, Medisauskaite, Potts, & Griffin, 2020). Perceived behavioral control may account for both the subjective appraisal of one's confidence and capacity to carry out a behavior, as well as an estimation of the level of autonomy one possesses. Each of these factors may contribute to an individual's intention to perform a behavior, which is simply a positive or negative orientation to its actual enactment. All of the factors described by the TPB are theorized to function in aggregate and result in behavior either occurring or not occurring. As applied to the behavior of syphilis screening, these components may reflect a provider's attitudes towards the perceived benefit of syphilis screening, its importance, and its perceived ease or difficulty (Ajzen, 1991). Perceived behavioral control may include beliefs about their own ability to carry out tasks related to syphilis screening, such as taking a sexual history, as well as the perceived constraints imposed by logistical concerns such as lack of time or resources. Social norms in this instance may include the perceived importance placed on syphilis screening by different social and professional referents, such as healthcare colleagues, professional organizations, and patients themselves.

The main research question this study sought to address was whether or not the theoretical constructs of the TPB would be associated with providers' self-reported syphilis screening intentions and behavior. Studying TPB in this context could provide important understanding of providers' syphilis screening behavior, and ultimately allowing for the prediction of provider compliance with screening recommendations. In addition, understanding how these factors vary among health care providers engaged in screening MSM for syphilis infection can lead to targeted interventions aimed at those factors related to behavior, significantly affecting syphilis rates in the United States.

## ***Methods***

Between September 2020 and February 2021, an online survey was distributed to healthcare providers who could order syphilis screening (MDs, DOs, nurse practitioners, physician assistants) nationwide. The survey was distributed through both passive and active means. Active recruitment was done primarily through the use of a proprietary email list that included names and emails of approximately 3,000 practicing US physicians, nurses and physician assistants. Additionally, academic and institutional LISTSERVS that included providers were used for distribution. Passive recruitment was carried out through online posts on both social media and closed interest groups catering to a range of healthcare professionals. Incentive was provided in the form of an optional raffle for one of five \$100 e-gift cards. To enter the raffle, participants voluntarily provided a preferred email address at the conclusion of the survey.

## ***Participants***

In total, 123 completed surveys were extracted from 167 submitted responses (74% complete). The 44 excluded surveys contained missing data that would have precluded use in analysis. To be eligible to participate, providers had to be currently practicing in the United States, be at least 18 years of age or older, report seeing MSM patients currently or in the past, and identify sexual health services (such as screening for gonorrhea, chlamydia, syphilis, HIV, or screening for HPV related cancers, etc.) to fall within the scope of services they provide. The study protocol was approved by the Temple University Institutional Review Board (# 27339).

## *Measures*

The Theory of Planned Behavior was used to develop the survey items comprising the main TPB variables of attitudes, social norms and perceived behavioral control. For the purpose of this study, attitudes were broken down between general syphilis screening attitudes and attitudes specific to screening for syphilis in MSM patients. Similarly, perceived behavioral control was divided between control beliefs and behavioral control, which distinguished between individuals' perception of their ability to carry out activities related to syphilis screening from logistical barriers that may constrain one's ability to carry out those activities. Social norms were assessed via items that addressed various social and professional referents and their perceived sense of importance to screen MSM patients for syphilis.

All TPB items were measured using bi-polar, 7-point Likert scales with labels ranging from Strongly Disagree to Strongly Agree for attitude and social norm items, Not At All Confident to Completely Confident for control belief items, and Not At All a Factor to Definitely a Factor for behavioral control items. The following is a more detailed summary of each item block.

**Attitudes (general):** Comprised six items assessing the perceived effectiveness, importance, benefit and difficulty of syphilis screening in general ( $\alpha=.460$ ).

**Attitudes (MSM):** Comprised six items assessing similar dimensions of effectiveness, importance etc., but specifically among MSM patients, including MSM living with HIV and MSM taking Pre-Exposure Prophylaxis (PrEP) for HIV prevention ( $\alpha=.508$ ).

**Social Norms:** Comprised five items assessing the perceived importance placed on syphilis testing by social and professional referents including healthcare provider peers and MSM

patients themselves, as well as the extent to which providers' individual practices and professional organizations are perceived to have clear guidelines regarding how frequently to screen MSM patients for syphilis ( $\alpha=.653$ ).

**Control Beliefs:** Comprised four items assessing the level of confidence to engage in behaviors associated with syphilis screening including conducting a sexual history, interpreting results and providing treatment ( $\alpha=.835$ ).

**Behavioral Control:** Comprised four items assessing the extent to which logistical concerns may negatively impact one's ability to engage in syphilis testing, including lack of time, lack of training and lack of support from clinical staff ( $\alpha=.843$ ).

In addition to these items blocks, syphilis knowledge was assessed by six true or false items extracted from a previously used survey (Bonnewell et al., 2020) and covered a range of domains including epidemiology, disease course, screening considerations and treatment. These were assessed individually as well as in sum with sum scores ranging from 0-6 to reflect the number of correct responses.

The main outcomes assessed on this survey were intention to screen MSM for syphilis infection and self-reported screening behavior. Intention to screen was assessed through the use of five brief case vignettes, a methodology that has been used previously to assess healthcare provider intentions (Jui-ying Feng & Wu, 2005; Rashidian & Russell, 2012), each corresponding to a patient for whom increased syphilis screening would be indicated according to USPSTF recommendations. These included: (1) an MSM patient who is HIV negative and taking PrEP; (2) an MSM patient who is HIV negative and not taking PrEP who has a history of gonorrhea or chlamydia infection; (3) an MSM patient who is HIV positive and has one main sexual partner;

(4) and MSM patient who is HIV positive who has a history of gonorrhea and chlamydia and one main sexual partner; and, (5) an MSM patient who is HIV positive and has multiple sexual partners and no other STI history. For each vignette, participants were asked to suggest a screening frequency of either: (1) more frequently than once every three months; (2) once every three months; (3) once every six months; (4) once every year; and (5) less frequently than annually. Self-reported screening behavior was assessed via two items. First, participants were asked to estimate how many of their last 10 MSM patients in the last year were recommended to undergo syphilis screening with possible responses ranging from 0 to 10 or *I have not seen 10 MSM patients in the last year*. As a follow-up to this question, participants were asked how many of those patients recommended to undergo syphilis screening were actually screened. Combining these items produced a behavioral outcome variable indicating those providers for whom 100% of their MSM patients who were recommended to undergo screening were actually screened and those providers for whom less than 100% of their MSM patients received screening.

Finally, a range of demographics were assessed that included practice setting (private hospital, public hospital, academic, specialty care, etc.), provider type (primary care physician, specialist physician, nurse practitioner, physician assistant, etc.), medical specialty (family medicine, infectious disease, internal medicine, etc.), number of years post-residency/training, US region, gender, sexual orientation, and race/ethnicity.

### ***Analytic Plan***

All survey items comprising TPB variables, knowledge, intention, self-reported screening behavior and participant demographics were subjected to descriptive analysis to obtain the frequencies and distribution of responses. Sum scores were then computed for Attitudes (general), Attitudes (MSM), Social Norms, Control Beliefs, Behavioral Control, and knowledge.

Items that were negatively framed were reverse coded prior to computing sums. Knowledge items were individually scored as 0 and 1, with 1 indicating correct response. This produced a knowledge sum score with a range of 0-6. The vignette items used to assess screening intention were dichotomized, differentiating between recommended screening at three month intervals or more frequent and six month intervals or less frequent. Mean scores of Attitudes (general), Attitudes (MSM), Social Norms, Control Beliefs, Behavioral Control and knowledge were then compared using independent samples T-Tests with each dichotomized intention variable assigned as the grouping variable. Finally, self-reported screening behavior was assessed two ways. First, the item asking providers to estimate how many of their last 10 MSM patients in the past year were recommended to undergo syphilis screening was dichotomized as 10, less than 10, and those who had not seen 10 MSM patients in the past year. Second, of those who recommended syphilis screening to their MSM patients, a follow-up item was presented asking how many of those patients who were recommended to undergo screening were actually screened. This produced a difference score which was used to compute a dichotomous item for those who had 100% of their MSM patients screened and those who had less than 100% of their MSM patients screened. Similar to intention, independent samples T-Tests and one-way ANOVA were used to compare means of Attitudes (general), Attitudes (MSM), Social Norms, Control Beliefs, Behavioral Control, and knowledge using these categorical self-reported behavior variables. All analyses were conducted using SPSS v.26 (IBM Corp, 2019)

## ***Results***

Sample demographics are displayed in Table 5. Most providers listed their practice setting as academic (42.3%), with specialty care clinics (e.g., HIV, LGBTQ, etc.) (35.8%), public hospitals (20.3%), and public non-profit agencies/primary care clinics (20.3%) following



as common settings. Most identified their profession as primary care physician (35%), with specialist physician (28.5%), nurse practitioner (13.8%), and physician assistant (13.0%) as the next most commonly reported. Of those clinicians who identified as having a medical specialty, 41.5% identified as infectious disease specialists and 17.9% as family medicine specialists, which other specialties reported with approximately the same frequency including sexual health (5.7%), HIV (4.1%) and Other (5.7%), which included specialists in addiction medicine, anorectal surgery, cancer control and emergency medicine. Most had less than 10 years of post-residency experience (48%), followed by 10-20 years (26.8%) and more than 20 years (18.7%). Three respondents (2.4%) reported still being in residency. The majority of respondents were located in the Northeastern United States (73.2%), followed by the Southwest (8.9%), Southeast (8.1%) and West (4.9%). The majority identified as female (70.7%) and heterosexual/straight (74%). Most identified their race as White/Caucasian (78.9%), followed by Asian or Pacific Islander (9.8%), Black/African American (4.1%), and Hispanic/Latinx (2.4%).

<b>Table 5. Sample Demographics</b>	
<b>Variable</b>	<b>N (%)</b>
<b>Practice Setting</b>	
Hospital (Private)	10 (8.1)
Hospital (Public)	25 (20.3)
Group Practice	17 (13.8)
Individual Practice	1 (0.8)
Academic	52 (42.3)
Private Agency/Primary Care/Clinic	12 (9.8)
Specialty Care (e.g., HIV, LGBT)	44 (35.8)
Public Non-Profit Agency/Primary Care/Clinic	25 (20.3)
<b>Clinician Type</b>	
Nurse Practitioner	17 (13.8)
Primary Care Physician	43 (35.0)
Specialist Physician	35 (28.5)
Resident or Fellow (Physician)	6 (4.9)
Physician Assistant	16 (13.0)
Other	3 (2.4)
<b>Specialty N=102</b>	
Family Medicine	22 (17.9)
Gynecology	1 (0.8)

<b>Table 5. Sample Demographics (codd.)</b>	
HIV	5 (4.1)
Infectious Disease	51 (41.5)
Internal Medicine	4 (3.3)
Pediatrics	3 (2.4)
Sexual Health	7 (5.7)
Urgent Care	2 (1.6)
Other (Addiction Medicine, Anorectal Surgery, Cancer Control, Critical Care, Emergency Medicine)	7 (5.7)
<b>Years Post-Residency/Training</b>	
Less than 10 years	59 (48.0)
10-20 years	33 (26.8)
More than 20 years	23 (18.7)
Still in residency or training	3 (2.4)
Missing	5 (4.1)
<b>Region</b>	
Midwest	3 (2.4)
Northeast	90 (73.2)
Southeast	10 (8.1)
Southwest	11 (8.9)
West	6 (4.9)
<b>Gender</b>	
Female	87 (70.7)
Male	30 (24.4)
Genderqueer/Gender Non-Binary	1 (0.8)
<b>Sexual Orientation</b>	
Heterosexual/Straight	91 (74)
Gay	11 (8.9)
Lesbian	4 (3.3)
Bisexual	10 (8.1)
Other (Queer)	2 (1.6)
<b>Race/Ethnicity</b>	
Hispanic/Latinx	3 (2.4)
White	97 (78.9)
Black/African American	5 (4.1)
Asian or Pacific Islander	12 (9.8)
Multiracial	1 (0.8)
Other (Arab/Middle Eastern)	3 (2.4)
Missing	5 (4.1)

Tables 6 and 7 report the distributions across all TPB variable items, as well as knowledge items and each intention item vignette. Syphilis knowledge was low, with nearly half of all respondents answering incorrectly for most knowledge items and a mean knowledge score of 3.4 (SD= 1.2, range: 1-6). Screening intention varied according to patient variables contained

in the case vignettes. Three-month screening intervals were the majority recommendation for all but one case vignette, an MSM patient who is HIV positive and has one main sexual partner, for which the plurality recommended annual screening (Table 8).

