Title
Evaluating an online patient engagement platform and smartphone application that notifies clients of sexually transmitted infection test results

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Publication Date
2016

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA

Los Angeles

Evaluating an online patient engagement platform and smartphone application that notifies clients of sexually transmitted infection test results

A dissertation submitted in partial satisfaction of the

requirements for the degree of Doctor of Philosophy

in Public Health

by

Adam Carl Cohen

2016

ABSTRACT OF THE DISSERTATION

Evaluating an online patient engagement platform and smartphone application that notifies clients of sexually transmitted infection test results

by

Adam Carl Cohen

Doctor of Philosophy in Public Health

University of California, Los Angeles, 2016

Professor Deborah C. Glik, Chair

Background: The Centers for Disease Control and Prevention (CDC) reports that men have recently experienced a rise in rates of sexually transmitted infections (STIs)—particularly chlamydia, gonorrhea, and syphilis. While STI testing has improved in cost, portability, and accuracy, STI notification still relies on telephone calls. Prompt STI notification is critical to reduce the number of days between STI test and STI treatment in order to stop future STI transmissions and prevent long-term health complications. In 2014, AIDS Healthcare Foundation (AHF) began implementing Healthvana, an online patient engagement platform and smartphone application, to notify AHF Wellness Center clients of STI test results. The primary study objective of this dissertation is to determine whether Healthvana reduced the number of days between STI test, notification, and treatment for male clients. The secondary study objective of this dissertation is to better understand the characteristics of clients who opted in to Healthvana.

Methods: STI test, notification, and treatment data as well as risk assessment data from 18 AHF Wellness Centers between January 1, 2014 and December 31, 2015 were retrospectively collected. Male clients were included in the cross-sectional analysis if they were tested, notified, and treated for STIs (n = 1,460). Ordinary least squares and Poisson regressions were utilized to analyze differences in the mean number of days between STI test, notification, and treatment. Logistic regressions were utilized to analyze the difference between clients who did not opt in to Healthvana and clients who opted in to Healthvana.

Results: The mean number of days between STI test and notification was reduced by 22 percent following Healthvana implementation, from nine days to seven days ($p < 0.001$). Overall, Healthvana implementation reduced the total days between STI test and treatment by two days, from 13 days to 11 days ($p = 0.022$). Clients under the age of 25 years experienced greater odds of opting in to Healthvana than clients who were 30-39 years old ($p = 0.027$) and clients who were aged 40 years and older ($p = 0.004$). Healthvana implementation at AHF Wellness Centers demonstrates a significant reduction in the number of days to STI treatment.

The dissertation of Adam Carl Cohen is approved.

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2016

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LIST OF ACRONYMS AND INITIALISMS

ACA	Affordable Care Act
AHF	AIDS Healthcare Foundation
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
DIS	Disease intervention specialist
GPS	Global positioning system
HIV	Human immunodeficiency virus
HPV	Human papillomavirus
iOS	Apple Inc. iPhone operating system
IRB	Institutional Review Board
IRR	Incidence rate ratio
MSM	Men who have sex with men
OLS	Ordinary least squares
OR	Odds ratio
SMS	Short message service
STI	Sexually transmitted infection

SIGNIFICANCE TESTING AND DATA TABLES

Unless otherwise stated, a significance level of $\alpha = 0.05$ is used for all statistical tests to determine statistical significance and all table percentages are row percentages.

ACKNOWLEDGEMENTS

I would like to acknowledge AIDS Healthcare Foundation and Healthvana for providing the data. I would also like to acknowledge Matthew Beymer for being a true friend and colleague. To quote author Chuck Palahniuk in his novel “Invisible Monsters” (1999), “Nothing of me is original. I am the combined effort of everybody I’ve ever known.”

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University of California, Los Angeles 2008-2010
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Public Health Consultant, AIDS Healthcare Foundation 2012-2016
Implement and promote the Los Angeles County and California Safer Sex in the Adult Film Industry Act ballot initiatives through social media, social marketing, and advocacy campaigns.

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CHAPTER 1: INTRODUCTION

Sexually transmitted infections among men

According to the Centers for Disease Control and Prevention (CDC), men in the United States account for 49 percent of the nearly 20 million new sexually transmitted infections (STIs) each year (CDC 2013). While infections among men are fewer overall compared to women, the rate of STIs—specifically chlamydia, gonorrhea, and syphilis—have disproportionately affected men in recent years (CDC 2014a). According to Kalmuss & Tatum (2007), the healthcare system in the United States fails to provide adequate sexual health services for men because STI testing guidelines lack consensus and guidance. As a result, fewer than one in five physicians screen men for chlamydia, gonorrhea, or syphilis, according to a national survey of healthcare providers (St. Lawrence et al. 2002). In contrast, women receive regular STI testing through gynecological exams and are encouraged to test annually (CDC 2014b).

The CDC reports STIs are rising at an alarming rate among men. Between 2009 and 2013, the rate of chlamydia for men increased 21.0 percent while the rate for women only increased 6.2 percent (Figure 1.1) (CDC 2014a). In the same time frame, the rate of gonorrhea for men increased 20.3 percent while the rate for women decreased 2.0 percent (Figure 1.2) (CDC 2014a). Lastly, between 2009 and 2013 the rate of primary and secondary syphilis for men increased 32.1 percent while the rate for women decreased 35.7 percent (Figure 1.3) (CDC 2014a). (See Chapter 4 for more information about chlamydia, gonorrhea, and syphilis.)

Figure 1.1: Chlamydia rates per 100,000 population by sex, United States, 2009-2013 (CDC 2014a)

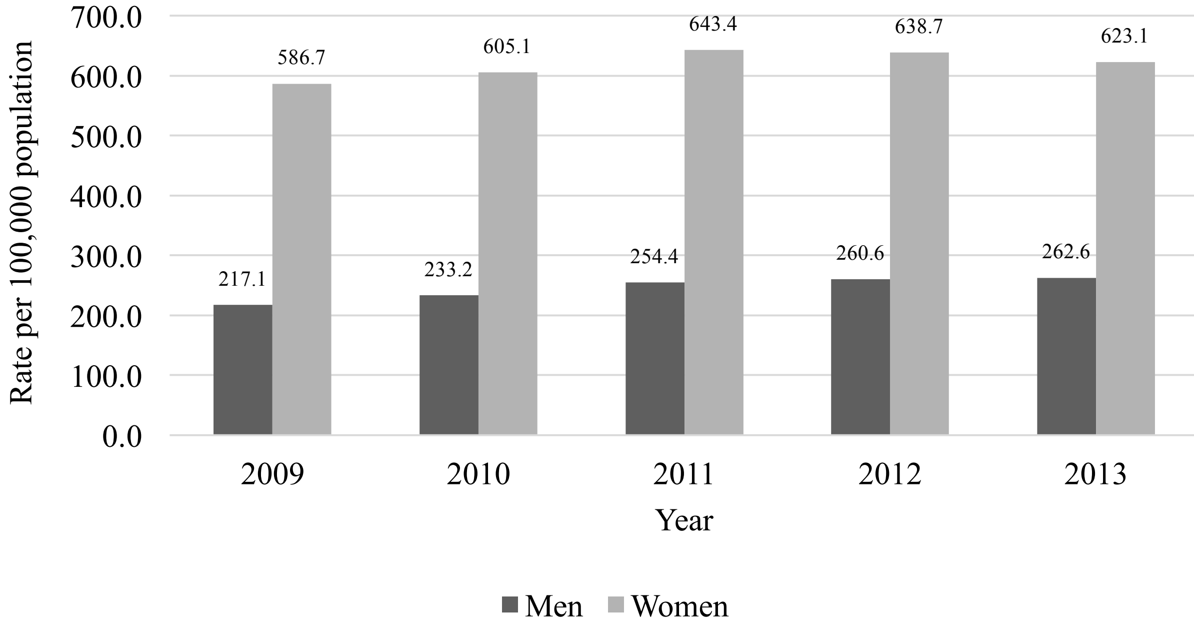


Figure 1.2: Gonorrhea rates per 100,000 population by sex, United States, 2009-2013 (CDC 2014a)

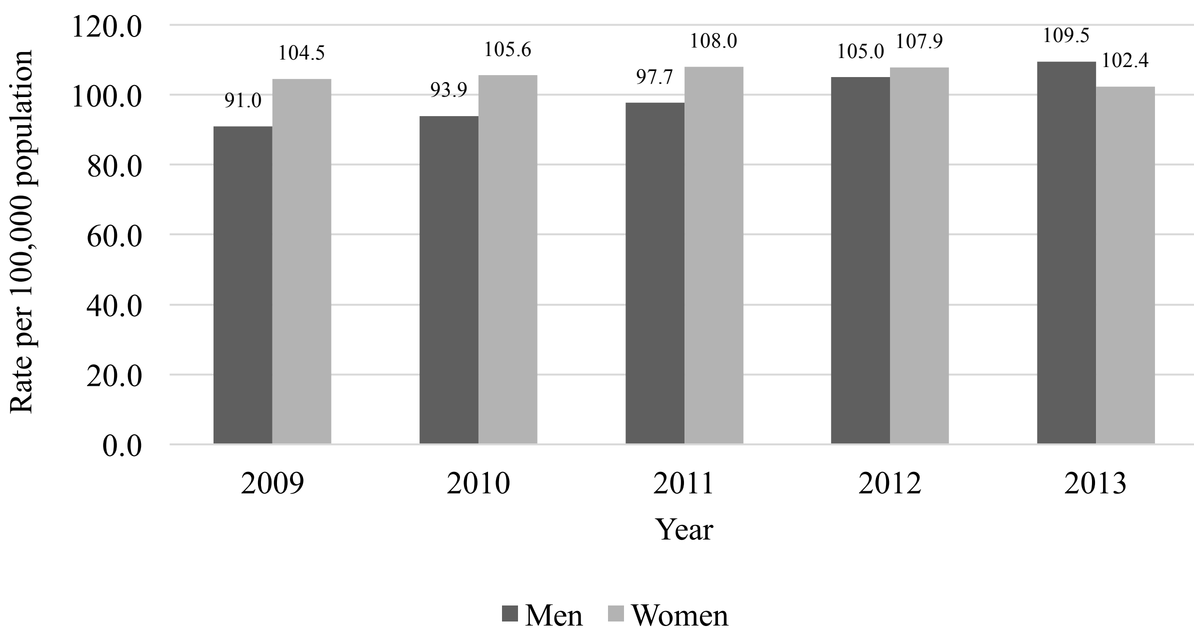
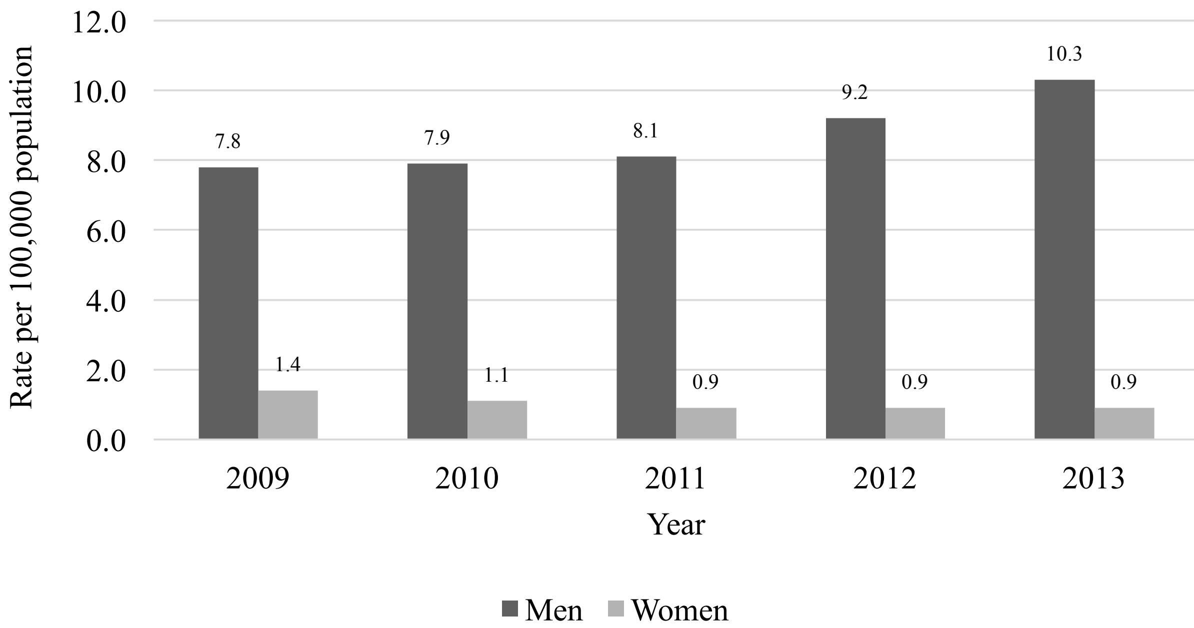


Figure 1.3: Primary and secondary syphilis rates per 100,000 population by sex, United States, 2009-2013 (CDC 2014a)



Chlamydia, gonorrhea, and syphilis can be successfully treated and cured if diagnosed early, however these three infections can lead to serious health complications if left untreated (Hunter et al. 2014). To add, delayed treatment will not undo the damage caused by these three STIs. Studies have also found that chlamydia, gonorrhea, and syphilis may facilitate the transmission of the human immunodeficiency virus (HIV) (Mayaud & McCormick 2001). These three STIs can be cured at relatively low cost, but subsequent HIV infections would require nearly half a million dollars in lifelong treatment and healthcare services per person (CDC 2013, Schackman BR et al. 2006). Therefore, STI services are an essential component of health promotion and disease prevention to reduce the risk of HIV acquisition, stop future STI transmissions to others, and prevent long-term health complications caused by untreated STIs (CDC 2013).

Disparities in STI data among men

The CDC suggests that the difference in rates between men and women may be due to improved diagnosis and case reporting, increased extra-genital testing (e.g., oropharyngeal and rectal screenings), and/or a rise in overall transmission (CDC 2014a). In addition, the CDC points to risky sexual behaviors as a factor contributing to increased STI rates among men in the United States (CDC 2014a). Risky sexual behaviors include—but are not limited to—having a history of STIs, having a large number of partners, and engaging in sex without the use of condoms (CDC 2014a). However, with the exception of syphilis, it is difficult to solely attribute increasing national STI rates among men to risky sexual behaviors because national STI data for chlamydia and gonorrhea do not include such behavioral data. Specifically, the CDC only publishes nationwide reports on positive chlamydia and gonorrhea test results in tandem with basic demographics (e.g., age, race, ethnicity, and gender). The scientific literature often suggests high rates are based on risky sexual behaviors among gay, bisexual, and other men who have sex with men (collectively known as MSM). Due to the HIV epidemic in the United States—where MSM represent the vast majority of new infections—MSM have been urged to seek HIV and STI testing between once every three months and once per year, depending on the individual's risky sexual behaviors (CDC 2014a). If women receive the most STI testing through annual gynecological exams, MSM likely represent a very close second. Heterosexual men, on the other hand, lag in a very distant third because the CDC does not include STI testing recommendations for heterosexual men other than an HIV test at least once in their lifetime (CDC 2014b).

It is important to note that the standard care for STI testing clinics has improved in recent years—particularly in STI cost, portability, and accuracy—which may help explain why national

STI data have found a sudden rise in overall STI rates among men. While it is not entirely a self-fulfilling prophecy to solely associate improved testing with higher diagnosis rates—as risky sexual behaviors can still weave a web of STI transmission—healthcare providers have worked to ensure all clients who seek STI services receive low cost, accessible, and high quality STI services. (See Chapter 4 for more information about the standard care for STI services.)

Nationwide campaigns to encourage STI testing have existed for decades. Post-World War I posters depicted images such as a soldier with an eagle perched on his shoulder and the message “stamp out venereal diseases” (Library of Congress, 2016). Such forms of traditional media (e.g., posters, billboards, and television commercials) are still in use today, but many STI campaigns have turned to digital media to reach adolescents and young adults where they spend most of their time: online. Digital media include internet-based campaigns such as Get Yourself Tested, an online campaign that partnered with Viacom in order to increase STI testing (Kaiser Family Foundation 2012, Friedman et al. 2014). Unfortunately, there is little evidence demonstrating that nationwide sexual health campaigns impact anything beyond knowledge and awareness (Friedman et al. 2014, Guse et al. 2012). According to Friedman et al. (2014), the limitations of STI-focused campaigns in the United States combined with the stigma associated with STI testing itself lead to modest behavior change effects. As reported rates of chlamydia, gonorrhea, and syphilis continue to rise among men in the United States, public health professionals and healthcare providers must consider novel approaches to bring STI services to the forefront of men’s sexual health.

Novel approaches to STI services

With the advent of accurate diagnostic screening tools, vaccinations, effective antibiotic treatments, and suppressive antiretroviral therapies, it would appear public health professionals and healthcare providers are unequivocally prepared to add STIs to the eradication list, next to smallpox. Unfortunately, cheap, fast, and effective testing and treatment tools have not necessarily reduced the incidence rate of STIs in the past decade because clinics are dependent on a weak link: the client not only has to seek regular STI testing, but also has to return for STI treatment at a later date in the event of a positive test result. While it is imperative for public health professionals and healthcare providers to identify people at risk, encourage regular testing, and provide appropriate treatment, there must exist an infrastructure that takes into account what Low et al. (2006) cites as "individual factors, cultural values, geography, demography, economics, health service, and political and legal structures" that may hinder successful STI treatment following a positive STI test result.

In the United States, the demand for STI testing clinics that can provide high quality services is expected to grow as rates continue to rise among men. This demand also stems from the recently passed Affordable Care Act (ACA), which has improved access to primary healthcare for millions of Americans (Dombrowski & Golden 2013). In order to accommodate the growing number of men seeking STI testing, clinics must take action to improve quality of care and client satisfaction (Dombrowski & Golden 2013).

According to mathematical modeling conducted by Aral & Roegner (2000), reducing the time between STI test and STI treatment proportionally reduces the risk of re-infection. STI testing has improved in cost, portability, and accuracy (Peeling 2006). Unfortunately, STI notification has not. Traditionally, clinic staff members call clients on the telephone to notify clients of positive STI test results (Rodriguez-Hart et al. 2015, Menon-Johansson et al. 2006). However, the number of days between the lab results returning to the STI testing clinics, successful contact with the client by telephone call to notify the client of a positive test result, and subsequent follow-up STI treatment may be hindered due to factors such as incorrect contact information, missed calls, impacted clinic flow, or too few clinic staff members (Brook et al. 2010, Rodriguez-Hart et al. 2015). STI notification interferences are especially disconcerting considering the fact that a significant proportion of clients who test positive for STIs fail to return for treatment (Hayes 2012, Lim et al. 2008, Schwebke et al. 1997). In addition, making telephone calls requires substantial clinic staff time, sometimes hundreds of hours per month, because staff may repeatedly attempt to contact clients by telephone call because positive STI test results cannot be left on a client's voicemail (Menon-Johansson et al. 2006).

Smartphones and smartphone applications

In order to successfully reach clients in the 21st century, public health professionals and healthcare providers have turned to advancements in smartphone communication technology to notify clients of positive STI test results (Bert et al. 2014). Smartphones are cellular devices with a camera, global positioning system (GPS), and wifi capability on mobile operating systems such as Android, iOS (iPhone), Windows Phone, and BlackBerry (Ozdalga et al. 2012, Boulos et al. 2011). Smartphones allow users to engage in digital activities similar to a personal computer except with the convenience of pocket-sized, wireless mobility (Luxton et al. 2011). According to the Pew Research Center (2015), 64 percent of Americans owned smartphones in 2014, a significant increase from 35 percent in 2011. In contrast to telephone calls to notify clients of STI results, smartphone notifications are automatic, immediate, and stored in a client's personal account until that client is ready to read the message.

Smartphone applications represent a high quality tool within the smartphone medium for healthcare communication. Smartphone applications are self-contained programs that either come with a smartphone or are downloaded to the smartphone. At present there are anywhere between 7,000 and 100,000 smartphone applications dedicated to health, on a continuum from simple to comprehensive and with varied degrees of evaluation in utilization and effectiveness (Kailas et al. 2010, Powell et al. 2014, Kamerow 2013).

Health-dedicated smartphone applications provide internet-based services such as health information resources, social networks, GPS-based physical exercise measurements, and communications from public health professionals and healthcare providers (Weinstein et al. 2014). As smartphones improve in capacity, speed, and security, researchers are increasingly interested in whether smartphone applications will provide the much-needed clinical efficiency for modern healthcare delivery systems. While it may be that smartphones offer a digital medium that can communicate relevant, tailored messages and information to clients in ways that are unmatched by any previous technology, the $64,000 question is whether smartphones improve public health. Specifically, and pertinent to this dissertation, do smartphone applications have utility in the STI testing clinic setting?

Public health professionals and healthcare providers have a novel opportunity to implement and evaluate smartphone applications in the STI testing clinic setting. This dissertation is about how one nonprofit organization—AIDS Healthcare Foundation (AHF)—implemented a new online patient engagement platform and smartphone application called Healthvana to notify clients of positive STI test results. The purpose of this dissertation is to evaluate Healthvana as a digital medium in order to determine whether Healthvana can successfully reduce the number of days between STI test, notification, and treatment.

AIDS Healthcare Foundation

Los Angeles-based AHF is the largest global HIV nonprofit that provides HIV-related services to nearly 600,000 patients in 36 countries. Officially established in 1987 as the AIDS

Hospice Foundation, AHF initially provided a safe and compassionate space for people who were dying from complications related to Acquired Immune Deficiency Syndrome (AIDS). Three years later, AHF changed its name to AIDS Healthcare Foundation to focus on HIV treatment and medical care. Today, AHF's mission is to provide "cutting-edge medicine and advocacy, regardless of ability to pay" (AIDS Healthcare Foundation, 2014).

AHF opened its first HIV and STI testing clinic in Hollywood, California to provide free, comprehensive HIV and STI testing and treatment services for men. Today, AHF operates 18 testing clinics—known as AHF Wellness Centers—in the United States (Table 1.1). AHF receives funding through federal grants, private donations, and the Health Resources and Services Administration 340B Drug Pricing Program to cover the staff, rent, and equipment costs of AHF Wellness Centers. In addition, a majority of the STI tests are paid for and/or reimbursed by government contracts, depending on the local health jurisdiction.

Each AHF Wellness Center offers free HIV and STI testing, notification, and treatment services in a non-traditional arrangement: on-demand, off-hours, and off-days. In other words, AHF Wellness Centers do not require appointments to be made in advance, are open in the evenings, and are open on the weekends. AHF utilizes this non-traditional clinic arrangement based on the notion that clients may be more likely seek HIV and STI testing and treatment services if they are convenient. AHF Wellness Centers do not offer obstetrics and gynecological services for women and do not prescribe hormonal contraception (i.e., medication for women containing estrogen and progestin to prevent pregnancy). As a result, the majority of clients who seek STI testing at AHF Wellness Centers are men.

Table 1.1: List of 18 AIDS Healthcare Foundation Wellness Centers by state and/or territory

AHF Wellness Center	Address
California	
Carl Bean	2146 W Adams Boulevard, Los Angeles, CA 90018
Hollywood	1300 N Vermont Avenue, Los Angeles, CA 90027
Long Beach	3500 E Pacific Coast Highway, Long Beach, CA 90804
Oakland	238 E 18th Street, Oakland, CA 94606
San Diego	3940 4th Avenue, Suite 140, San Diego, CA 92103
San Fernando Valley	4835 Van Nuys Boulevard, Suite 200, Sherman Oaks, CA 91403
San Francisco	518A Castro Street, San Francisco, CA 94114
District of Columbia	
Benning Road	1647 Benning Road NE, Suite 303, Washington, DC 20002
Florida	
Biscayne	2900 Biscayne Boulevard, Miami, FL 33137
Broward	700 SE 3rd Avenue, Suite 200, Ft Lauderdale, FL 33316
Jackson	100 NW 170th Street, Suite 208, North Miami Beach, FL 33169
Jacksonville	2 Shircliff Way, Suite 900, Jacksonville, FL 32204
Beach	1510 Alton Road, Miami Beach, FL 33139
South Wilton Manors	2097 Wilton Drive, Wilton Manors, FL 33305
Illinois	
Chicago	2600 S Michigan Avenue, Suite LL-D, Chicago, IL 60616
Ohio	
Columbus	815 West Broad Street, Suite 350, Columbus, OH 43222
New York	
Brooklyn	475 Atlantic Avenue, Brooklyn, NY 11217
Texas	
Dallas	7777 Forest Lane, Suite B122, Dallas, TX 75230

AHF: AIDS Healthcare Foundation

Healthvana

Beginning July 7, 2014, AHF Wellness Centers began offering clients an opportunity to receive their STI test results from an online patient engagement platform and smartphone application developed by a company called Healthvana. Healthvana retrieves STI test results from laboratory databases and sends the results through an online patient engagement platform and smartphone application to clients. Targeting a generation of smartphone dependent "digital natives" (Prensky 2001), the goal of this partnership between AHF and Healthvana is to reduce the number of days between STI test, notification, and treatment. According to the creators of Healthvana, the online patient engagement platform and smartphone application "…allows clinics to handle patient intake and deliver lab results, next steps, care instructions, and reminders to patients in order to increase staff efficiency and patient retention" (Crockett 2015).

Clients who seek STI testing at AHF Wellness Centers are provided the option to opt in to receive STI test results by Healthvana. Clients who opted in to Healthvana receive an email notification with a link to set up a unique username and password on the official Healthvana online patient engagement platform or through the Healthvana smartphone application. It is important to note that clients who do not opt in to Healthvana continue to receive the same quality of care from AHF Wellness Centers; the only difference is the form of STI notification.

After a client receives STI tests and the laboratory technician uploads STI test results to the Healthvana online engagement platform and smartphone application, AHF Wellness Center clients who opted in to Healthvana receive an email with instructions to login to the online patient engagement platform and/or smartphone application using the client's recently created username and password. Once a client logs in to the Healthvana online patient engagement platform or smartphone application, the client's STI test results are immediately available for the client to read. Test results include site-specific positive or negative results for chlamydia (urine and rectal), positive or negative results for gonorrhea (urine, oropharyngeal, and rectal), positive or negative results for syphilis, and only negative results for the rapid HIV antibody test. (Healthvana does not provide positive or negative HIV test results based on the Aptima HIV RNA qualitative assay nucleic acid amplified test at the request of AHF.) The Healthvana online patient engagement platform and smartphone application also offers a searchable map of STI testing clinics throughout the United States, which includes a list of services offered, the cost of the services, hours of operation, and crowd-sourced reviews based on a five-star rating system.

Approach

In order to measure whether Healthvana reduces the number of days between STI test, notification, and treatment, AHF and Healthvana provided retrospective data for male clients who sought chlamydia, gonorrhea, and/or syphilis testing at any of the 18 AHF Wellness Centers between January 1, 2014 and December 31, 2015 (two years of data). This dissertation will conduct a cross-sectional analysis of a study population of 1,460 unique male clients who tested positive for chlamydia, gonorrhea, and/or syphilis at any of the 18 AHF Wellness Centers, were successfully notified of their positive STI test by telephone call or Healthvana, and returned for STI treatment. As a cross-sectional study design, the study population of 1,460 unique male clients will be separated based on Healthvana implementation status, notification type status, and Healthvana opt-in status.

Healthvana implementation status: Sixteen of the 18 AHF Wellness Center implemented Healthvana on a rolling basis between July 7, 2014 and November 18, 2015; two clinics—Dallas and Jacksonville—did not offer Healthvana at all during the study period (Figure 1.4). In order to determine Healthvana's effects at the clinic level, clients will be separated into pre-Healthvana and post-Healthvana. In other words, clients will be separated based on whether they sought STI testing at AHF Wellness Centers before Healthvana was implemented (pre-Healthvana) or after Healthvana was implemented (post-Healthvana). This analysis does not take into account whether each client opted in to Healthvana; rather, this analysis measures whether the overall implementation Healthvana reduced the number of days between STI test, notification, and treatment at the clinic level.

Figure 1.4: Healthvana implementation dates at 18 AIDS Healthcare Foundation Wellness Centers

Notification type status: In a separate analysis from Healthvana implementation status, clients will be separated into notified by telephone call or notified by Healthvana. In other words, clients will be separated based on whether they were first notified of a positive STI test result by telephone call or by Healthvana. This analysis does not separate clients by whether they opted in to Healthvana; rather, this analysis addresses the day each client was notified of their positive STI test result, and whether that STI notification came first from a telephone call or from Healthvana. For example, a client who opted in to Healthvana, did not check their STI test results on Healthvana, and instead was notified of their positive STI test results by telephone call would be placed in the group of clients who were notified by telephone call. This analysis measures whether notification by Healthvana reduced the number of days between STI test, notification, and treatment at the client level.