In bivariable analysis (Table 9), decision to screen an MSM patient who is HIV negative and taking PrEP at three month intervals or less was associated with higher means of Attitudes (general) ( $t(121) = -2.30, p = .028$ ), Attitudes (MSM) ( $t(121) = -2.38, p = .019$ ), Social Norms ( $t(121) = -2.32, p = .022$ ), Control Beliefs ( $t(121) = -2.34, p = .021$ ) and Behavioral Control ( $t(121) = -2.27, p = .025$ ). Screening intervals of three months or less for an HIV negative MSM patient who is not taking PrEP and who has a history of gonorrhea or chlamydia was associated with higher means on Attitudes (MSM) ( $t(121) = -2.04, p = .043$ ), Social Norms ( $t(121) = -2.28, p = .025$ ), and Behavioral Control ( $t(121) = -2.78, p = .008$ ). No mean differences were observed for an MSM patient who is HIV positive and has one main sexual partner. Screening intervals of three months or less for an MSM patient who is HIV positive with a history of gonorrhea or chlamydia and one main sexual partner was associated with higher mean Behavioral Control ( $t(121) = -3.28, p = .002$ ) as was screening an MSM patient who is HIV positive with multiple sex partners and no other STI history ( $t(121) = -3.10, p = .002$ ).

Following the same procedure, mean differences between providers who recommended syphilis screening to all 10 of their last MSM patients was compared to those who did not recommend screening to all 10 or had not seen 10 MSM patients in the last year. Recommending screening to all 10 MSM patients was associated with higher mean Attitudes (general) ( $t(121) = -2.88, p = .005$ ), Attitudes (MSM) ( $t(121) = -2.70, p = .008$ ), Social Norms ( $t(121) = -2.65, p = .009$ ), Control Beliefs ( $t(121) = -4.38, p < .001$ ), and Behavioral Control ( $t(121) = -1.99, p = .049$ ). Lastly, differences between providers who reported 100% of their MSM patients who were

recommended screening actually received screening and those who reported less than 100% were also assessed. Reporting 100% of patients screened was associated with higher mean Attitudes (general) ( $t(109) = -2.99, p = .003$ ), Attitudes (MSM) ( $t(109) = -2.25, p = .026$ ), Social Norms ( $t(109) = -2.55, p = .012$ ), and Control Beliefs ( $t(109) = -2.72, p = .008$ ).

<b>Knowledge Item</b>	<b>Correct Response</b>	<b>True N (%)</b>	<b>False N (%)</b>
The number of annual cases of primary and secondary syphilis in the United States has remained stable over the last 15 years	<b>False</b>	4 (3.3)	119 (96.7)
Gay, bisexual, and other men who have sex with men account for approximately half of all new primary and secondary syphilis cases in the United States each year.	<b>False</b>	95 (77.2)	28 (22.8)
The median time from transmission to onset of symptoms of primary syphilis is one week.	<b>False</b>	52 (42.3)	71 (57.7)
Without treatment, half of people infected with syphilis will develop tertiary disease.	<b>False</b>	58 (47.2)	65 (52.8)
Non-treponemal tests remain elevated through all stages of syphilis (e.g. RPR, VDRL).	<b>False</b>	56 (45.5)	67 (54.5)
Secondary syphilis is treated with intramuscular Benzathine penicillin G for three doses at weekly intervals.	<b>False</b>	53 (43.1)	70 (56.9)

<b>Table 7. Theory of Planned Behavior Item Descriptive Summary</b>							
	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Somewhat Disagree</b>	<b>Neither Agree nor Disagree</b>	<b>Somewhat Agree</b>	<b>Agree</b>	<b>Strongly Agree</b>
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>	<b>(7)</b>
<b>Item</b>	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>
<b>Attitudes (General)</b>							
Routine screening for syphilis is effective at preventing new infections	1 (0.8)	3 (2.4)	1 (0.8)	7 (5.7)	12 (9.8)	26 (21.1)	73 (59.3)
*I only order syphilis screening if requested by a patient	71 (57.7)	29 (23.6)	8 (6.5)	3 (2.4)	1 (0.8)	2 (1.6)	9 (7.3)
Screening for syphilis more frequently is an effective way to detect asymptomatic cases	1 (0.8)	1 (0.8)	1 (.08)	2 (1.6)	14 (11.4)	33 (26.8)	71 (57.7)
*There are risks associated with syphilis screening that should be considered	15 (12.2)	26 (21.2)	22 (17.9)	19 (15.4)	24 (19.5)	15 (12.2)	2 (1.6)
Screening patients for syphilis is easy	0 (0)	1 (0.8)	6 (4.9)	2 (1.6)	10 (8.1)	41 (33.3)	63 (51.2)
Syphilis infection is a serious condition that can lead to disability or death	0 (0)	1 (0.8)	0 (0)	0 (0)	4 (3.3)	21 (17.1)	96 (78.0)
<b>Attitudes (MSM)</b>							
Screening for syphilis infection in all MSM patients should be a top priority	0 (0)	0 (0)	3 (2.4)	7 (5.7)	8 (6.5)	34 (27.6)	71 (57.7)
*There is little benefit to screening MSM patients for syphilis more frequently	58 (47.2)	47 (38.2)	9 (7.3)	8 (6.5)	1 (0.8)	0 (0)	0 (0)
MSM who are also living with HIV are not screened for syphilis as frequently as they should	1 (0.8)	7 (5.7)	6 (4.9)	31 (25.2)	25 (20.3)	37 (30.1)	16 (13.0)
MSM who are taking PrEP for HIV prevention are not screened for syphilis as frequently as they should	2 (1.6)	21 (17.1)	9 (7.3)	32 (26.0)	20 (16.3)	28 (22.8)	11 (8.9)
*MSM are likely to refuse syphilis screening	50 (40.7)	52 (42.3)	6 (4.9)	11 (8.9)	3 (2.4)	1 (0.8)	0 (0)
MSM are well informed about the potential harms associated with syphilis infection	5 (4.1)	37 (30.1)	29 (23.6)	24 (19.5)	20 (16.3)	5 (4.1)	3 (2.4)
<b>Social Norms</b>							
My MSM patients think it is important for me to screen them for syphilis infection regularly	0 (0)	2 (1.6)	5 (4.1)	23 (18.7)	32 (26.0)	38 (30.9)	23 (18.7)

<b>Table 7. Theory of Planned Behavior Item Descriptive Summary (continued)</b>							
My healthcare provider peers think it is important that I screen my MSM patients for syphilis regularly	0 (0)	3 (2.4)	1 (0.8)	16 (13.0)	13 (10.6)	48 (39.0)	42 (34.1)
My profession has clear guidelines for how frequently to screen MSM patients for syphilis	1 (0.8)	5 (4.1)	14 (11.4)	9 (7.3)	24 (19.5)	46 (37.4)	24 (19.5)
My medical practice has clear guidelines for how frequently to screen MSM patients for syphilis	2 (1.6)	11 (8.9)	14 (11.4)	9 (7.3)	15 (12.2)	40 (23.5)	32 (26.0)
<b>Control Beliefs</b>	<b>Not at all Confident</b>	<b>Very Unconfident</b>	<b>Somewhat Un-Confident</b>	<b>Unsure</b>	<b>Somewhat Confident</b>	<b>Very Confident</b>	<b>Completely Confident</b>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
How confident are you in your ability to conduct a sexual history with your MSM patients?	0 (0)	0 (0)	7 (5.7)	2 (1.6)	19 (15.4)	46 (37.4)	49 (39.8)
How confident are you in your ability to order syphilis screening for your MSM patients?	0 (0)	0 (0)	0 (0)	0 (0)	7 (5.7)	30 (24.4)	86 (69.9)
How confident are you in your ability to interpret syphilis screening results?	0 (0)	0 (0)	2 (1.6)	1 (0.8)	19 (15.4)	49 (39.8)	52 (42.3)
How confident are you in your ability to provide treatment for patients who screen positive for syphilis?	0 (0)	1 (0.8)	1 (0.8)	2 (1.6)	15 (12.2)	45 (36.6)	59 (48.0)
<b>Behavioral Control</b>	<b>Not at all a factor</b>			<b>Neutral/ Unsure</b>			<b>Definitely a factor</b>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
*Not enough time	52 (42.3)	21 (17.1)	14 (11.4)	10 (8.1)	16 (13.0)	4 (3.3)	6 (4.9)
*Not enough training	74 (60.2)	21 (17.1)	11 (8.9)	7 (5.7)	5 (4.1)	3 (2.4)	2 (1.6)
*Not enough resources	66 (53.7)	22 (17.9)	13 (10.6)	6 (4.9)	9 (7.3)	3 (2.4)	4 (3.3)
*Not enough support from clinical staff	60 (48.8)	20 (16.3)	14 (11.4)	14 (11.4)	10 (8.1)	4 (3.3)	1 (0.8)

\* Item was reverse-coded when computing sum scores

<b>Table 8. Distribution of screening recommendations for case vignettes</b>					
<b>What would you recommend as a syphilis screening frequency for the following patients if they were to present in your practice:</b>	<b>More frequently than once every three months (1) N (%)</b>	<b>Once every three months (2) N (%)</b>	<b>Once every six months (3) N (%)</b>	<b>Annually (once every year) (4) N (%)</b>	<b>Less frequently than annually (5) N (%)</b>
An MSM patient who is HIV negative and taking PrEP	0 (0)	95 (77.2)	17 (13.8)	10 (8.1)	1 (0.8)
An MSM patient who is HIV negative and <u>not</u> taking PrEP who has a history of gonorrhea or chlamydia.	13 (10.6)	81 (65.9)	18 (14.6)	9 (7.3)	2 (1.6)
An MSM patient who is HIV positive and has one main sexual partner	0 (0)	37 (30.1)	35 (28.5)	49 (39.8)	2 (1.6)
An MSM patient who is HIV positive who has a history of gonorrhea and chlamydia and one main sexual partner	5 (4.1)	67 (54.5)	27 (22.0)	22 (17.9)	2 (1.6)
An MSM patient who is HIV positive and has multiple sexual partners and no other STI history	26 (21.2)	83 (67.5)	7 (5.7)	6 (4.9)	1 (0.8)

	An MSM patient who is HIV negative and taking PrEP		An MSM patient who is HIV negative and not taking PrEP who has a history of gonorrhea or chlamydia.		An MSM patient who is HIV positive and has one main sexual partner		An MSM patient who is HIV positive who has a history of gonorrhea and chlamydia and one main sexual partner		An MSM patient who is HIV positive and has multiple sexual partners and no other STI history	
	≤ 3 mo (N=95)	> 3 mo (N=28)	≤ 3 mo (N=94)	> 3 mo (N=29)	≤ 3 mo (N=37)	> 3 mo (N=86)	≤ 3 mo (N=72)	> 3 mo (N=51)	≤ 3 mo (N=109)	> 3 mo (N=14)
<b>Variable</b>	<b>M (SD)</b>	<b>M (SD)</b>	<b>M (SD)</b>	<b>M (SD)</b>	<b>M (SD)</b>	<b>M (SD)</b>	<b>M (SD)</b>	<b>M (SD)</b>	<b>M (SD)</b>	<b>M (SD)</b>
Knowledge (range:1-6)	3.4 (1.3)	3.4 (1.0)	3.4 (1.2)	3.3 (1.3)	3.4 (1.4)	3.4 (1.1)	3.4 (1.3)	3.4 (1.2)	3.4 (1.3)	3.4 (1.1)
Attitudes General (range:21-42)	<b>36.5 (3.5)</b>	<b>34.0 (5.4)</b>	36.4 (3.5)	34.3 (5.5)	35.5 (3.7)	36.1 (4.3)	36.1 (3.7)	35.7 (4.7)	36.2 (4.0)	34.1 (4.6)
Attitudes MSM (range:22-42)	<b>31.9 (4.0)</b>	<b>29.9 (3.9)</b>	<b>31.8 (3.9)</b>	<b>30.1 (4.2)</b>	31.9 (3.6)	31.2 (4.2)	31.8 (3.8)	30.9 (4.4)	31.4 (4.1)	31.5 (3.3)
Social Norms (range:9-28)	<b>22.2 (4.0)</b>	<b>20.3 (3.5)</b>	<b>22.2 (2.7)</b>	<b>20.3 (4.2)</b>	22.5 (3.5)	21.4 (4.1)	21.9 (4.0)	21.6 (3.9)	21.8 (3.9)	21.2 (4.6)
Control Beliefs (range:4-28)	<b>25.5 (2.6)</b>	<b>24.1 (3.3)</b>	25.4 (2.7)	24.4 (3.0)	25.6 (2.9)	25.0 (2.8)	25.3 (2.8)	24.9 (2.9)	25.2 (2.9)	24.6 (2.4)
Behavioral Control (range:14-28)	<b>23.7 (5.0)</b>	<b>21.0 (6.2)</b>	<b>23.9 (4.8)</b>	<b>20.3 (6.4)</b>	24.2 (5.2)	22.6 (5.4)	<b>24.4 (4.4)</b>	<b>21.2 (6.0)</b>	<b>23.6 (5.0)</b>	<b>19.0 (6.7)</b>

	Thinking back to your last 10 MSM patients, how many did you recommend undergo syphilis screening?				How many of those patients who were recommended syphilis screening were actually screened?	
	<b>10</b> (N=92)	<b>&lt; 10</b> (N=20)	<b>Have not seen 10 MSM patients in the past year</b> (N=11)		<b>100%</b> (N=88)	<b>&lt; 100%</b> (N=24)
<b>Variable</b>	<b>M (SD)</b>	<b>M (SD)</b>	<b>M(SD)</b>	<b>Variable</b>	<b>M (SD)</b>	<b>M (SD)</b>
Knowledge	3.5 (1.3)	3.4 (1.3)	2.8 (1.3)	Knowledge	3.5 (1.3)	3.5 (1.2)
Attitudes General	<b>36.5 (4.1)</b>	<b>34.6 (4.0)</b>	<b>33.3 (5.1)</b>	Attitudes General	<b>36.7 (4.0)</b>	<b>34.0 (3.3)</b>
Attitudes MSM	<b>32.0 (3.8)</b>	<b>30.1 (4.1)</b>	<b>28.1 (4.4)</b>	Attitudes MSM	<b>32.1 (3.9)</b>	<b>30.1 (3.6)</b>
Social Norms	<b>22.3 (3.7)</b>	<b>20.7 (4.7)</b>	<b>19.3 (3.7)</b>	Social Norms	<b>22.5 (3.4)</b>	<b>20.4 (4.4)</b>
Control Beliefs	<b>25.8 (2.4)</b>	<b>24.2 (2.0)</b>	<b>21.9 (4.6)</b>	Control Beliefs	<b>25.8 (2.4)</b>	<b>24.3 (1.9)</b>
Behavioral Control	23.6 (5.4)	21.6 (5.5)	21.2 (5.1)	Behavioral Control	23.6 (5.4)	22.1 (5.1)

Significant ( $P < .05$ ) means differences are **bold**



## *Discussion*

This study is the first of its kind to assess healthcare providers' intention and behavior to screen MSM patients for syphilis at recommended intervals using the Theory of Planned Behavior. While the TPB has seen wide use in assessments of other provider behaviors, such as adhering to hand hygiene practices (Jenner et al., 2010) and providing cardiac patients with a smoking cessation protocol (Bolman et al., 2002), this study represents its first use in assessing provider adherence to syphilis screening recommendations for MSM patients. In addition to results related to provider behavior, several notable findings related to provider knowledge and intention emerged in analysis. First, it is noteworthy that despite an overall sample comprised of a plurality of infectious disease specialists, knowledge of syphilis was low. This supports what has been observed in similar studies (Bonnewell et al., 2020). Particularly relevant to the population that is the focus of this investigation, providers appear to underestimate the prevalence of syphilis among MSM. By far the knowledge item most consistently answered incorrectly on this assessment was with regard to the percent of primary and secondary syphilis (P&S) cases accounted for by gay, bisexual and other men who have sex with men. Approximately 77% of respondents incorrectly believed this population accounts for roughly half of P&S syphilis cases in the US, when in fact the CDC's most recent surveillance data estimates it is in excess of 60% (CDC, 2017). Despite this, knowledge did not vary according to any of the main outcomes reported in this analysis. This could be interpreted multiple ways. Either the knowledge items selected for this survey did not capture enough of the variance in syphilis knowledge broadly construed, or knowledge is not a significant factor for forming an intention to screen MSM for syphilis and screening behavior. This represents an area for further study.

This study provided significant new insight into providers' decision-making around syphilis screening as well. The variability in screening recommendations for the case vignettes presented on this survey provide some indication of providers' syphilis screening intentions that has not been presented elsewhere. The vignettes intentionally represent cases for whom frequent screening would be recommended if following the USPSTF guidelines (US Preventive Services Task Force, 2016). The USPSTF's conclusion is that 3 month screening for all MSM or HIV positive men is associated with increased detection (A. G. Cantor, Pappas, & Monica, 2016). With one exception, this was the most frequently recommended screening interval for the case vignettes presented. The only case vignette that was not recommended a 3-month screening interval by a majority of providers was an MSM patient living with HIV who has one main sexual partner. While the thought process underlying this decision cannot be inferred from the data presented here, it is conceivable that an MSM patient, regardless of HIV status, would be deemed to be at less risk of syphilis infection if reporting only one main sexual partner. This is problematic, however, as it does not account for a main sex partner having multiple sexual partners (non-mutual monogamy) (kimberly A. Workowski & Bolan, 2015). This is detailed in the CDC screening guidelines. Taking a sexual history would hope to accurately capture this risk but has been identified as a barrier for providers in previous studies (Carter et al., 2014). Our results support this, wherein only 40% of providers indicated they were "completely confident" with conducting a sexual history with MSM patients, the lowest among all Control Belief items.

In terms of how TPB variables were associated with differing screening intention and behavior, the differences noted by case vignette were unanticipated and require greater interpretation. Perhaps most surprising were the differences observed between HIV negative and HIV positive case vignettes. For HIV negative MSM both on and off PrEP, attitudes about

syphilis screening appear to be a greater factor when providers determine a screening interval for HIV negative MSM than for MSM who are living with HIV. Similarly, Social Norms, in the form of the perceived views of professional referents, appear to function in a comparable way. Not surprisingly, Behavioral Control was the most consistently significant factor associated with screening intention across case vignettes. This indicates that logistical considerations, such as time and resources, play an important role absent other factors in determining providers' syphilis decisions. However, these factors may be less amenable to intervention as they concern issues such as staffing and clinic workflow. Rather, developing interventions that incorporate factors inherent to the TPB, such as attitudes and perceived behavioral control, may be more achievable, and may result in greater intention to adhere to screening guidelines.

Finally, our analysis also included an examination of self-reported syphilis screening behavior. Both self-reported screening recommendation and self-reported percentage of patients actually screened were found to be significantly associated with TPB variables. In this instance, both general and MSM-specific attitudes, social norms, and control beliefs were significantly associated with recommending screening to MSM patients, as well as actual self-reported screening outcomes. This provides further evidence that Theory of Planned Behavior can be effectively used to determine, and perhaps even predict, provider adherence to syphilis screening guidelines.

These findings are notable, as they provide a potential target for future behavioral interventions intended for healthcare providers. By demonstrating that syphilis screening intention and behavior are associated with beliefs about the importance to screen MSM for syphilis infection, perceived expectations to screen patients more frequently, and confidence in the ability to carry out activities related to screening, this study presents a possible interpretation

for why compliance with screening recommendation has fallen short of its proposed objective. It further refines our understanding of the salient factors involved in syphilis screening intention and behavior by providing evidence that syphilis knowledge was not associated with syphilis screening intention and behavior.

### ***Limitations***

This study does have limitations that must be noted. First, an online sample may not be representative of providers nationwide. While efforts were made to solicit a diverse sample, both geographically and demographically, the respondents to this survey are homogenous in many ways, including gender and race that could negatively impact the external validity of the results. Additionally, small counts of providers of different training and professions precluded comparisons among these dimensions. However, this can be addressed in future studies by including a more diverse sample. This is of particular importance considering the prevalence of syphilis among MSM is highly influenced by geography and including providers from regions in which syphilis is locally endemic to this population, such as the US West and Southeast, will be vital. Second, this data relies on providers' self-report. This may have resulted in responses that were subject to social desirability bias. Self-reported behavior has also been shown to be a somewhat poor proxy for actual behavior, including among healthcare providers (Godin et al., 2008). Future studies should include objective measures of physician behavior, such as electronic medical records or lab orders to address this limitation. Finally, our use of multiple comparisons in bivariate analysis increases the risk of a type I error. No adjustments were made (for example, Bonferroni adjustments for multiple tests) due to the low stakes nature of the analyses and to avoid potential overcorrection (Perneger, 1998).

## **Conclusion**

This study is the first to examine the Theory of Planned Behavior as a means of assessing the variability observed in healthcare providers' syphilis screening intention and behavior. Through its application, several factors derived from the TPB were found to be significantly associated with providers' intention to screen MSM patients at the recommended frequency. This has several implications for designing future interventions targeted to providers in an effort to increase adherence to screening guidelines and ultimately reduce syphilis prevalence and the adverse health consequences associated with syphilis in this population.

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## CHAPTER 4: MANUSCRIPT 3

### *Predicting Healthcare Providers' Syphilis Screening Intention and Behavior Toward MSM Patients: An Application of the Theory of Planned Behavior*

Background: Men who have sex with men (MSM) are a population known to be at increased risk of syphilis infection. As a result, syphilis screening guidelines have identified them as a population that benefits from an increased screening frequency. Despite this, screening frequency in this population remains suboptimal. In an effort to better identify the factors that may contribute to healthcare providers screening MSM patients at recommended frequencies, the use of behavioral theory was evaluated for its ability to predict providers' screening intentions and behaviors.

Method: A survey designed according to the principles of the Theory of Planned Behavior (TPB) was administered to an online sample of 167 physicians, nurses, and other healthcare providers responsible for treating MSM patients. Surveys were completed by 74% (N=123) of respondents. Both exploratory (EFA) and confirmatory factor analysis (CFA) were used to establish and validate the measurement model. Structural equation modeling (SEM) was then used to assess the strength of the relationship between latent variables in the model, including intention to screen MSM at risk for syphilis and self-reported screening behavior.

Results: Results of the EFA and CFA were used to explore and test a four factor model that included attitudes, social norms, perceived behavioral control, and intention. Results from SEM revealed that intention and behavioral control were the strongest predictors of providers' self-reported screening behavior. Additionally, attitudes toward syphilis testing were revealed to be strongly associated with intention to screen. These results support the use of the TPB as an effective model to explain healthcare providers' syphilis screening intentions and behavior



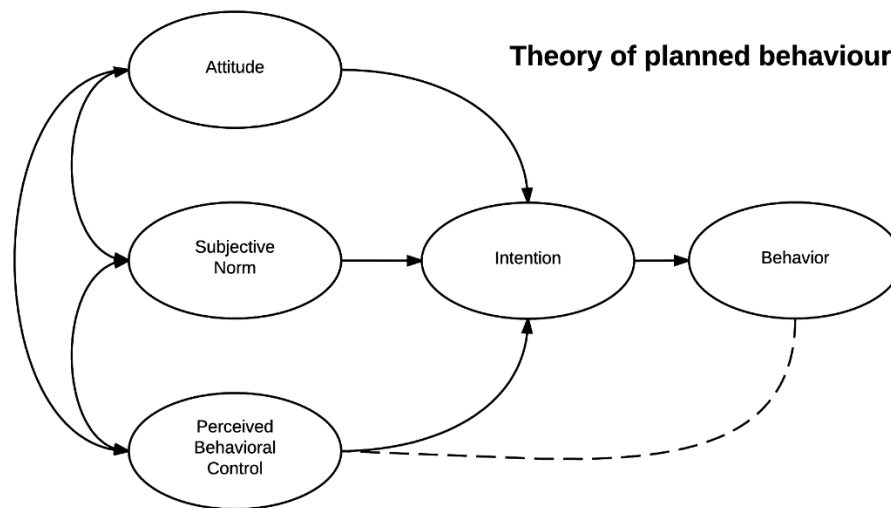
toward MSM patients and reveals potential applications in interventions to increase provider compliance with screening guidelines.