Healthvana opt-in status: In this analysis, clients will be separated into did not opt in to Healthvana and opted in to Healthvana. In other words, clients will be separated based on whether or not they initially opted in to Healthvana. This analysis does not separate clients by whether they were notified of their positive STI test results by Healthvana; rather, this analysis addresses whether or not clients initially opted in to Healthvana with the intention to receive their STI test results notification by Healthvana. Unlike Healthvana implementation status and notification type status, Healthvana opt-in status will be used to measure differences in demographics and risky sexual behaviors between clients who did not opt in to Healthvana and clients who opted in to Healthvana.

Significance

Prompt STI notification and treatment are critical components of STI testing to improve overall sexual health. This dissertation suggests that it is an AHF Wellness Center client's active participation in the Healthvana online patient engagement platform and smartphone application that reduces the number of days between STI test, notification, and treatment compared to clients who rely on STI notification by telephone call. This dissertation includes a theoretical framework based on three theories utilized in the public health scientific literature: the behavioral model of health service utilization, the social cognitive theory, and the uses and gratifications theory. The theoretical framework adapts components from each theory to ensure appropriate predictor and outcome variables are analyzed to determine whether Healthvana as a novel digital medium improves healthcare services for clients who seek STI testing at AHF Wellness Centers.

This dissertation was approved by the Institutional Review Board (IRB) at the University of California, Los Angeles (IRB #15-001578). This dissertation represents the first quantifiable analysis of Healthvana's impact on client services for AHF, which is timely as Healthvana moves forward with streamlining AHF Wellness Centers' electronic medical records. While the scientific literature surrounding novel approaches to STI testing include the use of text messaging notifications, this dissertation addresses the effects of newer technology—the smartphone application—on STI testing, notification, and treatment. This data set of clients who seek STI testing at AHF Wellness Centers provides an opportunity to better understand what happens when healthcare services traverse into the digital unknown of smartphone applications.

Summary

This chapter discussed the disproportionate rates of chlamydia, gonorrhea, and syphilis among men in the United States. In order to improve STI testing services for men, novel approaches in STI notification may be able to reduce the number of days between STI test, notification, and treatment. Chapter 2 addresses the theories surrounding media and healthcare utilization in order to frame Healthvana as a form of healthcare utilization for STI notification.

Chapter 2 concludes with a presentation of the theoretical framework that utilizes a majority of components from the behavioral model of health service utilization, as well as components from media effects theories. Chapter 3 discusses the study objectives, research questions, and hypotheses based on the theoretical framework found in Chapter 3 in order to comprehensively measure Healthvana's effects based on Healthvana implementation status, notification type status, and Healthvana opt-in status. Chapter 4 provides a literature review surrounding sexually transmitted infections, smartphone applications, demographics, and risky sexual behaviors outlined in the theoretical framework, study objectives, research questions, and hypotheses.

Chapter 5 discusses the research design and methods for measuring Healthvana's effects on STI testing, notification, and treatment as well as measuring which types of clients who seek STI services at AHF Wellness Centers opted in to Healthvana. Chapter 5 outlines the statistical tests that will be conducted in order to appropriately address the study objectives, research questions, and hypotheses. Chapters 6, 7, and 8 provide the statistical analyses based on Healthvana implementation status, notification type status, and Healthvana opt-in status, respectively. Lastly, Chapter 9 concludes the dissertation with a review of the findings, the strengths and limitations of the dissertation, and recommendations for future research.

CHAPTER 2: THEORETICAL FRAMEWORK

As digital media have grown in value, saturation, and reach in the 21st century, so too has interest in the critical theory of digital media's power to shape individual behavior, perceptions, responses to events, and normative practices. From a health communications perspective, theories that address media effects are more important for health behavior research than ever before. However, traditional behavioral science theories are also critical in the development and analysis of public health interventions because at the center of a public health problem is often a behavioral factor. This dissertation includes both media effects theories and behavioral science theories in order to frame a serious public health problem within the context of media effects. In other words, this chapter addresses the relationship between smartphone applications and sexually transmitted infections (STIs). More generally, this chapter aims to better understand how healthcare systems harness new media for special populations.

"The medium is the message"

According to Marshall McLuhan in *Understanding Media: The Extensions of Man* (1964), media effects are defined as the media's ability to change how individuals send, receive, and perceive information. However, it may not be the information presented in media that necessarily changes behaviors; rather, it is the medium through which the information is communicated that impacts behavior (McLuhan 1964). According to McLuhan, researchers interested in media effects largely miss the mark because researchers are too focused on media content (McLuhan 1964). It is the characteristics of the medium, says McLuhan, which merit scientific evaluation, and not just the content emitted to the audience (McLuhan 1964).

Whether or not McLuhan could have predicted the invention and mass adoption of the smartphone, his statement—"the medium is the message"—can still help researchers recognize that it is not the endless and immediate information, entertainment, and communication provided by smartphone applications that warrant understanding; rather, it is the fact that smartphone applications have created a new world in which users expect such endless and immediate information, entertainment, and communication. In addition, researchers interested in the effects of smartphone applications must move away from the traditional, passive audience and instead focus on active participation perpetuated by smartphone technology. There is no doubt that the smartphone has also expanded passive media consumption, but the smartphone has more importantly created an era of interactivity that encourages—if not mandates—active participation between the sender and the receiver of information, entertainment, and communication. For example, traditional media interaction in the 20th century involved turning a radio dial, clicking a television remote control, or turning the pages of a magazine or newspaper in order to passively consume one-directional media content. On the other hand, new technologies include input devices such as touchscreens, voice recognition software, and wireless communication; active participation is just as easy as turning a dial, changing a channel, or turning a page. These characteristics are known as "actionable properties" (Gibson 1977), and smartphone application designers build upon every actionable property available within the smartphone's operating system and hardware to encourage active participation and ultimately ensure continuous and ongoing application utilization. It is therefore not surprising that the most popular smartphone applications are specifically designed for active participation and include a well-oiled combination of information, entertainment, and communication: Facebook, Twitter, Instagram, and YouTube.

This dissertation is based on the idea that the Healthvana online patient engagement platform and smartphone application as an interactive participation medium enhances the message that prompt notification and treatment for sexually transmitted infections (STIs) are critical components of STI testing in order to improve overall sexual health. This dissertation suggests that it is the client's active participation in Healthvana that reduces the number of days between STI test, notification, and treatment compared to clients who rely on STI test results by telephone call. To better understand how the smartphone medium is the message, this dissertation includes a theoretical framework based on three theories utilized in the public health scientific literature: the behavioral model of health service utilization, the social cognitive theory, and the uses and gratifications theory.

The behavioral model of health service utilization

The behavioral model of health service utilization was initially proposed by Ronald Andersen in 1968 to measure individual and structural factors that either enable or hinder healthcare utilization (Andersen 1995). Andersen suggested that healthcare utilization is the intersection between the needs of the client and the services within the healthcare system, incorporating both individual and structural predictors of healthcare utilization (Babitsch et al. 2012).

Since 1968, Andersen's behavioral model has gone through four major iterations, and in 1995 Andersen recommended final amendments to his behavioral model—known as phase 4—that emphasize "the dynamic and recursive nature of a health services' use model which includes health status outcomes" (Andersen 1995). According to Andersen (1995), health service utilization is a function of three factors: predisposing factors, enabling factors, and need factors (Figure 3.1).

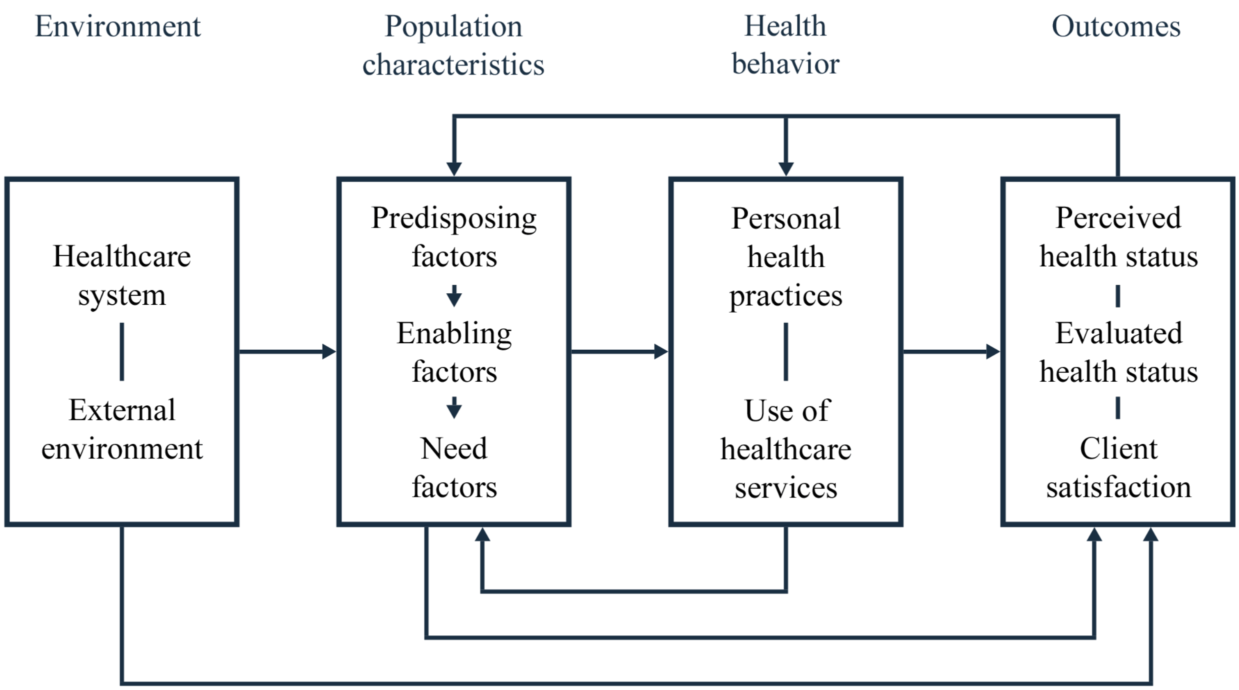
Predisposing factors: Predisposing factors represent an individual's demographics that exist prior to seeking healthcare services (Andersen 1995, Babitsch et al. 2012). Predisposing factors include demographics, such as age, race, ethnicity, and sexual orientation (Babitsch et al. 2012). Predisposing factors also include characteristics pertaining to health beliefs, including knowledge, attitudes, and values surrounding healthcare services (Babitsch et al. 2012). Lastly, predisposing factors include infrastructural and cultural characteristics, including education, occupation, and social networks (Babitsch et al. 2012).

Enabling factors: Enabling factors represent an individual's access to healthcare services based on financial and organizational conditions (Andersen 1995, Babitsch et al. 2012). Enabling factors include financial characteristics, such as income and health insurance (Babitsch et al. 2012). Enabling factors also include organizational characteristics, such as availability of clinic staff members, healthcare services, healthcare clinics, office hours, and staff-client ratios (Babitsch et al. 2012).

Need factors: Need factors represent an immediate need for healthcare services based on a client's potential or existing health problems (Andersen 1995, Babitsch et al. 2012). Need factors refer to perceived need, which includes how clients perceive their health, how clients experience disease symptoms, and how clients determine at what point to seek healthcare services (Babitsch et al. 2012). Need factors also refer to evaluated need, which includes how a healthcare provider evaluates a client's health status and need for healthcare services (Babitsch et al. 2012).

The behavioral model of health service utilization is one of the most frequently used theories to analyze how clients utilize healthcare services (Phillips et al. 1998). The model provides context within research surrounding healthcare utilization by including predisposing, enabling, and need factors as predictors of utilization. In Figure 2.1, Phase 4 of the behavioral model of health service utilization demonstrates how the model takes into account other characteristics, such as environmental factors, to better understand what factors influence healthcare utilization and, ultimately, health outcomes (Babitsch et al. 2012). Most importantly, Andersen's behavioral model of health service utilization takes into account the fact that health outcomes can affect future predisposing, enabling, and need factors that ultimately influence future health service utilization and health outcomes (Babitsch et al. 2012).

Figure 2.1: The behavioral model of health service utilization, phase 4 (Andersen 1995)



The behavioral model of health service utilization provides a comprehensive approach to analyzing operationalized predictors of the number of days between STI test, notification, and treatment for clients who seek STI testing at AIDS Healthcare Foundation (AHF) Wellness Centers. Within the model's enabling factors, the Healthvana online patient engagement platform and smartphone application represents an organizational communication medium. From the point of view of an STI testing clinic, the behavioral model of health service utilization provides a clear map to guide individual and structural predictors of STI test, notification, and treatment services.

The social cognitive theory

Albert Bandura's social cognitive theory posits that people's behaviors are dictated by a two-way interaction between the cognitive world and the environment, known as reciprocal determinism (Bandura 1986, Bandura 2001, Bandura 2002). To add, Bandura suggests that a person's ability to exercise a given behavior is also guided by that person's self-efficacy. In other words, as free agents people are proactive and self-regulating in their behaviors even when faced with personal and environmental barriers (Bandura 1986, Glanz & Rimer 1997). The remaining four constructs—behavioral capability, observational learning, reinforcements, and expectations—are applicable to media effects research because the social cognitive theory takes into account not only personal choices in media content but also how a person internalizes media's social construction of reality to reflect ideologies of human behaviors, cultural norms, and social structures (Gerbner et al. 1969, Bandura 1986, Bandura 2002).

The social cognitive theory contains three basic assumptions. The first assumption is that a person and their environmental factors influence each other in a reciprocal fashion (Bandura 2002). The second assumption of the social cognitive theory suggests that people can influence their own media consumption behaviors and their media environment based on their own interests and goals (Bandura, 2002). Unlike theories of one-way interaction between the media environment and consumers, the social cognitive theory assumes that people have influence over their surroundings. The third assumption is that learning does not necessarily translate to behavior change (Bandura 2002). In other words, learning and demonstration of learning are distinct courses of development. Bandura argues that learning requires an amalgamation of knowledge, cognitive skills, and new behaviors (Bandura 2002). Essentially, a person can learn a new behavior through media consumption but may not demonstrate that behavior until motivated to do so (Bandura 2002).

Cognitive theories in general have their limitations due to the narrow approach to behavior change through individual cognitions. First, the social cognitive theory places the expectation that environmental changes automatically lead to individual behavioral changes, but this may not be realistic. Second, Bandura does not discuss in depth the extent to which the interplay between a person, their behavior, and their environment occurs. Third, the social cognitive theory is very broad and may be difficult to operationalize in terms of media effects and health behaviors. However, according to Bandura (2002) the social cognitive theory addresses the "psychosocial mechanisms through which symbolic communication influences human thought, affect, and action" based on the media's influence on society. The social cognitive theory moves through all of the rings of the social ecological model in order to explain not only how the media both construct and reinforce social norms, but also how media consumers conform to norms, values, and practices that affect health behaviors and outcomes (Glanz & Rimer 1997, Bandura 2002).

Despite its limitations, the social cognitive theory is applicable to the smartphone application medium. Like the uses and gratifications theory, the social cognitive theory's frame of analysis places attitudes, cognitions, behaviors, and motives at the forefront of understanding why clients who seek STI testing may choose to be notified of their STI test results by Healthvana rather than by telephone call (Katz et al. 1973b). This dissertation will include the social cognitive theory within the theoretical framework in order to better understand Healthvana's effects on the study population of clients who sought STI services at AHF Wellness Centers.

The uses and gratifications theory

Coined by Jay Blumler and Elihu Katz in "The Uses of Mass Communications: Current Perspectives on Gratifications Research" (1974), the uses and gratifications theory is a psychological communication theory that explains how and why consumers utilize media to satisfy specific needs. In other words, while other media effects theories aim to understand what the media do to people, the uses and gratifications theory addresses how consumers actively choose the media that will satisfy their personal needs by asking "What do people do with media?" (Katz 1959, Katz et al. 1973a, Katz et al. 1973b, Blumler & Katz 1974, O'Donohue 1994, Ruggiero 2000, West & Turner 2006). Essentially, the uses and gratifications theory is about the drive for—rather than psychological effects of—media use.

There are two main assumptions found within the uses and gratifications theory. First, the theory assumes that consumers are active seekers of media (Conway 1991). In other words, the consumers aim to fulfill a need and will actively search for media content until that need is satisfied (Katz et al. 1973a). For example, if parents are interested in watching a science fiction series through an online video streaming service that is appropriate for all ages in order to watch the series with their children, the parents will choose media content based on those specific parameters: science fiction, online, and appropriate for children. Under this assumption, the consumer is a construct measured using individual attitudes, cognitions, behaviors, and motives (Katz et al. 1973a). The second assumption surrounds producers of media content, in which the uses and gratifications theory posits content producers must compete in the market for consumer gratifications. Therefore, the theory suggests that successful media are driven by consumer demand.

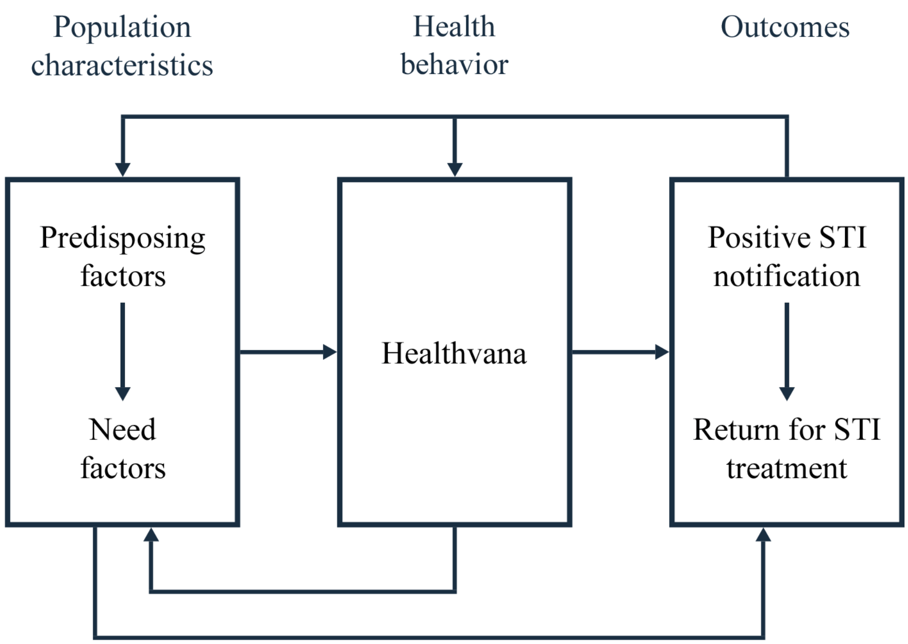
The uses and gratifications theory suggests that consumers are entirely self-aware of their media needs and subsequent choices, which means consumers do not appear to be manipulated or act at the whim of mass media's hegemony (Katz et al. 1973a). While it is drastic to assume the opposite—that individuals have no choice in the media they consume—to disqualify hegemony is to ignore the far-reaching power of media in our increasingly media-saturated society. Consumers may feel they have a choice of media to satisfy their needs, now that an unimaginable amount of content is available on a multitude of untethered mediums, but critical media theorists would argue that an individual's choice is still confined to the six vertically integrated media conglomerates: CBS, Disney, GE, News Corp, Time Warner, and Viacom Media Networks (Lutz 2012).

Despite its limitations, the uses and gratifications theory is applicable to the smartphone application medium. The theory's frame of analysis places attitudes, cognitions, behaviors, and motives at the forefront of understanding why clients who seek STI testing may choose to be notified of their STI test results by Healthvana rather than by telephone call (Katz et al. 1973b). This dissertation will include the uses and gratification theory within the theoretical framework in order to better explain why clients who seek STI testing at AIDS Healthcare Foundation (AHF) Wellness Centers would opt in to receive test results from the Healthvana online patient engagement platform and smartphone application.

Theoretical framework

The theoretical framework for this dissertation is largely an adaptation of the behavioral model of health service utilization. The uses and gratifications theory places the Healthvana online patient engagement platform and smartphone application as an enabling factor within the behavioral model of health service utilization. The social cognitive theory addresses the reciprocal determinism between the client and the Healthvana smartphone application. In order to determine whether Healthvana reduced the number of days between STI test, notification, and treatment among clients who sought STI testing at AHF Wellness Centers, Healthvana as a medium is the critical element in this dissertation's theoretical framework. Figure 2.2 demonstrates how the three theories will be utilized in this dissertation's theoretical framework.

Figure 2.2: Theoretical framework (Andersen 1995, Bandura 1986, Blumler & Katz 1974)



STI: Sexually transmitted infection

The three most important components of the theoretical framework include the predisposing factors, need factors, and Healthvana. Due to the nature of Healthvana in the healthcare setting, Healthvana is not only considered a health behavior but also a form of healthcare utilization. For the analysis conducted in Chapter 8, predisposing factors will include demographics such as age, race, ethnicity, and sexual orientation; need factors will include risky sexual behaviors such as having a history of STIs, number of partners in the past year, and condom use during last sex. These seven factors within the population characteristics represent predictors of opting in to Healthvana.

Healthvana is the most important component of the theoretical framework because Healthvana represents both a predictor variable and an outcome variable in terms of STI testing, notification, and treatment. As a predictor variable, Healthvana can be utilized based on Healthvana implementation status or notification type status. For Healthvana implementation status, clients can be separated based on whether Healthvana was implemented at AHF Wellness Centers, which represents an enabling factor at the clinic level. For notification type status, clients can be separated based on how they were notified of their positive STI test result, which represents an enabling factor at the client level. For both Healthvana implementation status and notification type status, Healthvana can be then utilized to predict the outcome variables surrounding the number of days between STI test, notification, and treatment.

As an outcome variable, Healthvana can be utilized based on Healthvana opt-in status. For Healthvana opt-in status, clients can be separated based on whether or not they opted in to Healthvana. Using population characteristics—demographics (predisposing factors) and risky sexual behaviors (need factors)—as predictor variables of STI acquisition, statistical tests can then measure the odds of opting in to Healthvana.

This theoretical framework addresses the study objectives discussed in Chapter 3, which are to measure the effects of Healthvana on the number of days between STI test, notification, and treatment, and to better understand the characteristics of clients who opted in to Healthvana. Due to the reciprocal determinism found within the behavioral model of health service utilization, Healthvana is both a predictor variable and an outcome variable. Healthvana is a predictor variable when addressing Healthvana implementation status and notification type status in order to measure the effects of Healthvana on the number of days between STI test, notification, and treatment. On the other hand, Healthvana is an outcome variable when addressing Healthvana opt-in status in order to measure which types of clients opt in to Healthvana. Combining theories surrounding behavioral science and media effects will help frame this dissertation as the study of a relationship between smartphone applications and STIs. The following chapter discusses the study objectives, research questions, and hypotheses surrounding Healthvana's effects on STI services at AHF Wellness Centers.

CHAPTER 3: STUDY OBJECTIVES, RESEARCH QUESTIONS, AND HYPOTHESES

As discussed in Chapter 2, digital media may have an effect on health behaviors. The main goal of this dissertation is to determine whether Healthvana—an online patient engagement platform and smartphone application—improves STI services for men who seek STI testing at AIDS Healthcare Foundation (AHF) Wellness Centers. This chapter discusses two study objectives, two research questions, and 13 hypotheses that will guide the analysis in subsequent chapters to evaluate Healthvana's effects on AHF Wellness Center clients.

Study objectives

Primary Study Objective: The Primary Study Objective of this dissertation is to retrospectively analyze STI test, notification, and treatment data from 18 AHF Wellness Centers in order to determine whether Healthvana reduced the number of days between STI test, notification, and treatment for clients. Using a cross-sectional study design, the Primary Study Objective frames an analysis at the clinic level in order to measure whether Healthvana ultimately improves clinic efficiency at AHF Wellness Centers.

Secondary Study Objective: The Secondary Study Objective of this dissertation is to better understand what type of AHF Wellness Center clients opted in to Healthvana when Healthvana was made available. This Secondary Study Objective will assist the Primary Study Objective by measuring factors that may be associated with opting in to Healthvana. Using a cross-sectional study design, the Secondary Study Objective frames an analysis at the individual level in order to predict which clients are most likely to opt in to new digital communication technology.

Research questions

Research Question 1: What is the effect of Healthvana on the number of days between STI test, notification, and treatment? In order to answer this research question, the study population will be separated by Healthvana implementation status and notification type status. For Healthvana implementation status, clients will be allocated to pre-Healthvana (before Healthvana was implemented at the clinic level) or post-Healthvana (after Healthvana was implemented at the clinic level). Since Healthvana was implemented on a rolling basis, the categories are based on both the date each AHF Wellness Center implemented Healthvana and the date each client sought STI testing. For notification type status, clients will be allocated to either notified by telephone call or notified by Healthvana. The category is based on whether the client was first notified of their positive STI test result by telephone call or by Healthvana. Research Question 1 corresponds with the Primary Study Objective to determine whether Healthvana reduces the number of days between STI test, notification, and treatment for AHF Wellness Center clients.

The analysis for Research Question 1 is based on records from individual clients and will utilize ordinary least squares (OLS) and Poisson regressions despite the fact that the outcome variables—days between STI test, notification, and treatment—are not normally distributed (refer to Figures 5.2-5.4). According to Lumley et al. (2002), linear regression models like OLS and Poisson are valid for sufficiently large samples. In addition, OLS and Poisson regression models have been selected over the Cox proportional hazards model because OLS and Poisson regressions measure the net effect of Healthvana on the number of days between STI test, notification, and treatment rather than the proportional effect. Under the Cox proportional hazards model, Healthvana's effects would be considered proportional on a single scale.

However, any changes in the number of days between STI test, notification, and treatment may not be proportional because not all AHF Wellness Centers are open every day.

Research Question 2: What are the differences in predisposing and need factors between clients who opted in to Healthvana and clients who did not opt in to Healthvana? In order to answer this research question, the study population will be separated based on whether they opted in to Healthvana. In order to answer this research question, data from logistic regressions will be utilized to determine which demographics (predisposing factors) and risky sexual behaviors (need factors) are associated with whether a client opted in to Healthvana. Logistic regressions are utilized to model the probability of an outcome—in this case, whether or not a client opted in to Healthvana—using an odds ratio. Using predisposing factors and need factors as predictor variables, logistic regressions will be used to measure the odds of opting in to Healthvana. Predisposing factors refer to a client's demographics, which include age, race, ethnicity, and sexual orientation. Need factors refer to a client's risky sexual behaviors, which include having a history of STIs, number of partners in the past year, and condom use during last sex. Research Question 2 addresses the Secondary Study Objective in order to better understand what type of clients from AHF Wellness Centers opted in to receive STI notification from Healthvana.

Healthvana implementation status hypotheses

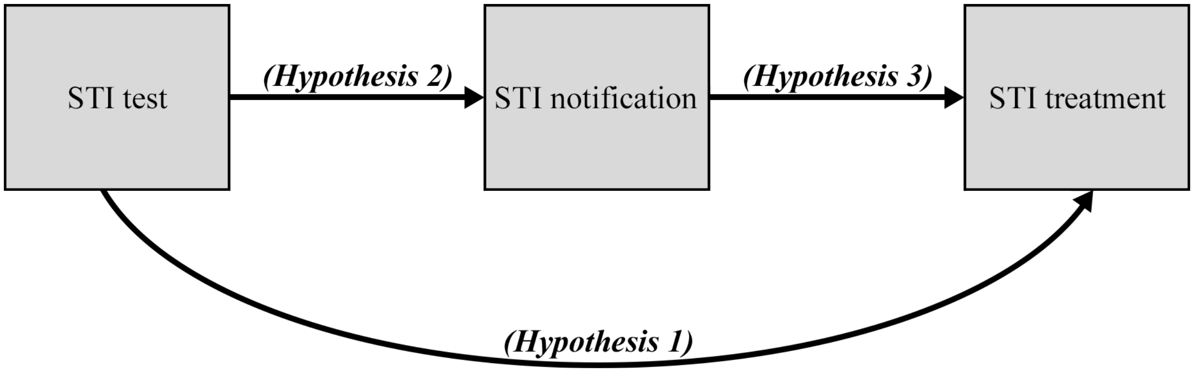
The three Healthvana implementation status hypotheses (Hypotheses 1-3) address the mean number of days between STI test, notification, and treatment based on data before Healthvana was implemented (pre-Healthvana) compared to data after Healthvana was implemented (post-Healthvana) (Figure 3.1). These three hypotheses correspond with the Research Question 1 and the Primary Study Objective.