### ***Background***

Men who have sex with men make up a disproportionate percentage of primary and secondary syphilis infections in the United States, accounting for more than half of all cases (Centers for Disease Control and Prevention, 2019b). Recognizing this disparity, increasing syphilis screening to every three months has been recommended for this population both as a means of detecting asymptomatic syphilis cases and as a control measure for reducing the number of new infections (Bibbins-Domingo et al., 2016; Cohen et al., 2005). In practice, however, screening frequencies have been revealed to fall short of this proposed screening interval (Bernstein et al., 2018; Parsons et al., 2018). Due to the many potential clinic, patient and provider-level factors that likely contribute to this deficit, a more thorough accounting of the variables that may influence providers' syphilis screening behavior is warranted (Carter et al., 2014).

Behavioral theories have been successfully used in the past to model the underlying determinants of specific behavioral outcomes (Kwon & Silva, 2020). In doing so, they provide greater insight into the direct antecedents that lead to a behavior occurring or not occurring. One of the more commonly utilized theories, the Theory of Planned Behavior (TPB), was selected for this very purpose, to identify the factors that contribute to healthcare providers' syphilis screening intentions and behavior. The TPB has been successfully applied to similar issues regarding healthcare provider behavior (Jurgens, 1996; Payant et al., 2008; Sauls, 2007), and guideline compliance in particular (Maue, Segal, Kimberlin, et al., 2004; Puffer, 2004). The theoretical model proposed by the TPB considers behaviors as being formed out of positive, pro-

behavior intentions. These intentions are in turn determined by attitudes toward the behavior, social and/or subjective norms surrounding the behavior, and the perceived ease or difficulty of performing the behavior (Ajzen, 1991). As it has been applied in the past, the TPB employs context specific indicators to evaluate what are perceived to be latent constructs encompassing each of the TPB factors (see fig.4). For assessing healthcare provider behavior, this task requires nuanced application since the behavior that is often evaluated is one that primarily affects patients' wellbeing and not the provider themselves. Despite this, the TPB has been shown to be an effective model to discern the underlying factors that lead to providers' behavioral outcomes. A major benefit of applying behavioral theories such as the TPB to issues of provider behavior is their ability to identify new targets for behavioral intervention. The TPB's ability to account for subjective elements that may be causal in determining a provider's clinical behavior allows for interventions to be developed that go beyond commonly targeted behavioral antecedents, such as provider knowledge, training, and workflow restrictions. In fact, interventions that are based on behavioral theory have been identified as an important method for translating clinical research and guidelines into clinical practice (Durks et al., 2017; Lenfant, 2003).



*Figure 4. The Theoretical TPB model as originally proposed by Ajzen (1991)*

A survey based on the theoretical constructs of the TPB was thus developed to assess whether providers' syphilis screening intentions and behaviors could be explained by differences in their attitudes, social norms, and perceived behavioral control. If the TPB model was found to significantly predict these outcomes, then interventions that address these as behavioral antecedents could be developed to increase the frequency at which providers order syphilis screening for their MSM patients.

***Methods***

Between September 2020 and February 2021, healthcare providers were requested to take an online survey. The survey was distributed both passively through social media and online interest groups, and actively through targeted email recruitment. Email recruitment included use of a proprietary contact list that was purchased from an online research and marketing firm that specializes in healthcare. Incentive to participate was provided in the form of an optional raffle for one of five \$100 e-gift cards. To enter the raffle, participants voluntarily provided a

preferred email address at the conclusion of the survey. The Temple University institutional review board reviewed and approved this study (# 27339).

### ***Participants***

Of the 167 survey responses submitted, 123 were complete, yielding a completed response rate of 74%. Eligible participants had to be currently practicing medicine as a physician, nurse practitioner, physician assistant or other professional able to prescribe syphilis screening. In addition, participants had to be practicing in the United States, be at least 18 years of age or older, report seeing MSM patients currently or in the past, and identify sexual health services (such as screening for gonorrhea, chlamydia, syphilis, HIV, or screening for HPV related cancers, etc.) to fall within the scope of services they provide.

### ***Measures***

The survey was developed in accordance with the underlying principles of the TPB. Additionally, interviews with healthcare providers who specialize in sexual healthcare for MSM helped inform survey item development. Before the final version of the survey was distributed, additional providers with content expertise reviewed the survey to assess face validity. The final version of the survey included 29 items to assess TPB variables of Attitudes, Social Norms, Perceived Behavioral Control, and Intention; in addition to Behavior, which was assessed via a single item. For a complete list of items see Table 10. For Attitude, Social Norms, and Perceived Behavioral Control items, a bipolar 7-point Likert scale was used. Intention was measured using 5 case vignette indicators, a methodology used previously to assess healthcare provider behavior (Jui-ying Feng & Wu, 2005; Rashidian & Russell, 2012). Each case represented an MSM patient for whom increased screening would be indicated according to guidelines (Bibbins-Domingo et

al., 2016) and was rated from 1 to 5 with each numeric value corresponding to a screening interval recommendation ranging from *more frequently than every three months* (5) to *less frequently than annually* (1), resulting in a continuous scale with higher values indicating greater intention to screen more frequently. Self-reported behavior was assessed via a single item asking providers to estimate the number of their last ten MSM patients who received syphilis screening with values ranging from 0-10. Demographics including gender, sexual orientation, race, ethnicity and practice setting were also assessed. The average time taken to complete the survey was 9 minutes.

### ***Analysis***

The methodology for this study proceeded in stages. First, hypotheses based on the TPB were developed. A measurement model was then tested using all TPB variables in exploratory factor analysis (EFA). Based on the results of the EFA, the model was refined and a structural model was tested using confirmatory factor analysis. Finally, structural equation modeling using the finalized model was performed to evaluate the strength of association between latent variables and outcome. Carrying forward the method used in EFA, Bayesian estimation was used for both CFA and SEM and as such, model fit was assessed using Posterior Prediction P value (PPP) Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) (Asparouhov & Muthén, 2020). All analyses were conducted using SPSS v.26 (IBM Corp, 2019) and Mplus v.8 (Muthén & Muthén, 2017).

## *Hypotheses*

Four main hypotheses were developed in accordance with the TPB.

### *Hypothesis 1 (Attitudes)*

According to the TPB, attitudes account for the subjective evaluation of a behavior in terms of its perceived benefit, ease, and value (Ajzen, 1991). The TPB as proposed by Ajzen (1991) presumes a direct relationship between attitude and intention to perform a behavior such as ordering syphilis screening for an MSM patient. Following this, it was hypothesized that:

**H1:** Attitudes regarding the benefit, ease, importance and value of syphilis screening would be positively associated with intention to screen.

### *Hypothesis 2 (Social Norms)*

Social norms refer to the perceived value placed on a behavior by important referents. These referents vary according to context but in the case of determining provider behavior, we examined professional referents and patients themselves. For instance, providers were asked to determine whether their healthcare provider peers felt it was important for them to screen their MSM patients for syphilis, whether their MSM patients thought it was important that they be screened, and whether they perceived an expectation to screen their MSM patients in the form of professional and individual practice-level guidelines. The TPB presumes that these perceived norms will have a positive association with behavioral intention. We therefore hypothesized that:

**H2:** The perceived social norms of patients and professional referents would be positively associated with intention to screen.

### *Hypothesis 3 (Perceived Behavioral Control)*

Perceived behavioral control is perhaps the most context-specific factor employed as part of the TPB model. This is due to the fact that, as conceptualized, it is influenced by both subjective appraisals of one's own ability to carry out a behavior, as well as objective factors that serve as constraints of one's ability to perform a behavior regardless of disposition. Due to uncertainty about how and to what extent these elements would vary in terms of their influence on practice behavior, our survey included items to assess what can be perceived as control beliefs (in the form of one's own confidence in carrying out activities related to syphilis screening) and behavioral actual behavioral control (in the form of how different logistical factors are perceived to be constraining, such as lack of time or clinical support). We therefore developed two hypotheses to be tested about perceived behavioral control:

**H3a:** Control beliefs and actual behavioral control would be independently and positively associated with both intention to screen and actual screening behavior.

-or-

**H3b:** Control beliefs and actual behavioral control would form a single factor, which would be positively associated with both intention to screen and actual screening behavior.

### *Hypothesis 4 (Intention)*

The main assertion of the TPB is that intention is the most immediate and direct contributor to behavior. So conceived, it is the individual's disposition toward performing a behavior or not. Much of the TPB is built on this principle: that people do what they intend to do and do not do what they do not intend to do. While somewhat facile, this notion has been the focus of multiple studies, including those of provider behavior, and its main supposition has been

consistently upheld (Cabana et al., 1999; Maue, Segal, Kimberlin, et al., 2004). Noting this, we hypothesized that:

**H4:** Intention to screen for syphilis would be positively associated with actual screening behavior.

While these four main hypothesis were developed based on the theory as originally conceived, it is important to note that in all its many application, the TPB has rarely demonstrated complete adherence to this model (Espada, Morales, Guillén-Riquelme, Ballester, & Orgilés, 2015; Johnson & Hall, 2005). Again, much of this is owed to the context-specific nature of the underlying constructs proposed by the TPB, and thus, a lack of significance between one or multiple constructs and acceptance of their null hypotheses does not indicate model failure, simply its ability to account for a range of behaviors and their most influential underlying antecedents.

## ***Results***

### ***Sample***

The majority of participants identified as female (70.7%) and heterosexual/straight (74%). Most also identified their race as White/Caucasian (78.9%), followed by Asian or Pacific Islander (9.8%), Black/African American (4.1%), and Hispanic/Latinx (2.4%). The practice settings identified by participants were mostly in academic (42.3%), specialty care clinics (e.g., HIV, LGBTQ, etc.) (35.8%), public hospitals (20.3%), and public non-profit agencies/primary care clinics (20.3%). A full description of sample demographics is presented in Table 11.



<b>Table 10. Theory of Planned Behavior Survey Items by Construct and Knowledge Items</b>	
<b>Attitudes (0-7; Strongly Disagree-Strongly Agree)</b>	
(Att1)	Routine screening for syphilis is effective at preventing new infections
(Att2)	I only order syphilis screening if requested by a patient
(Att3)	Screening for syphilis more frequently is an effective way to detect asymptomatic cases
(Att4)	There are risks associated with syphilis screening that should be considered
(Att5)	Screening patients for syphilis is easy
(Att6)	Syphilis infection is a serious condition that can lead to disability or death
(Att7)	Screening for syphilis infection in all MSM patients should be a top priority
(Att8)	There is little benefit to screening MSM patients for syphilis more frequently
(Att9)	MSM who are also living with HIV are not screened for syphilis as frequently as they should
(Att10)	MSM who are taking PrEP for HIV prevention are not screened for syphilis as frequently as they should
(Att11)	MSM are likely to refuse syphilis screening
(Att12)	MSM are well informed about the potential harms associated with syphilis infection
<b>Social Norms (0-7; Strongly Disagree-Strongly Agree)</b>	
(SN1)	My MSM patients think it is important for me to screen them for syphilis infection regularly
(SN2)	My healthcare provider peers think it is important that I screen my MSM patients for syphilis regularly
(SN3)	My profession has clear guidelines for how frequently to screen MSM patients for syphilis
(SN4)	My medical practice has clear guidelines for how frequently to screen MSM patients for syphilis
<b>Control Beliefs (0-7; Not at all confident – Very confident)</b>	
(PBC1)	How confident are you in your ability to conduct a sexual history with your MSM patients?
(PBC2)	How confident are you in your ability to order syphilis screening for your MSM patients?
(PBC3)	How confident are you in your ability to interpret syphilis screening results?
(PBC4)	How confident are you in your ability to provide treatment for patients who screen positive for syphilis?
<b>Behavioral Control (0-7; Not at all a factor- Definitely a factor)</b>	
(ABC1)	Not enough time
(ABC2)	Not enough training
(ABC3)	Not enough resources
(ABC4)	Not enough support from clinical staff
<b>Intention (0-5; More frequently than once every three months- Less frequently than annually)</b>	
(int1)	An MSM patient who is HIV negative and taking PrEP
(int2)	An MSM patient who is HIV negative and not taking PrEP who has a history of gonorrhea or chlamydia.
(int3)	An MSM patient who is HIV positive and has one main sexual partner
(int4)	An MSM patient who is HIV positive who has a history of gonorrhea and chlamydia and one main sexual partner
(int5)	An MSM patient who is HIV positive and has multiple sexual partners and no other STI history
<b>Behavior (0-10)</b>	
(Beh)	Thinking back to your last 10 MSM patients, how many did you recommend undergo syphilis screening?