Hypothesis 1: H_0: There is no difference in the mean number of days between STI test and STI treatment at AHF Wellness Centers after Healthvana was implemented (post-Healthvana) compared to AHF Wellness Centers before Healthvana was implemented (pre-Healthvana). H_A: There is a difference in the mean number of days between STI test and STI treatment after Healthvana was implemented (post-Healthvana) compared to before Healthvana was implemented (pre-Healthvana).

Hypothesis 2: H_0: There is no difference in the mean number of days between STI test and STI notification at AHF Wellness Centers after Healthvana was implemented (post-Healthvana) compared to AHF Wellness Centers before Healthvana was implemented (pre-Healthvana). H_A: There is a difference in the mean number of days between STI test and STI notification after Healthvana was implemented (post-Healthvana) compared to before Healthvana was implemented (pre-Healthvana).

Hypothesis 3: H_0: There is no difference in the mean number of days between STI notification and STI treatment at AHF Wellness Centers after Healthvana was implemented (post-Healthvana) compared to AHF Wellness Centers before Healthvana was implemented (pre-Healthvana). H_A: There is a difference in the mean number of days between STI notification and STI treatment after Healthvana was implemented (post-Healthvana) compared to before Healthvana was implemented (pre-Healthvana).

Figure 3.1: Visualization of Healthvana implementation status hypotheses



STI: Sexually transmitted infection

Notification type status hypotheses

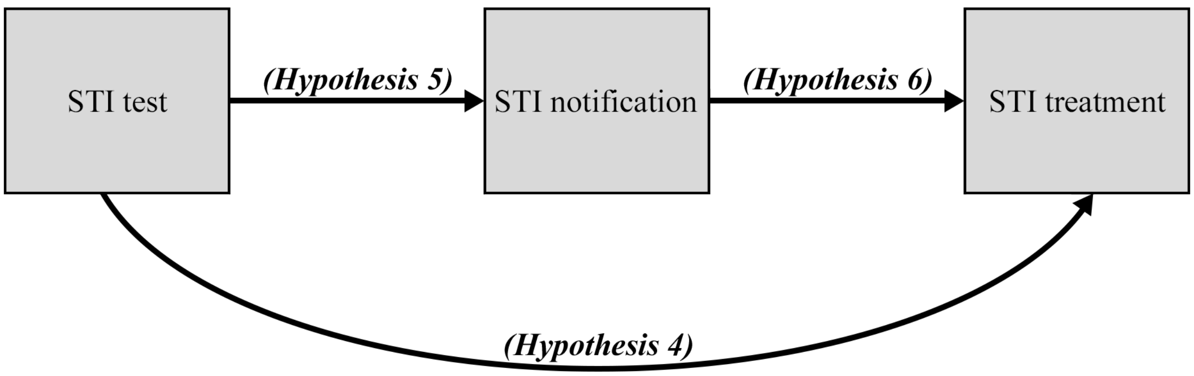
The three notification type status hypotheses (Hypotheses 4-6) address the mean number of days between STI test, notification, and treatment data for clients who were notified by telephone call compared to clients who were notified by Healthvana (Figure 3.2). These three hypotheses correspond with Research Question 1 and the Primary Study Objective.

Hypothesis 4: H_0: There is no difference in the mean number of days between STI test and STI treatment for clients who were notified by telephone call compared to clients who were notified by Healthvana. H_A: There is a difference in the mean number of days between STI test and STI treatment for clients who were notified by telephone call compared to clients who were notified by Healthvana.

Hypothesis 5: H_0: There is no difference in the mean number of days between STI test and STI notification for clients who were notified by telephone call compared to clients who were notified by Healthvana. H_A: There is a difference in the mean number of days between STI test and STI notification for clients who were notified by telephone call compared to clients who were notified by Healthvana.

Hypothesis 6: H_0: There is no difference in the mean number of days between STI notification and STI treatment for clients who were notified by telephone call compared to clients who were notified by Healthvana call. H_A: There is a difference in the mean number of days between STI notification and STI treatment for clients who were notified by telephone call compared to clients who were notified by Healthvana.

Figure 3.2: Visualization of notification type status hypotheses



STI: Sexually transmitted infection

Healthvana opt-in status hypotheses

The seven Healthvana opt-in status hypotheses are divided into two groups: demographics (predisposing factors) and risky sexual behaviors (need factors). The four demographics (predisposing factors) hypotheses (Hypotheses 7-10) are based on variables of age, race, ethnicity, and sexual orientation. The three risky sexual behaviors (need factors) hypotheses (Hypotheses 11-13) are based on variables of having a history of STIs, number of partners in the past year, and condom use during last sex. These seven hypotheses correspond with Research Question 2 and the Secondary Study Objective.

Hypothesis 7: H_0: There is no difference in self-reported age between clients who did not opt in to Healthvana and clients who opted in to Healthvana. H_A: There is a difference in self-reported age between clients who did not opt in to Healthvana and clients who opted in to Healthvana.

Hypothesis 8: H_0: There is no difference in self-reported race between clients who did not opt in to Healthvana and clients who opted in to Healthvana. H_A: There is a difference in self-reported race between clients who did not opt in to Healthvana and clients who opted in to Healthvana.

Hypothesis 9: H_0: There is no difference in self-reported ethnicity between clients who did not opt in to Healthvana and clients who opted in to Healthvana. H_A: There is a difference in self-reported ethnicity between clients who did not opt in to Healthvana and clients who opted in to Healthvana.

Hypothesis 10: H_0: There is no difference in self-reported sexual orientation between clients who did not opt in to Healthvana and clients who opted in to Healthvana. H_A: There is a difference in self-reported sexual orientation between clients who did not opt in to Healthvana and clients who opted in to Healthvana.

Hypothesis 11: H_0: There is no difference in self-reported history of chlamydia, gonorrhea, and/or syphilis infection between clients who did not opt in to Healthvana and clients who opted in to Healthvana. H_A: There is a difference in self-reported history of chlamydia, gonorrhea, and/or syphilis infection between clients who did not opt in to Healthvana and clients who opted in to Healthvana.

Hypothesis 12: H_0: There is no difference in self-reported number of partners in the past year between clients who did not opt in to Healthvana and clients who opted in to Healthvana. H_A: There is a difference in self-reported number of partners in the past year between clients who did not opt in to Healthvana and clients who opted in to Healthvana.

Hypothesis 13: H_0: There is no difference in self-reported condom use during last sex between clients who did not opt in to Healthvana and clients who opted in to Healthvana. H_A: There is a difference in self-reported condom use during last sex between clients who did not opt in to Healthvana and clients who opted in to Healthvana.

Summary

The Primary Study Objective of this dissertation is to determine whether STI notification by Healthvana reduced the time to STI treatment for clients (Table 3.1). Research Question 1, which is associated with the Primary Study Objective, addresses differences in the number of days between STI test, notification, and treatment based on Healthvana implementation status (Hypotheses 1-3). In other words, Hypotheses 1-3 are based on whether a client sought STI testing at AHF Wellness Centers before Healthvana was implemented (pre-Healthvana) or after Healthvana was implemented (post-Healthvana). Research Question 1 also addresses changes in the number of days between STI test, notification, and treatment based on notification type status (Hypotheses 4-6). In other words, Hypotheses 4-6 are based on whether a client was successfully notified by telephone call or successfully notified by Healthvana.

The Secondary Study Objective is to better understand which types of clients opted in to Healthvana. Research Question 2, which is associated with the Secondary Study Objective, addresses the demographics (predisposing factors) and risky sexual behaviors (need factors) of clients who did not opt in to Healthvana and clients who opted in to Healthvana (Table 3.1). The characteristics include demographics (predisposing factors) of age, race, ethnicity, and sexual orientation (Hypotheses 7-10,) and risky sexual behaviors (need factors) of having a history of STIs, number of partners in the past year, and condom use during last sex (Hypotheses 11-13, respectively).

The purpose of these study objectives, research questions, and hypotheses is to ultimately evaluate Healthvana's effects on AHF Wellness Center clients. In the next chapter, the variables addressed in the 13 hypotheses are reviewed based on each variable's utilization in the scientific literature. Chapter 5 then goes into greater detail surrounding how the statistical tests that will be utilized in order to evaluate the 13 hypotheses. In the remaining chapters, the research questions and study objectives will then be answered based on which null hypotheses are rejected.

Table 3.1: Summary of study objectives, research questions, and hypotheses

Study objectives	Research questions	Hypotheses
Primary	Research Question 1	Healthvana implementation status
		Hypothesis 1: STI test to STI treatment
		Hypothesis 2: STI test to STI notification
		Hypothesis 3: STI notification to STI treatment
Primary	Research Question 1	Notification type status
		Hypothesis 4: STI test to STI treatment
		Hypothesis 5: STI test to STI notification
		Hypothesis 6: STI notification to STI treatment
Secondary	Research Question 2	Healthvana opt-in status
		Hypothesis 7: Age
		Hypothesis 8: Race
		Hypothesis 9: Ethnicity
		Hypothesis 10: Sexual orientation
		Hypothesis 11: Having a history of STIs
		Hypothesis 12: Number of partners in the past year
		Hypothesis 13: Condom use during last sex

STI: Sexually transmitted infection

CHAPTER 4: LITERATURE REVIEW

Multiple factors may contribute to sexually transmitted infection (STI) acquisition and healthcare utilization among clients who seek STI testing at AIDS Healthcare Foundation (AHF) Wellness Centers. This chapter will first discuss the three STIs addressed in this dissertation—chlamydia, gonorrhea, and syphilis. In addition, this chapter will discuss the standard care in the United States for these three STIs. Next, this chapter will review the existing literature regarding smartphone applications. In addition, this chapter will review the existing research surrounding predisposing factors (demographics) in terms of healthcare utilization—in this case, Healthvana, the online patient engagement platform and smartphone application utilized at AHF Wellness Centers. Next, this chapter will review the existing research surrounding predisposing factors (demographics) and need factors (risky sexual behaviors) in terms of STI acquisition. Lastly, this chapter will summarize the overall findings in preparation for the following chapter on research design and methods.

Chlamydia

Since 1994, chlamydia has been the most commonly reported notifiable STI in the United States (CDC 2014a). Caused by the bacterium *Chlamydia trachomatis*, the transmission of chlamydia may occur—with or without ejaculation—through sexual contact with the penis, vagina, anus, or mouth of a partner who is infected with chlamydia (CDC 2014c). In addition, an individual who has been infected with chlamydia and received treatment may get infected again if that individual has unprotected sexual contact with an infected partner (CDC 2014c).

Most individuals infected with chlamydia exhibit no symptoms and display no physical abnormalities (CDC 2014c). In fact, up to 90 percent of men infected with chlamydia are asymptomatic (Farley et al. 2003, Korenromp et al. 2002). The incubation period for chlamydia is not well defined due to the bacterium's slow replication cycle; those who exhibit symptoms may not notice an infection until weeks after being exposed (CDC 2014c). For men who are symptomatic, symptoms are often specific to the anatomical site of infection. For example, men who are infected in the genitals may experience inflammation of the urethra—known as urethritis—which often leads to a mucus-like or watery discharge from the urethra and/or painful or difficult urination (CDC 2014c). A minority of men with a genital infection develop an inflammation of the epididymis—known as epididymitis—which can lead to testicular tenderness, swelling, and pain (CDC 2014c). For rectal chlamydia, which can infect men who engage in unprotected receptive anal sex with an infected partner, symptoms may include inflammation of the rectum and anus—known as proctitis—which can lead to rectal pain, discharge, and/or bleeding (CDC 2014c). Oropharyngeal chlamydia, where chlamydia is found in the throats of men who engage in unprotected oral sex with an infected partner, is most often asymptomatic and not likely to lead to the inflammation of the pharynx—known as pharyngitis or, more commonly, a sore throat (CDC 2014c). Lastly, conjunctivitis from chlamydia has been known to occur through eye contact with infected genital secretions (CDC 2014c).

The most sensitive diagnostic test for chlamydia is the nucleic acid amplification test (NAAT), which is performed on a urine specimen obtained from a client seeking STI testing. In addition, a clinic staff member must obtain an extra-genital swab specimen from the rectum to test for rectal chlamydia. For men who test positive for chlamydia, the infection is easily cured with a single injection of 250 milligrams of the antibiotic ceftriaxone. Men who receive treatment for chlamydia are requested to abstain from sexual encounters for one week after treatment to prevent the spread of chlamydia to other partners. While treatment will stop chlamydia, treatment will not repair any permanent damage to the body caused by the STI.

In 2013, there were 1,401,906 cases of chlamydia in the United States, a rate of 446.6 cases per 100,000 population (CDC 2014a). While the overall rate of chlamydia decreased 1.5 percent between 2012 and 2013, and the rate for women in particular decreased 2.4 percent, the rate actually increased 0.8 percent for men (CDC 2014a). Upon expanding the time frame, the evidence of the increasing burden for men is clear: between 2009 and 2013 the rate of chlamydia for men increased 21.0 percent while the rate only increased 6.2 percent for women (CDC 2014a).

Gonorrhea

Gonorrhea is the second most commonly reported notifiable STI in the United States (CDC 2014a). Caused by the bacterium *Neisseria gonorrhoeae*, gonorrhea transmission may occur—with or without ejaculation—through sexual contact with the penis, vagina, anus, or mouth of a partner who is infected with gonorrhea (CDC 2014c). In addition, an individual who has been infected with gonorrhea and received treatment may get infected again if that individual has unprotected sexual contact with an infected partner (CDC 2014c).

Most men who are infected with gonorrhea experience no symptoms (Peterman et al. 2006). For men who are symptomatic, gonorrhea symptoms include urethral infections such as painful or difficult urination—known as dysuria—and/or a green, yellow, or white urethral discharge (CDC 2014c). Some men infected in the genitals experience testicular or scrotal pain—known as epididymitis (CDC 2014c). For rectal gonorrhea, infections are most often asymptomatic, but some men experience symptoms including anal itching, soreness, bleeding, discharge, or painful bowel movements. Oropharyngeal gonorrhea infection may lead to pharyngitis, but gonorrhea in the throat is often asymptomatic.