<b>Table 11. Sample Demographics</b>	
Variable	N (%)
<b>Practice Setting</b>	
Hospital (Private)	10 (8.1)
Hospital (Public)	25 (20.3)
Group Practice	17 (13.8)
Individual Practice	1 (0.8)
Academic	52 (42.3)
Private Agency/Primary Care/Clinic	12 (9.8)
Specialty Care (e.g., HIV, LGBT)	44 (35.8)
Public Non-Profit Agency/Primary Care/Clinic	25 (20.3)
<b>Clinician Type</b>	

<i>Table 11. Sample Demographics (continued)</i>	
Nurse Practitioner	17 (13.8)
Primary Care Physician	43 (35.0)
Specialist Physician	35 (28.5)
Resident or Fellow (Physician)	6 (4.9)
Physician Assistant	16 (13.0)
Other	3 (2.4)
Specialty N=102	
Family Medicine	22 (17.9)
Gynecology	1 (0.8)
HIV	5 (4.1)
Infectious Disease	51 (41.5)
Internal Medicine	4 (3.3)
Pediatrics	3 (2.4)
Sexual Health	7 (5.7)
Urgent Care	2 (1.6)
Other (Addiction Medicine, Anorectal Surgery, Cancer Control, Critical Care, Emergency Medicine)	7 (5.7)
Years Post-Residency/Training	
Less than 10 years	59 (48.0)
10-20 years	33 (26.8)
More than 20 years	23 (18.7)
Still in residency or training	3 (2.4)
Missing	5 (4.1)
Region	
Midwest	3 (2.4)
Northeast	90 (73.2)
Southeast	10 (8.1)
Southwest	11 (8.9)
West	6 (4.9)
Gender	
Female	87 (70.7)
Male	30 (24.4)
Genderqueer/Gender Non-Binary	1 (0.8)
Sexual Orientation	
Heterosexual/Straight	91 (74)
Gay	11 (8.9)
Lesbian	4 (3.3)
Bisexual	10 (8.1)
Other (Queer)	2 (1.6)
Race/Ethnicity	
Hispanic/Latinx	3 (2.4)
White	97 (78.9)
Black/African American	5 (4.1)
Asian or Pacific Islander	12 (9.8)
Multiracial	1 (0.8)
Other (Arab/Middle Eastern)	3 (2.4)
Missing	5 (4.1)

### *Measurement Model*

Prior to assessing a measurement model in exploratory factor analysis, descriptive analysis for each survey item was first performed to assess for non-normal distribution and to compute reliability coefficients. Skewness metrics ranged from -3.86 to 0.527 indicating non-normality in the distribution of several items. Reliability was evaluated using both Cronbach's alpha ( $\alpha$ ) and McDonald's omega ( $\omega$ ) was assessed using all scale items, which produced the following: 1. Attitudes (12 items;  $\alpha = .625$ ;  $\omega = .625$ ); 2. Social Norms (4 items;  $\alpha = .653$ ;  $\omega = .726$ ); 3. Perceived Behavioral Control (8 items;  $\alpha = .786$ ;  $\omega = .831$ ); and, 4. Intention (5 items;  $\alpha = .840$ ;  $\omega = .841$ ). This indicated a moderate degree of internal consistency for the total item scales. All inter-item correlations and descriptives appear in Table 12.

Taking into account the non-normal distribution of items and the restrictions imposed by a small sample size, Markov Chain Monte Carlo, a Bayesian estimation method, was selected for use in exploratory factor analyses. The Bayesian approach to estimation has been shown to outperform other estimators such as maximum likelihood (ML) and the diagonally weighted least squares (WLSMV) approach under similar conditions (Holtmann et al., 2016). In exploratory factor analysis, both four and five factor models were assessed. Reasons for including a five factor model were based on the uncertainty of how the essential composite of perceived and actual behavioral control items would perform under analysis. While both the four and five factor model produced solutions with comparable fit indices, a four factor model that included Attitudes, Social Norms, Perceived Behavioral Control, and Intention was ultimately favored due to the presence of numerous cross-loading items comprising the alternative five factor solution, which separated perceived behavioral control and actual behavioral control as distinct factors. The decision was also made with reference to the original set of hypotheses implied by the

theoretical model. Independent of this decision, several problematic items including weakly loading and cross-loading items were identified that necessitated further revision. This resulted in a final model consisting of 17 of the original 29 items corresponding to four factors.

Individual factor loadings and other relevant indices are reported in Table 13. Confirmatory factor analysis (CFA) confirmed a modest but acceptable alignment between the data and this revised measurement model ( $PPP=.001$ ;  $RMSEA=0.076$ , 95% CI 0.069-0.084;  $CFI= 0.88$ ,  $TLI=0.87$ ). The CFA also confirmed that all factor loadings based on the revised measurement model were significant, providing additional evidence for construct validity.

### ***Structural Equation Model***

Having specified a model based on the results of the EFA and CFA, structural equation modeling was then used to assess the strength of associations between TPB factors and the behavioral outcome. The model diagram produced through this analysis can be found in Figure 5. The resulting model again demonstrated a modest yet acceptable fit to the data ( $PPP=.001$ ;  $RMSEA=0.056$ , 95% CI: 0.052-0.064;  $CFI= 0.85$ ,  $TLI=0.93$ ). The model produced estimates that were therefore deemed to be reliable for evaluating the paths and associations between TPB variables and behavioral outcome.

### ***Hypothesis Tests***

The results of structural equation modeling were used to either accept or reject each null hypotheses (as detailed above). Rejection of the null hypothesis was supported by positive and significant ( $P<.05$ ) path coefficients. Using these criteria, null hypotheses for H1 and H4 were rejected, indicating that there was a positive and significant association between attitudes and intention, and between intention and behavior. The indirect effect of attitudes on behavior as

mediated by intention was also found to be significant ( $\beta=.073$ ,  $P=.05$ ). Null hypotheses for H3 were partially rejected due to the fact that Perceived Behavioral Control did demonstrate a significant, positive association with behavior, but not with intention. Because Social Norms were not found to be significantly associated with intention, we failed to reject the null hypothesis for H2.

Table 12. Descriptive statistics and correlation coefficients for all items (r)

	M	SD	Att1	Att2	Att3	Att4	Att5	Att6	Att7	Att8	Att9	Att10	Att11	Att12	SN1	SN2	SN3	SN4	PBC1	PBC2	PBC3	PBC4	ABC1	ABC2	ABC3	ABC4	Int1	Int2	nt3	Int4	Int5					
Att1	6.2	1.2	1.00																																	
Att2	6.0	1.7	0.03	1.00																																
Att3	6.3	1	.333**	.222*	1.00																															
Att4	4.5	1.7	0.05	0.03	.203*	1.00																														
Att5	6.2	1.1	.345**	0.01	.219*	.304**	1.00																													
Att6	6.7	0.7	.236**	-0.06	0.12	-0.05	.198*	1.00																												
Att7	6.3	1	.239**	-0.07	.293**	.213*	.341**	0.12	1.00																											
Att8	6.2	0.9	.220*	0.09	.368**	.232**	.417**	0.14	.519**	1.00																										
Att9	5	1.4	.193*	0.12	0.06	-0.02	0.09	-0.03	0.16	.193*	1.00																									
Att10	4.4	1.6	.198*	0.14	0.07	-0.02	0.13	0.01	0.15	0.03	.578**	1.00																								
Att11	6.1	1.1	0.17	0.13	.287**	0.15	.376**	0.11	.191*	.449**	0.18	0.09	1.00																							
Att12	3.4	1.4	0.01	-0.10	-0.02	-0.05	0.02	0.04	0.10	0.05	-0.15	0.01	0.00	1.00																						
SN1	5.4	1.2	.221*	0.05	.246**	0.11	.183*	0.05	0.18	.257**	0.14	0.10	.328**	.357**	1.00																					
SN2	5.9	1.2	0.07	-0.01	0.15	0.07	.246**	-0.01	.179*	.313**	-0.10	-0.10	.238**	0.15	0.15	1.00																				
SN3	5.3	1.4	0.14	0.02	.200*	-0.01	.232**	.218*	.282**	.322**	-0.08	0.09	0.16	0.17	0.08	.373**	1.00																			
SN4	5.2	1.7	0.06	0.16	.373**	0.07	0.16	-0.08	.214*	.325**	-0.05	0.14	0.15	0.15	.226*	.348**	.650**	1.00																		
PBC1	6	1.1	.259**	0.10	.309**	.193*	.218*	0.11	.242**	.277**	0.13	0.16	.367**	0.14	.380**	0.15	.241**	.327**	1.00																	
PBC2	6.6	0.6	.220*	0.04	.266**	0.06	.353**	.207*	0.10	.302**	0.06	0.02	.403**	0.10	.246**	0.17	.188*	0.16	.533**	1.00																
PBC3	6.2	0.8	.182*	0.03	.213*	.210*	.500**	0.11	0.15	.350**	0.12	0.07	.359**	0.15	.419**	.200*	.262**	.331**	.588**	.524**	1.00															
PBC4	6.3	0.9	0.13	0.06	.249**	0.16	.367**	0.08	.223*	.321**	0.14	0.07	.326**	0.17	.374**	.252**	.283**	.347**	.545**	.525**	.778**	1.00														
ABC1	5.4	1.8	0.08	0.17	0.11	0.05	0.08	0.12	.199*	.188*	-0.05	-0.05	.195*	0.16	.192*	.193*	.249**	0.16	.250**	.300**	.211*	.239**	1.00													
ABC2	6.1	1.4	0.11	0.08	0.08	0.12	.293**	0.16	.217*	.356**	0.04	0.05	.279**	.177*	.254**	.265**	.236**	.283**	.428**	.398**	.598**	.517**	.498**	1.00												
ABC3	5.9	1.6	0.06	0.16	0.04	0.16	.229*	0.07	0.11	.227*	0.00	-0.08	.371**	0.03	0.14	.253**	.184*	0.13	.195*	.208*	.327**	.299**	.558**	.565**	1.00											
ABC4	5.7	1.6	0.08	0.01	0.12	0.05	0.12	0.09	.219*	.236**	0.03	-0.12	.302**	0.13	.201*	.202*	.192*	.236**	.261**	0.16	.207*	.209*	.615**	.474**	.754**	1.00										
Int1	3.7	0.7	0.13	0.03	.318**	0.09	.180*	0.03	.250**	.339**	-0.11	-0.04	.229*	0.09	0.17	.304**	0.06	0.16	0.14	0.06	0.16	0.18	0.08	.292**	.243**	.216*	1.00									
Int2	3.8	0.8	0.09	0.01	0.06	0.12	0.14	-0.03	.190*	.192*	-0.15	0.03	0.06	0.04	-0.04	.221*	0.04	0.02	0.02	-0.04	0.10	-0.03	.178*	.318**	.285**	.230*	.630**	1.00								
nt3	2.9	0.9	-0.06	-0.08	0.10	0.02	0.08	-0.09	.248**	0.16	-0.18	-0.08	0.11	0.05	-0.06	.227*	0.08	.178*	0.05	0.02	0.01	0.02	0.13	0.10	0.15	.221*	.441**	.416**	1.00							
Int4	3.4	0.9	-0.02	0.01	0.03	0.09	-0.04	-0.12	.190*	0.12	-0.08	-0.05	0.08	0.08	-0.01	0.17	0.05	0.06	0.02	0.00	0.02	-0.02	.203*	0.11	.261**	.293**	.485**	.532**	.689**	1.00						
Int5	4.0	0.7	0.16	0.00	0.09	0.05	0.04	0.04	0.04	0.16	-0.09	-0.12	0.03	0.01	-0.01	.258**	0.11	0.05	0.04	-0.07	0.03	0.00	0.12	0.12	.228*	.271**	.547**	.640**	.354**	.470**	1.00					