Similar to chlamydia, the most sensitive diagnostic tests for gonorrhea is the NAAT and the test must be conducted at specific anatomical sites. A urine specimen obtained from a client seeking STI testing may be used to diagnose urogenital gonorrhea, but in order to diagnose oropharyngeal and rectal gonorrhea a clinic staff member must obtain extra-genital swab specimens from the throat and rectum, respectively. For men who test positive for gonorrhea, the infection can be cured with a single injection of 250 milligrams of ceftriaxone followed by one gram orally of azithromycin as directly observed therapy. While treatment will stop gonorrhea, treatment will not repair any permanent damage to the body caused by the infection. In recent years, the CDC has issued warnings of antimicrobial resistance in gonorrhea, which means not all treatments successfully remove the *Neisseria gonorrhoeae* bacterium from the body (CDC 2015a, Mayaud et al. 2001).

In 2013, there were 333,004 cases of gonorrhea in the United States, a rate of 106.1 cases per 100,000 population (CDC 2014a). For the first time since the year 2000, the rate of gonorrhea for men was higher than the rate for women at 109.5 versus 102.4 per 100,000 population, respectively (CDC 2014a). Between 2012 and 2013, the rate of gonorrhea for men increased 4.3 percent while the rate decreased 5.1 percent for women (CDC 2014a). Enlarging the time frame demonstrates an even greater disparity: between 2009 and 2013 the rate of gonorrhea for men increased 20.3 percent while the rate decreased 2.0 percent for women (CDC 2014a).

Syphilis

Syphilis infections have steadily increased in the United States since 2001, despite a successful decline by 89.7 percent between 1990 and 2000 (CDC 2014a). Caused by the bacterium *Treponema pallidum*, syphilis is transmitted by skin-to-skin vaginal, anal, or oral sexual contact with a chancre—also known as a syphilitic sore. Depending on where the initial exposure occurred, chancres caused by syphilis appear on the genitals, vagina, lips, or anus; in the rectum; or inside the mouth (CDC 2014c). An individual who has been infected with syphilis and received treatment may get infected again if that individual has unprotected sexual contact with an infected partner (CDC 2014c).

After an individual is infected with syphilis, the number of days between a syphilis infection and the start of the first symptoms can range from 10 to 90 days, but on average symptoms appear three weeks after an infection. The CDC refers to syphilis as the 'great pretender' because syphilis symptoms may be mistaken for other diseases. In addition, syphilis symptoms do not persist for very long, which means infected individuals may believe the symptoms were caused by a different non-serious malady. Syphilis follows a progression of stages, referred to as primary, secondary, latent, and late. Each stage can last weeks, months, or years.

The primary stage begins when an infected individual experiences the appearance of one or more chancres on or in the area where the exposure occurred. A chancre caused by a syphilis infection is often painless, round, and firm (CDC 2014c). The chancre lasts between three and six weeks and heals regardless of treatment. However, if an infected individual is not treated then primary syphilis progresses to secondary syphilis.

Secondary syphilis is marked by the appearance of skin rashes (CDC 2014c). Skin rashes may develop while the chancre is healing or weeks after the chancre has healed (CDC 2014c). The skin rashes often appear on the palm of the hands and the bottom of the feet as rough red or reddish brown spots (CDC 2014c). In addition to skin rashes, some infected individuals experience sores in the mouth, vagina, or anus—known as mucous membrane lesions—and some also experience large and raised white or gray lesions in the mouth, underarm, or genitals—known as condyloma lata (CDC 2014c). In addition to rashes that occur during secondary syphilis, other symptoms may include sore throat, headaches, patchy hair loss, weight loss, muscle aches, fever, swollen lymph glands, and fatigue (CDC 2014c). Secondary syphilis symptoms will heal with or without treatment. However, if an infected individual is not treated then secondary syphilis progresses to the latent and late stages of syphilis.

Latent syphilis represents the hidden third stage of syphilis once primary and secondary syphilis symptoms disappear (CDC 2014c). Latent syphilis is divided into two time-based categories: early latent and late latent. Early latent syphilis refers to a syphilis infection that occurred within the past year and late latent syphilis refers to a syphilis infection that occurred more than a year ago (CDC 2014c). Latent syphilis can last for years, and will continue to remain hidden unless it progresses to late stage syphilis. Individuals with latent syphilis experience no symptoms.

Late stage syphilis appears 10 to 20 years after an individual acquired syphilis, but only reaches this stage in around 15 percent of infected individuals (CDC 2014a). During the late stage, syphilis can seriously damage internal organs, including bones, joints, nerves, blood vessels, heart, eyes, and the brain (CDC 2014c). As a result, individuals who progress to late stage syphilis may experience paralysis, blindness, numbness, dementia, and even death (CDC 2014c).

Syphilis diagnosis involves two types of blood tests: a nontreponemal test and a treponemal test. A nontreponemal test—known as the rapid plasma reagin (RPR) test—is a blood test that detects nontreponemal antibodies that are present in the blood of individuals who have been infected with syphilis. While a nontreponemal test is simple and inexpensive, it is not sufficient for confirming a syphilis diagnosis. Individuals who test positive using a nontreponemal test also receive a treponemal test to confirm a syphilis diagnosis. A treponemal test—known as the fluorescent treponemal antibody absorption (FTA-ABS) test—detects treponemal antibodies, which appear in the body earlier than nontreponemal antibodies in the blood of individuals who have been infected with syphilis. This sequence of testing—a nontreponemal test followed by a treponemal test—is considered the standard testing procedure for STI testing clinics. If a treponemal test is used first and the test results are positive, a nontreponemal test is required to confirm a syphilis diagnosis. The treponemal test followed by the nontreponemal, test—known as the reverse testing procedure—is more convenient for laboratories but its clinical interpretation is problematic. The reverse testing procedure is not recommended because treponemal antibodies remain in the body of an individual who had been infected with syphilis in the past even if that individual had been successfully treated. The reverse testing procedure may therefore initially and incorrectly diagnose an individual with syphilis. Therefore, the CDC recommends that all STI testing clinics follow the standard syphilis testing procedure (CDC 2014c).

For men who test positive for syphilis, the infection can be cured with a single intramuscular injection of 2.4 million units of benzathine penicillin G for any stage. Men who receive treatment for syphilis are requested to abstain from sexual encounters for the week following treatment and, if a client is tested during the primary stage, until chancres are completely healed to prevent spreading syphilis to other partners (CDC 2014c). While treatment will stop syphilis, it will not repair any permanent damage to the body caused by the infection.

It is important to note the significant correlation between syphilis and HIV infection in the United States (CDC 2014a). Open sores caused by syphilis disrupt natural barriers, which make HIV transmission and acquisition easier (CDC 2014a). For example, chancres on the genitals from primary syphilis can bleed easily while in contact with mucous membranes during sexual encounters (CDC 2014a). For individuals who are already infected with HIV, neurological damage from syphilis increases as a result of the existing HIV infection (CDC 2014a).

In 2013, there were 17,375 cases of primary and secondary syphilis in the United States, a rate of 5.5 per 100,000 population (CDC 2014a). Between 2012 and 2013, the number of primary and secondary syphilis cases increased 10.9 percent, from 15,667 in 2012 to 17,375 in 2013 (CDC 2014a). This increase represented a rate change from 5.0 per 100,000 population in 2012 to 5.5 per 100,000 population in 2013 (CDC 2014a). Between 2012 and 2013, the rate of primary and secondary syphilis for men increased 12.0 percent while the rate for women remained unchanged (CDC 2014a). Upon expanding the time frame, the evidence of the increasing burden for men is clear: between 2009 and 2013 the rate of syphilis for men increased 32.1 percent while the rate decreased 35.7 percent for women (CDC 2014a). Of the three STIs, the change in syphilis rates is the most unsettling because the CDC cannot entirely explain why syphilis—an infection nearly dissipated by the turn of the century—has returned with a vengeance.

Standard care for STIs

Sexually transmitted infections (STIs) spread from sexual partnerships to larger sexual networks and ultimately to greater populations (Gross & Tyring 2011, Low et al. 2006). A population at highest risk for STIs can be attributed to a group of individuals—referred to in epidemiological research as core transmitters—who partake in both risky sexual behaviors and low health-seeking behaviors (Low et al. 2006). Core transmitters spread infections through sexual partnerships, which grow into sexual networks, and eventually bridge to the greater population (Low et al. 2006). Core transmitters can sustain and perpetuate an STI epidemic indefinitely (Low et al. 2006).

It is difficult for public health professionals and healthcare providers to directly target core transmitters for STI treatment, which is why public STI testing clinics in the United States are available for all clients who wish to receive STI testing. In addition, local public health departments hire disease intervention specialists (DIS) to work with STI testing clinics to help locate clients who were unable to be notified of a positive STI test result or did not return for treatment. In addition, DIS interviews clients who received a positive STI test result in order to obtain information of the client's sexual partner(s) and then notify the sexual partner(s) of their exposure to an STI. When an individual seeks care at an STI testing clinic, standard care involves three major elements: risk assessments, STI vaccinations, and STI testing and treatment (CDC 2014d).

Risk assessments: Clients who seek STI testing at an STI testing clinic in the United States often receive two risk assessments: behavioral and biological. A behavioral risk assessment requires a clinic staff member, such as a counselor or physician, to obtain details surrounding a client's risky sexual behaviors that may place that client at risk for infection. During a behavioral risk assessment, a clinic staff member may inquire about a client's sexual history using culturally sensitive, respectful, and nonjudgmental open-ended questions (e.g., "Tell me about any new sex partners since your last visit to an STI testing clinic," or "What has your experience with using condoms been like?") (CDC 2014d). Next, a clinic staff member may conduct a biological risk assessment, which requires a clinic staff member to screen a client for STIs based on the responses found in the client's behavioral risk assessment. STIs are considered biological markers of risky sexual behaviors. During the biological risk assessment, clients are informed about all the STIs for which the client is being tested (CDC 2014d). For example, if a client engages in unprotected receptive anal sex, a clinic staff member may recommend an extra-genital swab specimen collection from the rectum to test for rectal chlamydia and rectal gonorrhea.

Clients who are found to engage in risky sexual behaviors are encouraged by the clinic staff member to improve sexual health behaviors through methods such as regular condom use. Male and female condoms made of latex and polyurethane are widely promoted throughout the United States as forms of effective barrier protection to reduce STI transmission (Low N et al. 2006). Correct and consistent condom use can both protect an uninfected individual from acquiring an STI and also prevent an infected individual from transmitting an STI if the infection site is covered by the condom. Prospective studies by Holmes et al. (2004) and Winer et al. (2006) have found condom use to successfully reduce STI transmission. Unfortunately, despite its effectiveness and extremely low cost, consistent condom use has stagnated in the United States in recent years (CDC 2012).

STI vaccinations: Vaccines are listed among the ten great public health achievements in the 20th century (CDC 1999). The first vaccine that protected against an STI was for hepatitis B, an STI that is still a leading cause of liver cancer (Low et al. 2006). The hepatitis B vaccine is administered as a series of three intramuscular injections within a six-month period, which means the second dose is administered one month after the first dose and the third dose is administered six months after the first dose. The hepatitis B vaccine is recommended beginning at birth (CDC 2015c).

The second STI vaccine developed was against the human papillomavirus (HPV). Available in 2006, the HPV vaccine offers a high level of protection against strains that cause genital warts and cervical cancer (Low et al. 2006). The HPV vaccine is recommended for boys and girls during pre-teen years (e.g., 11 or 12 years old) in order to ensure the vaccine is provided before sexual debut (CDC 2015b, CDC 2015d). The HPV vaccine is administered as a series of three intramuscular injections within a six-month period, which means the second dose is administered one to two months after the first dose and the third dose is administered six months after the first dose (CDC 2015d). The expected repetition to seek annual STI testing is a far more difficult behavior to adhere to when compared to a one- to three-dose vaccination. Unfortunately, vaccines that protect against bacterial STIs—such as chlamydia, gonorrhea, and syphilis—have not yet been discovered. Therefore, clients must continue to seek out regular STI testing in order to reduce the risk of HIV acquisition, stop future STI transmissions to others, and prevent long-term health effects caused by untreated STIs.

STI testing and treatment: The CDC urges men who have sex with men (MSM) to screen at least once per year for HIV and STIs, and every three months for MSM who engage in risky sexual behaviors. On the other hand, the CDC provides no STI testing recommendations for heterosexual men (CDC 2014b), other than a single HIV test at least once in their lifetime. In addition, there is limited research in the scientific literature that address STI testing for heterosexual men. At-risk heterosexual men are not encouraged to seek testing at STI testing clinics; rather, researchers recommend heterosexual men receive client-delivered partner treatment outside of the clinic setting (Golden et al. 2005). Client-delivered partner treatment refers to a method of treatment where women who test positive for STIs are treated within the clinic setting and then provided additional treatment by a clinic staff member to be given to their male sexual partners outside of the clinic setting (Schillinger et al. 2003). The justification for client-delivered partner treatment is that men who have sex with women do not seek timely STI testing and treatment on their own (Schillinger et al. 2003, Golden et al. 2005). This may represent a self-fulfilling prophecy because, given that untested and untreated men, regardless of sexual behavior, are a growing source of infection, and that men who are infected with an STI often exhibit no symptoms, it appears that public health professionals and healthcare providers may not adequately address the imbalanced healthcare infrastructure that may inhibit men from seeking regular STI testing and treatment services. This disconnect ultimately triggers a misappropriation of men's responsibility to regularly get tested for STIs.

Smartphone applications

Prior to the development of smartphone applications, studies found overwhelming success with mobile phone short message services (SMS)—more commonly known as text messages—as a public health intervention tool (Lunny et al. 2014). Text messaging has been utilized to address a multitude of public health issues, such as smoking, diabetes, asthma, obesity, depression, cancer, and STIs (Obermayer et al. 2004, Lazev et al. 2004, Haug et al. 2012, Bielli et al. 2004, Hanauer et al. 2006, Benhamoua et al. 2007, Franklin et al. 2006, Kim 2007, Tasker et al. 2007, Martínez-Pérez et al. 2013, Krishna & Boren 2008, Yoon & Kim 2008, Nickels & Dimov 2012, Lv et al. 2012, Petrie et al. 2012, Baptist et al. 2011, Prabhakaran et al. 2010, Holtz & Whitten 2009, Strandbygaard et al. 2010, Van Der et al. 2007, Ostojic et al. 2005, Anhøj J & Møldrup 2004, Neville et al. 2002, Kubota et al. 2004, Lim et al. 2008).

Studies have demonstrated the value of text messaging to improve client services in STI testing clinics through appointment reminders, re-screening reminders, general information about STIs, sexual health promotion, assistance with partner treatment, and notification of STI test results (Hunter et al. 2014, Lim et al. 2008, Lester et al. 2010, Dyer 2003, Free et al. 2013, Guy et al. 2013, Downing et al. 2013, Kegg et al. 2004, Menon-Johansson et al. 2006, Dhar et al. 2006, Brugha et al. 2011, Pal et al. 2004, Gold et al. 2011, Bilardi et al. 2010, Tomnay et al. 2004, Hopkins et al. 2010, Newell 2001). To expand on text messaging's effects on STI notification, text messaging has been shown to decrease the number of days between STI notification and treatment (Hunter et al. 2014). For example, in a study by Menon-Johansson et al. (2006), clients who received positive test result for chlamydia by text message not only received their diagnosis sooner, but were also treated sooner compared to clients who received their positive test result by telephone call (Menon-Johansson et al. 2006). In the same study, the utilization of text messages for STI diagnosis also reduced the time spent by staff members to contact clients about positive test results (Menon-Johansson et al. 2006). According to a study by Lim et al. (2008), clients who sought STI testing overwhelmingly preferred text messaging over telephone calls for STI test results. Communication by mobile phones appears to be a favorable and preferred STI notification medium over telephone calls. In fact, in a study by Dhar et al. (2006), 100 percent of clients who received STI test results by text message were satisfied with the clinic's text messaging service.

While text messaging has demonstrated its effectiveness in medical and public health services—including STI test results notification—smartphone applications have not received the same level of attention (Hasman 2011). Smartphones have surpassed all other mobile phone ownership (Hightow-Weidman et al. 2014). In fact, 85 percent of young adults—the population most at-risk for STIs in the United States—owned a smartphone in 2014 (Pew 2015). According to Tucker (2011), smartphone applications have been recognized by the CDC and the United Nations as important tools in health promotion and disease prevention. This is due to the fact that smartphones have allowed individuals to become untethered to geographic boundaries and free to access vast amounts of information through a medium that fits comfortably in a pocket (Boulos et al. 2011). According to Boulos et al. (2011), the smartphone "provides an essential 'any time, any place' portal into the entire world wide web of knowledge," which gives public health professionals and healthcare providers an opportunity to utilize smartphone applications to promote healthy behaviors. Ninety percent of smartphone owners are within arms' reach of their smartphones 24 hours a day; traditional media simply cannot compete with that level of consistent exposure (Glynn et al. 2014).

Unfortunately, the majority of smartphone applications—including smartphone applications devoted to health—are neither developed using evidence-based research nor evaluated using scientific methods (Goyal et al. 2013, Donker et al. 2013, Direito et al. 2014). In addition, health-related smartphone applications currently on the market lack diversity, with the majority of smartphone applications targeting physical activity and weight management (Martínez-Pérez et al. 2013, Conroy et al. 2014, Lane et al. 2011). Smartphone applications that address other public health issues—such as cancer and smoking cessation—often lack proper evaluation (Bender et al. 2013, Direito et al. 2014). Ultimately, research surrounding the utilization of smartphone applications for public health interventions is still in its infancy.

To prepare for future scientific research surrounding smartphone applications, Eng et al. (2013) developed a guideline for researchers who are developing smartphone applications for public health interventions. According to Eng et al. (2013), a smartphone application's success is dependent upon a researcher's ability to: demonstrate effectiveness of a health-based smartphone application, integrate the health-based smartphone application into healthcare delivery services, and ensure the users of the smartphone application have accurate information surrounding its safety and utility. According to Muessig et al. (2013), there are 55 smartphone applications that address STIs and HIV. However, three-fourths of the 55 smartphone applications only provide passive information surrounding STIs and HIV. In addition, many of the smartphone applications devoted to STIs and HIV "failed to attract user attention and positive reviews" (Muessig et al. 2013). While smartphone applications that specifically address HIV regarding testing and antiretroviral therapy adherence have been evaluated and found to be relatively successful, there is very little research surrounding the effectiveness of smartphone applications surrounding other STIs (Sun et al. 2014, Perera et al. 2014, Holloway et al. 2014, Muessig et al. 2015, Besoain et al. 2015). According to Paneth-Pollak et al. (2010), smartphone applications that provide STI test results have the potential to help improve efficiency in the clinic setting due to the smartphone's streamlined and instantaneous communication of test results using electronic medical records.

The scientific literature overwhelmingly supports text messaging as a medium to improve STI testing and subsequent treatment because STI testing clinics can notify clients of positive STI test results faster than telephone calls (Rodriguez-Hart et al. 2015). One could argue that smartphone applications are unnecessary as text messaging interventions have already demonstrated success in the STI testing clinic setting. However, this may reflect the nature of scientific research—published peer reviewed literature often cannot keep up with the effects of novel technological advancements. Smartphone applications include numerous benefits that cannot be matched by text messaging. At the basic level, text messages are limited to alphanumeric characters, while smartphone applications are not limited by any characters. In addition, text messages rely on clients to actively respond that the message has been read; smartphone applications on the other hand can provide an automatic response back to the STI testing clinic about when and where clients checked their STI test results. Most importantly, smartphone applications include a myriad of software intricacies only limited by the smartphone's operating system and the designer's inventiveness while text messages are just that—messages in the form of text. Smartphone applications have the potential to offer STI test results to clients through a comprehensive and efficient manner that exceeds the rudimentary capabilities of text messaging.

Healthvana utilization

While smartphone ownership has increased in recent years, most available smartphone applications that address STIs have not received successful attention or positive reviews (Muessig et al. 2013). In order for Healthvana to demonstrate a significant reduction in number of days between STI test, notification, and treatment, AHF Wellness Center clients must first choose to opt in to the Healthvana online patient engagement platform and smartphone application. As described earlier in this chapter, there are multiple risk factors associated with STI acquisition. In a recent study conducted by the Pew Research Center, some of the risk factors discussed may also help describe the characteristics associated with clients who opted in to Healthvana.

Predisposing factors: According to the Pew Research Center (2015), smartphone utilization varies by age, race, and ethnicity. Eighty-five percent of adults aged 18-29 owned a smartphone compared to 54 percent of adults aged 50-64 (Pew 2015). One hundred percent of adults aged 18-29 used their smartphone for text messaging, 97 percent for internet use, 93 percent for voice or video calls, and 91 percent for email (Pew 2015). Most pertinent to Healthvana, 77 percent of adults aged 18-29 used their smartphone to look up health information (Pew 2015).

In terms of race, 61 percent of adults who self-identified as White and not Hispanic owned a smartphone, and 70 percent of adults who self-identified as Black or African American owned a smartphone (Pew 2015). In terms of ethnicity, 71 percent of adults who self-identified as Hispanic or Latino owned a smartphone (Pew 2015). The fact that high rates of STIs and smartphone ownership overlap among young men, men who self-identify as Black or African American, and men who self-identify as Hispanic or Latino is encouraging for Healthvana's utility at AHF Wellness Centers.

STI acquisition

Predisposing factors: As discussed in Chapter 3, predisposing factors within the context of the behavioral model of health service utilization are factors that represent a client's demographics that exist prior to seeking healthcare services. In this dissertation, predisposing factors include variables associated with the risk of STI acquisition that may have led clients to seek STI testing at AHF Wellness Centers: age, race, ethnicity, and sexual orientation.

Age is a strong predictor of STI acquisition; the Centers for Disease Control and Prevention (CDC) estimates that young people under 25 years old account for half of all new infections in the United States (CDC 2014a). According to Falasinnu et al. (2015), clinical recommendations surrounding STI acquisition risk recommend STI testing clinics specifically target young people. In 2013, men aged 20-24 accounted for the highest rate of chlamydia, gonorrhea, and primary and secondary syphilis compared to any other age (CDC 2014a).

According to the CDC (2014), race is associated with health status determinants such as low educational attainment and poverty. These determinants ultimately place people at risk for STI acquisition. People who self-identify as Black or African American experience higher rates of chlamydia, gonorrhea, and syphilis (CDC 2014a). Despite the high rates of STIs among people who self-identify as Black or African American, a study by Falasinnu et al. (2015) still suggests STI acquisition risk is only moderately associated with a client's race.

According to the CDC (2014), people who self-identify as Hispanic or Latino experience higher rates of chlamydia, gonorrhea, and syphilis compared to people who do not identify as Hispanic or Latino. In a study by Perez-Escamilla (2010), people who self-identify as Hispanic or Latino may face barriers associated with immigration or undocumented citizenship that negatively impact healthcare seeking behaviors, such as STI testing.

According to the CDC (2013), gonorrhea rates among men surpassed women in 2013, which the CDC attributed to increased transmission and improved screening among MSM. In terms of syphilis, MSM accounted for three-fourths of all primary and secondary syphilis cases in 2013 (CDC 2014a). According to a study by Mojola & Everett (2012), MSM were significantly more likely than heterosexual men test positive for an STI.

Need factors: As discussed in Chapter 3, need factors within the context of the behavioral model of health service utilization are factors that represent a need for healthcare services based on a client's risky sexual behaviors. In this dissertation, need factors include variables associated with the risk of STI acquisition that led clients to seek STI testing at AHF Wellness Centers: having a history of STIs, number of partners in the past year, and condom use during last sex.

Having a history of STIs is associated with the contraction of STI acquisition (Crosby et al. 2000). From a biological standpoint, chlamydia and gonorrhea are non-ulcerative STIs that lead to increased vulnerability to skin tearing, and syphilis is an ulcerative STI that leads to open lesions on or near the genitals, mouth, or anus. As a result, the inflammatory response from a previous STI may increase the risk for future infections. In addition, having a history of STIs may be indicative of a history of engaging in risky sexual behaviors. According to a study by Crosby et al. (2000), having a history of STIs is the strongest indicator of subsequent STI acquisition, especially among young people. On the other hand, Falasinnu et al. (2015) suggests having a history of STIs is weakly associated with STI acquisition.

Engaging in sexual acts with multiple partners is a risk factor associated with STI acquisition (Santelli et al. 1998, Baldwin & Baldwin 1988, Desiderato & Crawford 1995). According to Rosenberg et al. (1999), a greater number of partners is associated with an increased risk of STI acquisition. According to Falasinnu et al. (2015), clinical recommendations surrounding STI acquisition risk include clients who had multiple partners. However, Falasinnu et al. (2015) also found that multiple partners in the past month is only moderately associated with STI acquisition risk. On the other hand, having multiple lifetime partners—as opposed to multiple partners in the past month—is strongly associated with STI acquisition risk (Falasinnu et al. 2015).

Correct and consistent condom use is effective against STI acquisition (Guttmacher Institute 1999). However, Falasinnu et al. (2015) argues condom use is not strongly associated with STI acquisition risk. The authors argue that this limited association between condom use and STI acquisition risk may be due to the fact that self-reported condom use is an "enduring measurement problem" in STI research (Falasinnu et al. 2015).

Summary

The predisposing factors and need factors discussed in this chapter have been utilized in a similar study surrounding STI testing by Porter & Ku (2000). While predisposing factors, such as age, race, ethnicity, and sexual orientation are associated with existing STI rates in the United States, some studies suggest varying strengths of association. In addition, need factors such as having a history of STIs, number of partners in the past year, and condom use during last sex have varying strengths of association. However, the researchers discussed in this chapter agree that these seven predictor variables are associated with STI acquisition, even if the association is due to ancillary factors not available for this dissertation (e.g., income level).

Ultimately, the Primary Study Objective of this dissertation is to determine whether Healthvana implementation reduced the number of days between STI test, notification, and treatment. The Primary Study Objective does not rely on the predisposing and need factors discussed in this chapter because the predictor is Healthvana and the outcome is the number of days between STI test, notification, and treatment. It is the Secondary Study Objective that relies on the predisposing and need factors in order to determine what type of clients opted in to Healthvana.

CHAPTER 5: RESEARCH DESIGN AND METHODS

The data set analyzed in this dissertation contains sexually transmitted infection (STI) testing, notification, treatment, and risk assessment data provided by AIDS Healthcare Foundation (AHF) and Healthvana. Retrospective data were provided by AHF and Healthvana in order to conduct a cross-sectional study of Healthvana's effects on AHF Wellness Centers. This chapter will first describe how the data set is restricted to only include the study population of interest: men who received STI testing, notification, and treatment services at any of the 18 AHF Wellness Centers between January 1, 2014 and December 31, 2015 (two years of data). Next, this chapter will discuss how demographics (predisposing factors) and risky sexual behaviors (need factors) within the theoretical framework discussed in Chapter 3 are operationalized using the risk assessment data. Lastly, the chapter will discuss the analytical strategy for this dissertation.