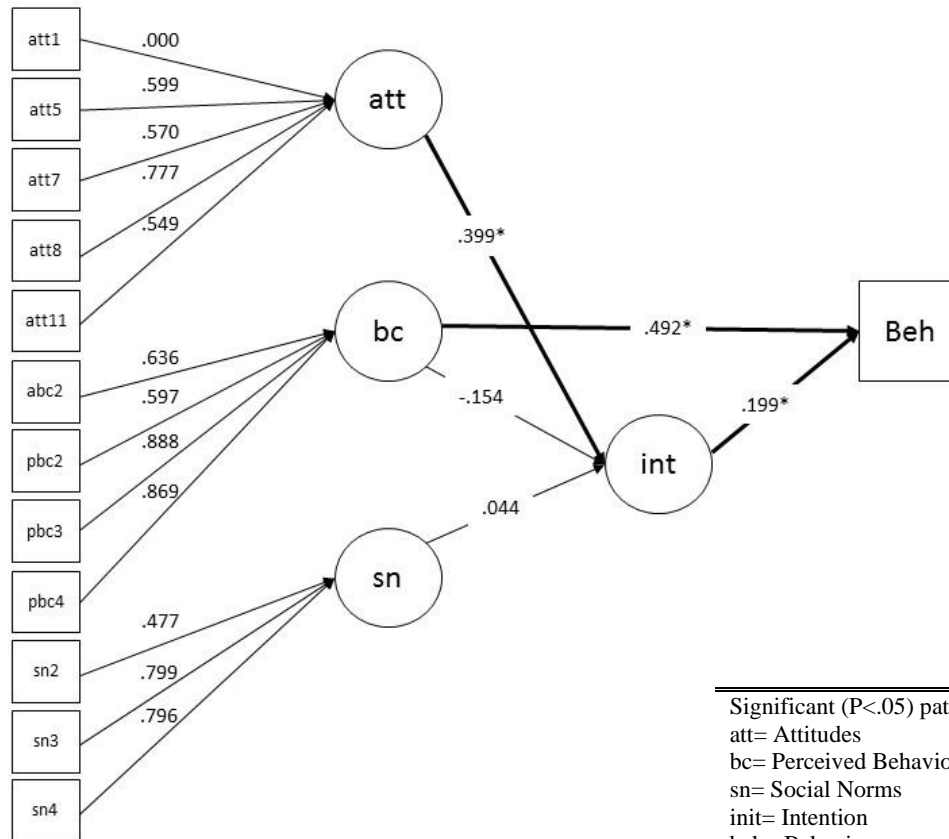
\*<.05, \*\*<.01, \*\*\*<.001

**Table 13. Revised Measurement Model (with Geomin rotation)**

Item	Scale	Factor and Loadings			
		1	2	3	4
<b>Att1</b> Routine screening for syphilis is effective at preventing new infections	Attitude	.268*			
<b>Att2</b> Screening patients for syphilis is easy	Attitude	.482*			
<b>Att7</b> Screening for syphilis infection in all MSM patients should be a top priority	Attitude	.538*			
<b>Att8</b> † There is little benefit to screening MSM patients for syphilis more frequently	Attitude	.650*			
<b>Att11</b> † MSM are likely to refuse syphilis screening	Attitude	.479*			
<b>SN2</b> My healthcare provider peers think it is important that I screen my MSM patients for syphilis regularly	Social Norms		.352*		
<b>SN3</b> My profession has clear guidelines for how frequently to screen MSM patients for syphilis	Social Norms		.697*		
<b>SN4</b> My medical practice has clear guidelines for how frequently to screen MSM patients for syphilis	Social Norms		.876*		
<b>PBC2</b> How confident are you in your ability to order syphilis screening for your MSM patients?	Perceived Behavioral Control			.528*	
<b>PBC3</b> How confident are you in your ability to interpret syphilis screening results?	Perceived Behavioral Control			.932*	
<b>PBC4</b> How confident are you in your ability to provide treatment for patients who screen positive for syphilis?	Perceived Behavioral Control			.805*	
<b>ABC2</b> † Not enough time	Perceived Behavioral Control			.583*	
<b>Int1</b> (Case vignette 1)	Intention				.719*
<b>Int2</b> (Case vignette 2)	Intention				.805*
<b>Int3</b> (Case vignette 3)	Intention				.611*
<b>Int4</b> (Case vignette 4)	Intention				.734*
<b>Int5</b> (Case vignette 5)	Intention				.731*

	Eigenvalue	4.81	2.88	1.45	1.27
† Indicates item was reverse-coded	% Variance Explained	28.3	17.0	8.5	7.5
* Indicates significant factor loading	% Cumulative Variance Explained	28.3	45.3	53.8	61.3

Figure 5. Final Structural Model




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Significant (P<.05) paths appear in bold      *Posterior Predictive P value: .001*  
 att= Attitudes      *RMSEA: 0.056*  
 bc= Perceived Behavioral Control      *CFI: 0.85*  
 sn= Social Norms      *TLI:0.928*  
 int= Intention  
 beh= Behavior



## *Discussion*

The main objective of this study was to test the Theory of Planned Behavior as a model that could be used to predict healthcare providers' syphilis screening intentions and behaviors with regard to MSM patients. In doing so, we hoped to identify significant factors that may be useful in designing future interventions targeted to providers and intended to increase compliance with established screening guidelines.

Results from SEM analysis indicate that while the TPB is an acceptable model for predicting providers' syphilis screening intention and behaviors, more work can be done to improve our understanding of how these latent dispositional factors function to produce or inhibit clinical behavior. Two of our main hypotheses were borne out in analysis, namely, that attitudes towards syphilis testing in MSM significantly influenced intention to screen patients at more frequent intervals, and that intention significantly predicted self-reported screening behavior. Structural equation modeling analysis also revealed that perceived behavioral control, in the form of both subjective appraisals of ability and assessment of logistical factors that may constrain one's ability, significantly predicted self-reported screening behavior. Our null finding that social norms were not significantly associated with intention is also worth noting, as this can help further refine our understanding of what factors to intervene on in future behavioral interventions.

With this said, it is also possible that improvements to the survey design and resultant measurement model may reveal additional significant associations between factors. A known issue when adapting TPB principles to experimental designs is its assumption of construct unidimensionality (Hankins, French, & Horne, 2007). The theory proposes that factors like social norms and attitudes each represent a single, homogenous construct. However, when assessed

through traditional survey methodology, this can be untenable since attitudes theoretically include all salient beliefs about a behavior and therefore are difficult to disaggregate from other constructs. This measurement ambiguity could be partially addressed through further refinement of the survey instrument, though total disambiguation cannot be achieved, and therefore must be recognized as a limitation. Despite this, our results demonstrating that attitudes were indirectly associated with behavior through intention is an important finding and one that should be investigated further for its potential application in behavioral interventions targeted to providers.

Interventions that have sought to increase syphilis screening frequency in MSM patients have almost exclusively targeted either patients themselves or introduced modifications to clinic workflow and lab order procedure (Bissessor, Fairley, Leslie, Howley, & Chen, 2010a; Callander et al., 2013; Wayal et al., 2019). Targeting attitudes towards syphilis screening, such as its importance, ease, and benefit, could be an essential component of increasing provider guideline compliance that has been neglected. This could be achieved through the design of new interventions that focus on this component or could be added to existing interventions as a way to augment their impact and perhaps increase their sustainability. In addition to this finding, our results also support the need to address behavioral control factors such as increased training to improve competency and limiting the effect of logistical constraints imposed by lack of time and lack of clinical support. Identifying perceived behavioral control as having the strongest and most immediate effect on self-reported behavior supports the continued examination of clinical factors that may be facilitatory or inhibitory of providers' screening behavior.

### ***Limitations***

There are limitations to this study and analysis that must be addressed. First, the sample used in this analysis is small for an SEM problem. This may have affected the ability to detect

significant associations and likely negatively impacted overall model fit. Attempts to limit the effect of this constraint were made through the use of Bayesian estimation, which has been shown to be more robust to sample size issues than alternatives (Mcneish & Mcneish, 2016). A limited sample size also increases the potential that a poorly fit model will fail to be rejected. This may provide an explanation for why the model produced in our SEM analysis differed from the implied theoretical model. Second, exploratory and confirmatory analyses were performed on the same sample. Ideally, results from the exploratory analysis should be confirmed on an independent sample to eliminate the capitalization on chance as a plausible explanation for the consistency between exploratory and confirmatory results. Third, our use of an online sample that was homogenous, particularly in terms of race and sex, may limit the external validity of our results. Future studies should focus on expanding the types of providers, diversifying the sample in terms of demographics, and ensuring that all types of settings in which syphilis screening occurs are represented. Finally, our use of a self-reported behavioral outcome measure limits our ability to assess the effect of TPB variables on actual screening behavior. Use of self-reported behavior in TPB studies has been shown to be more strongly correlated with constructs such as attitudes and social norms than objective measure (Godin et al., 2008), and thus this study should be replicated with behavior measures such as medical record or lab orders.

### ***Conclusion***

This study is the first to use the Theory of Planned Behavior to predict syphilis screening intentions and behaviors among healthcare providers. In doing so, greater insight into the antecedents leading to providers screening MSM patients at recommended frequencies was gained. By identifying components that are significant to both provider intention and self-reported behavior, this study provides an evidence base upon which to develop and augment both

new and existing behavioral interventions targeted to healthcare providers. Develop methods to increase healthcare providers' syphilis screening in MSM patients may result in a reduction in syphilis cases, thus reducing the disease burden affecting this population.

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## CHAPTER 5: DISCUSSION OF MAIN FINDINGS

### *Introduction*

These manuscripts present novel findings related to healthcare providers' syphilis screening perceptions, intentions, and behavior with regard to MSM patients. The purpose of this study was to identify new opportunities to improve the quality of clinical care received by MSM patients and to address a persistent public health disparity. Syphilis infection poses a serious risk to the health of MSM in the United States, and efforts to control syphilis in this population have encountered barriers at multiple levels (Turpin, Rosario, & Dyer, 2020). Despite the many underlying factors driving this syphilis disparity, there are elements that are amenable to intervention that, if adequately addressed, may have a profound impact on reducing syphilis transmission and prevalence. Increasing provider adherence to syphilis screening guidelines is one such element and results from this study point to potential pathways to increase screening frequency.

Our research has demonstrated that providers' syphilis screening intention and behavior significantly vary according to attitudes, behavioral control variables, and social norms, illustrating the worth of using theoretical constructs to understand provider behavior. We also present evidence to suggest that attitudes toward syphilis screening in this population are predictive of self-reported screening behavior, as mediated through intention to screen patients more frequently. Identifying attitudes toward syphilis screening as having a significant indirect effect on self-reported behavior has several implications that could inform behavioral interventions. In addition to this, perceived behavioral control was also identified as having an independent, main effect on self-reported screening behavior.



To summarize, this research's main findings were:

1. **The Theory of Planned Behavior is an appropriate and effective model for understanding healthcare providers' clinical behaviors.** This has been previously demonstrated, as evidenced in the results of our scoping review. However, this study provides further support, and adds to the extant literature, by showing this model applies to healthcare providers' syphilis screening behavior and intentions as well.
2. **Providers' syphilis screening behaviors and intentions are influenced by factors that exceed knowledge.** Through our use of the TPB, we identified factors other than knowledge and awareness of syphilis that were significant in determining screening intentions and behaviors. This is important because it reframes the issue of provider non-adherence to syphilis screening recommendations as one that may be amenable to psychosocial or behavioral intervention and not simply through additional medical education or training.
3. **Providers' syphilis screening intentions are variable.** This has been established in previous studies that have examined syphilis screening frequencies retrospectively. These studies have found that opportunities to screen patients are frequently missed by providers, indicating discrepancies in what are evidence-based best practices and clinical behavior. Our study provides additional insight by examining how intention to screen patients at variable frequencies is in part determined by patient-level factors; and this was shown to be true for both patients prescribed PrEP, and patients in HIV care. This also has potential application to interventions by helping physicians identify unconscious biases that may influence screening behavior.

This chapter will discuss these main findings in context and explore potential opportunities to adapt them to provider-targeted behavioral interventions.

*Providers as an Intervention Focus – How it Fits With Syndemics*

This study was introduced with a discussion of syphilis infection among MSM as part of a syndemic; similar to how HIV infection is perceived to function in this population. There is both intuitive and empirical support for such an assumption. First, many of the same vulnerabilities that are implicated in the HIV syndemic (substance use, mental health burden, stigma, etc.) are likely to affect syphilis outcomes as well, and this has been demonstrated in sexual minority men (Ferlatte et al., 2018). Another possible interpretation is to see syphilis infection as a component of the HIV syndemic due to the disease processes that lead to greater susceptibility to HIV infection, and this has also been shown to be the case among MSM and transgender women who have sex with men (Singer, 2010; Solomon et al., 2014). Regardless of how one interprets these overlapping and mutually reinforcing health outcomes, it is clear that this web of causation has many strands, and each (or perhaps all) could be the target of an intervention.

Why then focus on providers as an intervention target for reducing syphilis prevalence among MSM? The answer is again based on the assumption of a syndemic. Counterintuitive to what has long been the presiding ideology of syndemic theorists, that the identification of additive and synergistically related multi-morbidities requires a multi-component intervention, a close reading of how syndemics have been operationalized in research reveals that this is not necessarily the case. Tsai (2018) has demonstrated that many investigations of syndemics assume a sufficient cause interaction between component causes. Essentially, this assumption implies that the elimination of one component cause would be sufficient for preventing the

outcome. This is because most investigations of syndemics use an additive association model, wherein the total syndemic effect (what Tsai refers to as the “omnibus exposure of interest” (Tsai, 2018, p. 5)) is assumed to be the sum of all syndemic causes experienced by individual study participants. Notably absent from many of these investigations, however, are factors related to healthcare beyond participant insurance status and access (Gandhi, Spinelli, & Mayer, 2021; Halkitis, Moeller, Siconolfi, Solomon, & Bub, 2013; Morano et al., 2013).

Designing multicomponent interventions is not only methodologically unsupported, it is often prohibitive due to their resource intensive nature. Designing interventions that sufficiently target one component cause are much more feasible, and even if adopting the underlying assumptions of a syndemic, should result in a significant reduction in the outcome. Taken together, this supports the inclusion of providers and their clinical behavior as a potential factor in determining syphilis healthcare outcomes. The role providers play in both screening for and treating syphilis should be considered a direct and proximal cause of syphilis outcomes, and one that is appropriate for intervention. This idea receives further support from mathematical modeling studies, which have demonstrated that, keeping all other factors constant, increasing syphilis screening frequencies to three months among high-risk MSM would reduce reported and incident cases by approximately 87% (Tuite et al., 2013). Determining what factors may be implicated in providers adopting and maintaining this syphilis screening behavior is thus an important endeavor and one that this study has begun to address.

### ***Behavioral Interventions for Providers***

As results from our literature review presented in Manuscript 1 demonstrate, healthcare provider behavior is subject to a variety of perceptual, dispositional and belief-based factors. As such, attempts to modify clinical behavior without addressing these factors are likely to meet with resistance or result in their reduced efficacy. While our literature review also demonstrates that several interventions have been piloted that sought to increase healthcare providers' syphilis screening frequency, none of these interventions included methods to address these subjective elements. Most attempted to increase screening by manipulating structural level factors, such as EHR prompts. Therefore it cannot be stated whether or not the efficacy of these types of structural level interventions would be enhanced through the application of behavioral theory to address provider level factors, which presumably would have longer lasting effects on syphilis screening behavior. However, there is strong evidence to support the use of behavioral theory as an effective tool for translating research evidence to clinical practice (Durks et al., 2017). By targeting factors that are revealed to be most salient to the desired behavioral outcome, mapping interventions on the basis of behavioral theory avoids issues that are described by Kok and Mesters (2011) such as:

“...trying to change behavior that was not related to the problem, trying to change determinants for behaviors that were not relevant to the behavior, trying to change individual behavior while environmental factors were responsible, trying to apply change methods that were never shown to be effective, trying to implement programs by health professionals that were inadequately trained to do so, and so forth”

(Kok & Mesters, 2011, p. 176).

Our use of the Theory of Planned Behavior was intended to circumvent these issues. As a well-established theory of behavior that has been shown to be effective at modeling a range of healthcare provider clinical outcomes, we believe our findings related to providers' syphilis

screening intention and behavior could be effectively utilized in future intervention mapping studies. There are many ways in which this could be achieved. For instance, training materials could be developed that emphasize key attitudes and dispositions toward screening MSM patients for syphilis, such as its benefit, need, and importance. Having healthcare colleagues, representatives from healthcare institutions, or professional organizations speak to the importance of frequent screening in this population could generate positive, pro-behavior social norms. Additional training around complementary clinical behavior, such as conducting sexual histories, lab ordering procedure and interpreting screening results could be a way to increase provider confidence and knowledge related to ordering syphilis screening for MSM, and thus produce a greater sense of behavioral control. Our results clearly indicate that even basic knowledge about syphilis sequela and epidemiology are lacking, which could significantly affect overall behavioral control and self-efficacy. And since our results suggest that perceived behavioral control also includes logistical elements, addressing clinical factors related to personnel management, and time and resource allocation are likely needed as well. Nearly all the existing clinic-based interventions identified in our literature review operate on this level exclusively. Their demonstrated efficacy provides a solid basis upon which to integrate the other subjective elements that were revealed to be associated with behavioral outcomes in our analysis.

In addition to intervention mapping, our provider survey based on the TPB was shown to be a valid and effective measure of providers' syphilis screening intention and behavior. With further refinement, this survey could be adapted to a brief assessment tool, able to identify providers who are "at risk" for guideline non-adherence and who may benefit from additional training. This could be done in conjunction with TPB-based behavioral interventions to more effectively target providers who would receive the most benefit. Austin et. al. (2020) utilized

intervention mapping to increase healthcare providers' HPV vaccination in Federally Qualified Health Centers. Their intervention specifically targeted behavioral components that exceeded HPV knowledge, identified through the application of behavioral theory. Their iterative approach to designing provider-based interventions focused on theoretically derived behavioral determinants is illustrative of the type of intervention that could be developed in response to sub-optimal syphilis screening rates.

Lastly, as reported in Manuscript 2, our findings suggest gaps in provider knowledge related to syphilis exist, though it was not strongly associated with screening intention or behavior. However, this finding should be explored further, for it is possible that knowledge is correlated with other factors such as attitudes, or potentially unmeasured factors with plausible association with the outcome. For instance, our finding that a majority of the providers surveyed underestimated syphilis prevalence in the MSM population may be directly related to attitudes about the importance to screen more frequently. This could be integrated into interventions so that providers are more aware of the prevalence of syphilis in at-risk populations.

### ***Limitations***

There were several limitations to these studies that should be addressed. First, our data was derived from a small and fairly homogenous sample. This limits our ability to extrapolate our findings to a broader and more diverse population of healthcare providers in the US. This is a limitation that must be dealt with before proceeding to any intervention development or pilot testing. Replicating this study with a larger, more representative sample of healthcare providers would strengthen our inferences, and perhaps reveal additional factors that are implicated in syphilis screening intention and behavior. With regard to factors, the survey that was developed for this study could be further refined to reduce the potential for measurement ambiguity, which

likely contributed to the null results reported as part of our SEM analysis. Selecting appropriate indicators for TPB factors can be an iterative process, and this should be included as part of any future studies. This applies to the use of objective measures of provider screening in future studies.

There are also factors that this study does not address. There are many potential patient-provider variables that might affect syphilis screening outcomes. Our focus on provider intentions and behavior limited our ability to assess these in a manner consistent with the TPB. While this is a methodological constraint, it should not be taken to imply that patient-level factors are not involved in syphilis screening outcomes. It is well documented that patient motivation, hesitancy and non-compliance have been noted by providers as particular concerns when prescribing PrEP to high-risk MSM (Krakower, Ware, Mitty, Maloney, & Mayer, 2014; Spector, Remien, & Tross, 2015) and it is possible that these same concerns apply to syphilis screening and treatment as well.

This study also does not address the issue of healthcare access, which is undoubtedly one of, if not the most, salient contributor to this syphilis disparity. This study chose to focus primarily on MSM patient populations who would be connected to some form of sexual health care, either through their accessing PrEP or through HIV care. By doing so, our intention was to bring provider-level clinical factors into sharper relief. However, the elimination of syphilis, as was the CDC's goal at the turn of the 21<sup>st</sup> Century, will likely require an unprecedented expansion in healthcare access, especially to the most marginalized in the population.

Finally, we stop short of providing a detailed description of behavioral interventions that may be developed on the basis of these findings. Because this study was exploratory in many of its aims, it cannot be claimed that our results point definitively to a model of provider behavior

that would be translatable across all providers and all clinic settings. However, we believe this study provides a basis for developing an understanding of how these clinic and provider-based variables, such as whether an EMR-based prompt system has already been implemented, might affect the impact of behavioral interventions when applied, and thus direct focus to an area in which more research is necessary.

### ***Lessons Learned***

This research also provided many additional insights that may be instructive for future studies. Foremost among them is the importance of including healthcare providers' psychosocial and behavioral factors into conceptualizations of population health. This is particularly relevant to the conceptualization of health outcomes experienced by sexual and gender minorities. As is frequently the case with MSM and other sexual minority men's health, the sole or most salient focus of healthcare interventions has been on the behavior of those in the population. While this is undoubtedly an appropriate and effective intervention target, adopting this focus at the exclusion of examining other actors, such as those who provide care to this population, risks a kind of myopia that leaves important factors unaccounted for and may even exacerbate the stigma experienced by sexual minority patients (Schwartz & Grimm, 2019), further contributing to a syndemic.

Second, the hypertrophied expansion of pharmaceutical interventions for both the prevention and treatment of HIV may be the model going forward for preventing other infections like syphilis, though this should continue to be examined critically. Several pilot randomized control studies have already investigated the use of doxycycline prophylaxis for syphilis and other bacterial STI prevention in high risk populations (Grant et al., 2020). The efficacy and potential consequences of this type of intervention modality, if implemented at scale in



populations with high prevalence, is still being examined. However, it brings to light an inescapable challenge presented by the ouroboros of endemic syphilis. The persistent high prevalence of syphilis makes any macrolide use in either pre- or post-exposure interventions a threat to resistomes that are already challenged by overconsumption of antimicrobials (Kenyon, 2019). And yet, frequent screening and treatment of infections remains the only path forward for reducing syphilis prevalence. That being the case, whether it is complementary to these intervention modalities or in place of them, increased syphilis screening will remain a critical component of any and all prevention efforts and must be studied more rigorously.

Finally, syphilis is unique in many regards; both as an organism, and for the historical, social and psychological milieu it occupies. Healthcare providers in the United States are no doubt aware of the laden historical significance and appalling example of the United States Public Health Service's study of untreated syphilis in Black males, which took place in Tuskegee, Alabama in the first half of the 21<sup>st</sup> Century. This abject violation of human rights and medical ethics is frequently associated with the enduring medical mistrust experienced by US racial minorities, particularly Black and African Americans (Brandon, Isaac, & Laveist, 2005; Gamble, 1997). Given providers' awareness of this history, and the knowledge of how it justifiably shapes their patients' perceptions, extra consideration of how providers' attitudes toward the screening and management of this disease in at-risk and marginalized population is warranted and definitely should not be shied away from.

### ***Conclusion***

This study had three main objectives. First, to describe a novel application of the Theory of Planned Behavior to a well-known and persistent health disparity. Second, to better understand the ways in which providers vary in terms of their attitudes, social norms, perceived

behavioral control and intention with regard to screening MSM at risk for syphilis. And finally, to test whether these factors can be used to predict syphilis screening outcomes. In meeting these objectives, this study is the first to provide an evidence base for future interventions targeting healthcare providers, in an effort to increase compliance with syphilis screening recommendations. Men who have sex with men stand to greatly benefit from increased provider compliance with screening. Syphilis infection is a condition with the potential to result in severe injury to health, and reduction in the overall burden of disease in this population will have both immediate and long-term benefits.

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## Appendix A. SURVEY RECRUITMENT LETTER

Dear Provider,

We would like to invite you to participate in a new research study that we are conducting with medical professionals nationwide. Our study is titled, "Applicability of the Theory of Planned Behavior to explain clinicians' intention to screen men who have sex with men for syphilis infection."

The goal of the study is to investigate clinicians' attitudes, social norms, perceived behavioral control and intentions related to syphilis screening within a population known to be at elevated risk. We will also ask you some questions regarding your attitudes and social norms regarding routine HIV testing in the general population and among men who have sex with men.

If you choose to participate, you will be asked to complete a one-time electronic survey that should not take more than 10 minutes.

Upon completion, you will be given the option to enter a sweepstakes for one of five \$100 e-gift cards. We expect 250 people will take the survey.

If you are interested in participating, please open the link below for the electronic consent followed by the survey.

[Please Proceed to the Qualtrics Survey](#)

Please contact Paul D'Avanzo at 215-204-0377 or email [paul.davanzo@temple.edu](mailto:paul.davanzo@temple.edu) if you have any questions about this study. Thank you in advance for your interest and invaluable input.

Sincerely,

Paul A. D'Avanzo, MS, PhD(c)  
Department of Social and Behavioral Sciences  
College of Public Health  
Temple University

Kathleen A. Brady, MD  
Philadelphia Department of Public Health  
AIDS Activities Coordinating Office  
Medical Director/Medical Epidemiologist

Sarah Bauerle Bass, PhD, MPH  
College of Public Health  
Department of Social and Behavioral Sciences  
Director, Risk Communication Laboratory

## Appendix B. SEARCH STRATEGY FOR SCOPING REVIEW

<b>Embase, Ebscohost</b> Filter: Reviews	
<i>Behavioral theory</i> 1. physician.tw. 2. doctor.tw. 3. clinician.tw. 4. nurse.tw. 5. professional.tw. 6. guideline.tw. 7. adherence.tw. 8. 6-7.ti. 9. intention.tw. 10. behavior.tw. 11. 1-5 and 9-10.ti.	<i>Syphilis Screening</i> 1. provider.tw. 2. clinic.tw. 3. screening.tw. 4. guideline.tw. 5. gay.tw. 6. homosexual.tw. 7. MSM.tw. 8. Men who have sex with men.tw./ 9. PLWH.tw. 10. HIV.tw. 11. People living with HIV.tw./ 12. syphilis.tw. 13. sexually transmitted infection.tw./ 14. 1-2 and 12-13.ti. 15. 1-2 and 6-10.ti
<b>PubMed</b> <i>Behavioral Theory</i> (((((physician[tw] OR doctor[tw] OR clinician[tw] OR practitioner[tw] OR nurse[tw] OR professional[tw] OR guideline[tw] OR practice[tw] OR intention[tw] OR behavior[tw]))) AND ((theory[tw] OR predict*[tw]))))	
<i>Syphilis screening</i> (((((physician[tw] OR doctor[tw] OR clinician[tw] OR practitioner[tw] OR nurse[tw] OR professional[tw] OR guideline[tw] OR practice[tw] OR provider [tw] OR clinic*[tw]))) AND ((screening[tw] OR syphilis OR treponema[Mesh] OR sexually transmitted infections [Mesh])))	
<b>Cochrane</b> <i>Behavioral Theory</i> (physician OR doctor OR clinician OR practitioner OR nurse OR professional OR guideline OR practice OR intention OR behavior) AND (theory OR predict*) Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase Database - Cochrane Database of Systematic Reviews	
<i>Syphilis Screening</i> (physician OR doctor OR clinician OR practitioner OR nurse OR professional OR guideline OR practice OR provider OR clinic*) AND (screening OR syphilis OR treponema* OR sexually transmitted infections) Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase Database - Cochrane Database of Systematic Reviews	

## Appendix C. ONLINE SURVEY IN MICROSOFT WORD FORMAT

### Full Syphilis Survey – Philadelphia\_ Mod

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Start of Block: Consent

*Title of research:*

**Applicability of the Theory of Planned Behavior to explain clinicians' intention to screen men who have sex with men for syphilis infection**

*Investigators and Departments:*

**Paul A. D'Avanzo, PhD(c), MS – Temple University, Department of Social and Behavioral Sciences;  
Sarah Bauerle Bass, PhD, MPH - Temple University, Department of Social and Behavioral Sciences;  
Kathleen A. Brady, MD – Philadelphia Department of Public Health, AIDS Activities Coordinating Office**

**Dear provider, thank you for accepting our invitation to take part in this research study.**

***The purpose of this study is to collect information on your attitudes and beliefs around Syphilis screening practices and your attitudes, norms, perceived control and intention to screen men who have sex with men (MSM) for Syphilis. We also want to collect information on your attitudes, beliefs, and practices around HIV testing in patients with a sexually transmitted infection (STI)***

*Here are the important details about **your rights as a participant** in this study:*

- Whether or not you take part is up to you.
- You can choose not to take part.
- You can agree to take part and later change your mind.
- Your decision will not be held against you.

*Here are the important details about **what you are being asked to do** for this study:*

- You are being asked to complete a survey.
- The survey will take approximately 10-15 minutes to complete.
- You will be asked about your attitudes, opinions and ideas about syphilis screening
- All questions are voluntary but we request you provide as much information as you are able

*Here are the important details about **how you may be compensated for your time** for this study:*

- At the conclusion of the survey you will be given the option to provide your preferred email address.
- Your email address will be automatically entered into a sweepstakes to receive one of five \$100 e-gift cards.
- If your email address is drawn, we will notify you through your preferred email with the gift card attached.
- We anticipate approximately 250 healthcare providers will take this survey.

**Who can I talk to about this research?**

**If you have questions about: This study, complaints, or think the study has hurt you**  
**Please Contact: Paul A. D'Avanzo, Temple University - 215-204-0377,**  
**paul.davanzo@temple.edu, 1301 Cecil B. Moore Ave.,**  
**Philadelphia, PA 19122**

**If you have a concern or complaint, or questions about your rights as a research participant**  
**while you are in this study or after the study ends.**

**Please contact: Institutional Review Board at Temple University**  
**215-707-3390 or email them at irb@temple.edu**

**Below, please find the full consent form for this study. You may download it, review and keep**  
**it for your own records before providing your consent.**

**Once you have decided whether you would like to participate, please choose one of the two**  
**options that appear at the bottom of this screen**

- I agree to participate in completing this survey.
- I do not want to participate in completing this survey.

**End of Block: Consent**

**Start of Block: Eligibility**

Before we begin the survey, we must first ask you a few basic questions to determine your eligibility

---



Are you 18 years of age or older?

No

Yes

Are you currently practicing medicine in the United States?

No

Yes

Do sexual health screenings fall within the scope of services you provide or would provide if requested or indicated? (sexual health screenings may include diagnostic HIV testing, testing for Gonorrhea, Chlamydia or Syphilis, or screening for HPV related cancers)

No

Yes

Do you currently or have you in the past treated patients who identify as a man who has sex with men (MSM)? Note that we are not asking you to determine whether your patients identify as gay, bisexual or as a sexual minority. For the purpose of this survey, we are only asking if you have/had male identified patients who report engaging in sexual behavior with other male identified people.

No

Yes

**End of Block: Eligibility**



**Start of Block: TPB**

The first set of items will ask you to consider your attitudes towards syphilis screening in general. Please rate the following statements based on the extent to which you agree or disagree

	Strongly Disagree	Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Agree	Strongly Agree
Routine screening for syphilis is effective at preventing new infections	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I only order syphilis screening if requested by a patient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Screening for syphilis more frequently is an effective way to detect asymptomatic cases	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are risks associated with syphilis screening that should be considered	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Screening patients for syphilis is easy

Syphilis infection is a serious condition that can lead to disability or death

The next set of items will ask you to consider your attitudes towards syphilis screening specifically for men who have sex with men (MSM). We will also be asking about syphilis screening practices for MSM who are and are not using pre-exposure prophylaxis (PrEP), which refers to the use of antiviral medication for the prevention of HIV.

	Strongly Disagree	Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Agree	Strongly Agree
Screening for syphilis infection in all MSM patients should be a top priority	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is little benefit to screening MSM patients for syphilis more frequently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSM who are also living with HIV are not screened for syphilis as frequently as they should	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSM who are taking PrEP for HIV prevention are not screened for syphilis as frequently as they should	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSM are likely to refuse syphilis screening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

MSM are well informed about the potential harms associated with syphilis infection



The next set of items will ask you to consider how people who may be important to your decision-making around syphilis screening think.

	Strongly Disagree	Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Agree	Strongly Agree
My MSM patients think it is important for me to screen them for syphilis infection regularly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My healthcare provider peers think it is important that I screen my MSM patients for syphilis regularly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My profession has clear guidelines for how frequently to screen MSM patients for syphilis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My medical practice has clear guidelines for how frequently to screen MSM patients for syphilis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The next set of questions ask you to rate your own ability to engage in activities related to syphilis screening in MSM.

	Not at all confident	Very unconfident	Somewhat unconfident	Unsure	Somewhat confident	Very confident	Completely confident
How confident are you in your ability to conduct a sexual history with your MSM patients?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How confident are you in your ability to order syphilis screening for your MSM patients?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How confident are you in your ability to interpret syphilis screening results?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How confident are you in your ability to provide treatment for patients who screen positive for syphilis?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

To what extent would any of the following factors limit your ability to screen your MSM patients for syphilis? Please rate from 1 to 7, where 1 is Not at all a factor, 7 is Definitely a factor, and 4 is Neutral or Unsure

	Not at all a factor (1)	2	3	Neutral/Unsure (4)	5	6	Definitely a factor (7)
Not enough time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not enough training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not enough resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not enough support from clinical staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**End of Block: TPB**

---

**Start of Block: Knowledge**

Based on your current knowledge of syphilis and syphilis screening, please answer the following to the best of your ability

The number of annual cases of primary and secondary syphilis in the United States has remained stable over the last 15 years

True

False

---



Gay, bisexual, and other men who have sex with men account for approximately half of all new primary and secondary syphilis cases in the United States each year.

True

False

---

The median time from transmission to onset of symptoms of primary syphilis is one week.

True

False

---

Without treatment, half of people infected with syphilis will develop tertiary disease.

True

False

Non-treponemal tests remain elevated through all stages of syphilis (e.g. RPR, VDRL).

True

False

---

Secondary syphilis is treated with intramuscular Benzathine penicillin G for three doses at weekly intervals.

True

False

**End of Block: Knowledge**

**Start of Block: Intent**

What would you recommend as a syphilis screening frequency for the following patients if they were to present in your practice:

	More frequently than once every 3 months	Once every three months	Once every six months	Annually (once every year)	Less frequently than annually
An MSM patient who is HIV negative and taking PrEP	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
An MSM patient who is HIV negative and not taking PrEP who has a history of gonorrhea or chlamydia.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
An MSM patient who is HIV positive and has one main sexual partner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
An MSM patient who is HIV positive who has a history of gonorrhea and chlamydia and one main sexual partner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
An MSM patient who is HIV positive and has multiple sexual partners and no other STI history	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thinking back to your last 10 MSM patients in the past two years, how many of them did you recommended undergo syphilis screening?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- I have not seen 10 MSM patients in the past two years

---

How many of those patients recommended to undergo screening were actually screened? (Please enter a numeric value from **0-10**)

---

**Start of Block: Demographics**

Thank you for your responses. Please tell us a little about yourself

**How would you best describe the setting(s) where you currently practice medicine? (Please check all that apply)**

- Hospital (Private)
  - Hospital (Public)
  - Group Practice
  - Individual Practice
  - Academic
  - Private Primary Agency/Primary Care/Clinic
  - Specialty Practice (eg, LGBT, HIV)
  - Public or non-profit Agency/Primary Care/Clinic
- 

**In what region of the US do you currently provide healthcare?**

- Midwest - IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI
  - Northeast - CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT
  - Southeast - AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV
  - Southwest - AZ, NM, OK, TX
  - West - AK, CA, CO, HI, ID, MT, NV, OR, UT, WA, WY
-

Are you currently practicing in Philadelphia, PA?

No

Yes



What ZIP code is your practice located in?

---

What type of clinician are you?

Nurse practitioner

Primary Care Physician

Specialist Physician

Resident or Fellow (Physician)

Physician Assistant

Other (specify) \_\_\_\_\_



Do you have a specific specialty?

No

Yes

**What area(s) of medicine do you consider your specialty?**

Anesthesia

Cardiology

Dermatology

Endocrinology

Family medicine

Gastroenterology

Gynecology

Hematology

Immunology

Infectious disease

Nephrology

Obstetrics

Oncology

Pathology

Pediatrics

Pulmonology

Sexual health

Urology

Other (please specify) \_\_\_\_\_

**How many years post-residency/training are you?**

Less than 10 years

10-20 years

More than 20 years

Still in residency or training

**How would you describe yourself?**

Male

Female

Trans Male/Trans Man

Trans Female/Trans Woman

Genderqueer/Gender Nonconforming

A different identity not listed (please specify)

\_\_\_\_\_

-----  
**What sex were you assigned at birth, such as on an original birth certificate?**

Male

Female

**Do you consider yourself to be:**

- Heterosexual or straight
  - Gay
  - Lesbian
  - Bisexual
  - Other not listed (please specify) \_\_\_\_\_
- 

**Do you consider yourself to be Hispanic or Latinx?**

- Yes
  - No
- 

**How do you identify your race?**

- White/Caucasian
- Black/African American
- Asian or Pacific Islander
- Native American or Alaskan Native
- Multiracial (please specify) \_\_\_\_\_
- Other (please specify) \_\_\_\_\_

**End of Block: Demographics**

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