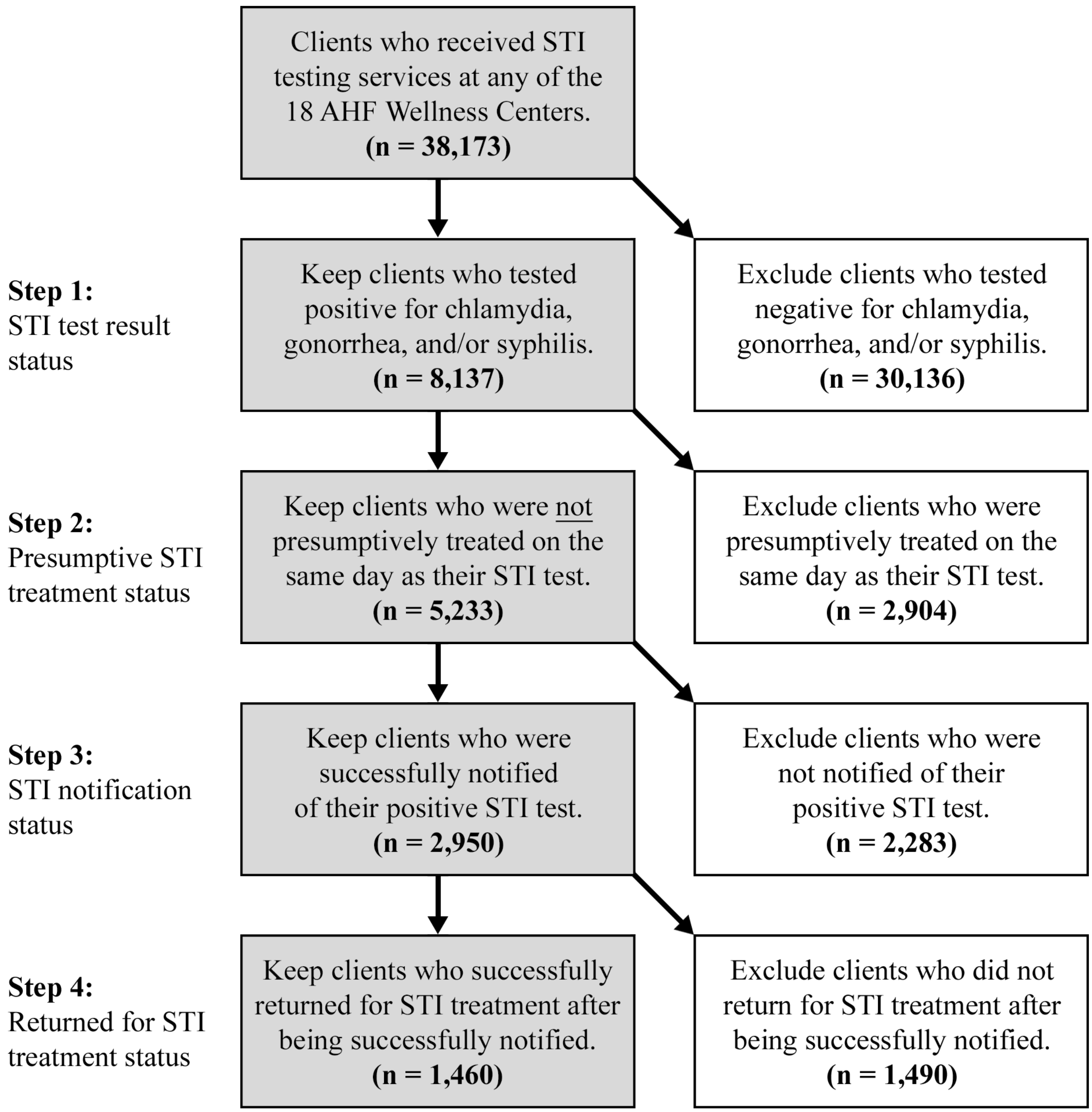
Study population

The data set for this dissertation contains STI test, notification, and treatment data as well as risk assessment data from clients who sought STI testing at any of the 18 AHF Wellness Centers between January 1, 2014 and December 31, 2015 (two years of data). This dissertation utilizes these data to measure whether Healthvana reduced the number of days between STI test, notification, and treatment as well as better understand which types of AHF Wellness Center clients opted in to Healthvana.

Starting with the raw data set, four steps were taken to include clients who meet the criteria for this dissertation. Specifically, this dissertation will utilize a data set of clients who tested positive for chlamydia, gonorrhea, and/or syphilis (Step 1), who were not presumptively treated at the time of their initial visit (Step 2), who were successfully notified of their positive

STI test result (Step 3), and who successfully returned for STI treatment following notification (Step 4). The four steps to refine this data set to meet these criteria are described in detail below and presented in Figure 5.1.

Figure 5.1: Study population inclusion criteria steps



STI: Sexually transmitted infection

Step 1: From the total number of clients who sought STI testing at AHF Wellness Centers within the study time frame (n = 38,173), separate clients by STI test result status into either tested negative for chlamydia, gonorrhea, and/or syphilis (n = 30,036) or tested positive for chlamydia, gonorrhea, and/or syphilis (n = 8,137). Keep only clients who tested positive (n = 8,137) because clients who tested negative would not require notification or follow-up treatment.

Step 2: From the clients who tested positive (n = 8,137), separate clients by presumptive STI treatment status into either presumptively treated (n = 2,904) or not presumptively treated (n = 5,233). Keep only clients who were not presumptively treated (n = 5,233) because clients who were presumptively treated would not require follow-up treatment. Presumptive treatment is a treatment given to a client for a presumed—rather than confirmed—STI (World Health Organization 2008). At AHF Wellness Centers, clients who seek STI testing and present symptoms of chlamydia, gonorrhea, and/or syphilis are presumptively treated during the same visit. As a result, clients who are presumptively treated at the time of their STI test are not required to return for follow-up treatment regardless of the STI test results.

Step 3: From the clients who tested positive and were not presumptively treated (n = 5,233), separate clients by STI notification status into either not notified (n = 2,283) or successfully notified (n = 2,950). Keep only clients who were successfully notified of their positive STI test (n = 2,950) because notification of clients who are not successfully notified after three attempts by AHF Wellness Center staff are passed on to local health department disease intervention specialists (DIS) for further investigation. As a result, it is not possible to determine whether clients who were not notified by AHF Wellness Center staff were successfully notified by DIS.

Step 4: From the clients who tested positive and were not presumptively treated and were successfully notified (n = 2,950), separate clients by STI treatment status into not treated (n = 1,490) and successfully treated (n = 1,460). Keep only clients who were successfully treated following successful notification (n = 1,460). This is the final step in which the analysis will be conducted using 1,460 unique male clients who tested positive for chlamydia, gonorrhea, and/or syphilis, were not presumptively treated, were successfully notified, and were successfully treated following successful notification.

STI test data collection

When a new client seeks care at any of the 18 AHF Wellness Center STI testing clinics that offer STI test results through Healthvana, the client is asked by an AHF Wellness Center staff member to sign in on a clipboard located at the front desk with only the client's initials and time of arrival. The client is then asked to sit in the waiting room and wait to be called back up to the front desk. When an AHF Wellness Center staff member calls up the client to the front desk, the client is asked whether he is a new client or a returning client. As a new client, the staff member hands the client three paper forms: registration form, consent form, and visit purpose form.

Registration form: The registration form requires new clients to fill out demographics: full name, date of birth, social security number, address, telephone number, email address, gender identity, sexual orientation, race, ethnicity, primary language, and emergency contact. The registration form also requires the client to sign that he understands the privacy practices, health information disclosure authorization, and service conditions for the STI testing clinic accompanying the form.

Consent form: The second form is a consent form for clients who wish to receive their STI test results by Healthvana. New clients are asked to write in their name, date of birth, and email address on this form if they wish to be notified of STI test results by Healthvana. Clients who choose not to fill out this consent form will be notified by telephone call of positive STI test results.

Visit purpose form: The visit purpose form accompanies the client throughout the AHF Wellness Center STI testing clinic experience. The visit purpose form requires clients to fill out their full name, date of birth, telephone number, email address, whether or not they are already receiving STI results by Healthvana (yes/no), whether or not they would like to receive their STI test results by Healthvana (yes/no), and the reason for their AHF Wellness Center visit. There are three options for clients to select their reason for their AHF Wellness Center visit: testing only, doctor visit, or telephone call. Under testing only, clients can select: human immunodeficiency virus (HIV) and STI testing, HIV testing only, STI testing only, or rapid HIV antibody testing only. Under doctor visit, clients can select: symptoms/treatment, partner exposure, repeat treatment, or post-exposure prophylaxis. Lastly, under telephone call, clients can select: received a telephone call from the clinic instructing him to return to AHF Wellness Centers, referred by another agency, or received instructions from Healthvana to return to AHF Wellness Centers.

After a new client completes the three forms, the client returns the forms to the front desk staff member. The front desk staff member provides the client with a business card that includes the client's unique identification number associated with when the client initially signed in on the clipboard (e.g., the third client who signed in on the clipboard receives the identification number "3"). That unique number allows AHF Wellness Center staff members to call out the client's unique identification number rather than the client's name when called into the counseling office in order to comply with confidentiality laws surrounding HIV and STI testing. The card is also a two-sided advertisement for Healthvana, which reads: “Get your test results fast in a secure online account.”

In addition to ensuring clients fills out all forms correctly, the AHF Wellness Center staff member at the front desk is responsible for entering each client’s forms using the Centricity Practice Solution software installed on a desktop computer, which is an electronic medical record software used in all AHF Wellness Centers. Within the electronic medical record software, new clients are automatically assigned a unique nine-digit identification number, which is forever associated with each client’s electronic medical records and referenced anytime a client seeks STI testing at any AHF Wellness Center. For example, if a client returns to an AHF Wellness Center, the AHF Wellness Center staff member only needs a client’s last name and date of birth in order to find the client’s unique identification number. This allows AHF Wellness Center staff members to review clients’ previous STI testing and treatment services.

Once a client is called into the counseling office, the client sits down in a private room with an AHF Wellness Center counselor to discuss the client’s risky sexual behaviors. The counselor uses the Centricity Practice Solution software installed on a desktop computer to access the client’s electronic medical records. Using the software, the counselor administers a risk assessment and asks the client for the following information: any positive STI tests in the past year, any STI symptoms in the past year, types of sexual partners in the past year, sexual practices in the past year, condom use during last sex, number of partners in the past year, percentage of partners who were anonymous in the past year, prior HIV test, date of last HIV test, result of last HIV test, and specific HIV and STI tests requested during that day’s visit. The AHF Wellness Center counselor enters all responses into the software using a drop-down options and fill-in spaces. If a client requests a rapid HIV antibody test, the counselor administers the test in the counseling office. Once the rapid HIV antibody test is complete, the counselor enters the results into the Centricity Practice Solution software.

After meeting with the counselor, a client is brought back to the waiting room to wait to be called into the testing office. Once called into the testing office, the client sits down with an AHF Wellness Center phlebotomist to receive the requested tests the client initially filled out in the visit purpose form and discussed with the counselor. For chlamydia and gonorrhea testing by urine and/or rectal swab, the client is asked to visit the restroom to collect the specimens on their own. For gonorrhea testing by oropharyngeal swab as well as HIV and syphilis testing by blood draw, the phlebotomist conducts the tests in the testing office. After the testing is complete, the client's appointment is finished and the client can leave the clinic.

STI notification data collection

All test specimens, except the rapid HIV antibody test, are mailed to laboratory technicians for analysis. The laboratory technician enters HIV and STI test results into the Centricity Practice Solution software, in which the test results are uploaded to the Healthvana online engagement platform for clients who opted-in to Healthvana. Once the results are uploaded to the Healthvana database, an email is sent to the client notifying him that his test results are available through Healthvana. The client then has the option to login to the Healthvana online patient engagement platform and/or open the Healthvana smartphone application. Healthvana displays a list of the client's tests conducted and subsequent results. Positive STI test results include a message requesting the client to return to the clinic to receive treatment. Data collected through Healthvana include not only STI tests and results, but also the date and time the STI test results were made available to the client and the date and time the client checked the test results. It is important to note that clients who opted in to Healthvana were still contacted by telephone during the rolling implementation of Healthvana.

For clients who did not opt in to Healthvana, clients are notified of positive STI test results by telephone call from an AHF Wellness Center staff member. The AHF Wellness Center staff member enters a note into the Centricity Practice Solution software if the client was successfully notified of a positive test result. After the note is entered, the Centricity Practice Solution software automatically records the date and time the AHF Wellness Center staff member typed in the note. If the client does not answer the telephone call, AHF Wellness Center staff members will leave a message requesting that the client call the AHF Wellness Center. If the client does not answer the telephone call after three tries, the AHF Wellness Center staff member fills out a form requesting that disease intervention specialists (DIS) from the local health jurisdiction track down the client for STI treatment.

STI treatment data collection

Clients who are notified of positive STI test results by Healthvana or telephone call are requested to return to the AHF Wellness Center immediately for treatment. When the client arrives at the AHF Wellness Center, the client is once again asked by an AHF Wellness Center staff member to sign in on the clipboard located at the front desk with only the client's initials and time of arrival. The client is then asked to sit in the waiting room and wait to be called. When a staff member calls up the client to the front desk, the client is then asked whether he is a new client or a returning client. As a returning client receiving treatment, the client is only asked to fill out the client tracking form, and this time the client will select their reason for visit under the notification category: received a telephone call from the clinic instructing him to return, referred by another agency, or received instructions through Healthvana to return.

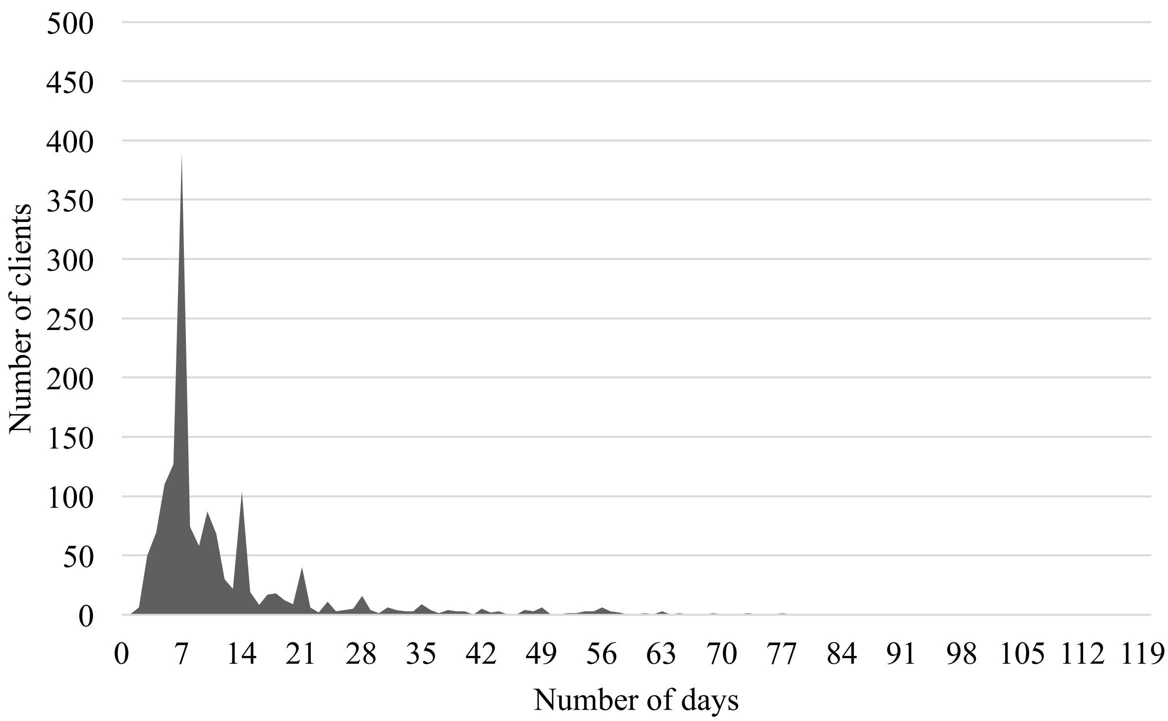
When a client is called into the clinic for treatment, a clinic staff member will administer the injection and/or oral medication associated with the infection. For chlamydia, clients receive a single injection of 250 milligrams of ceftriaxone. For gonorrhea, clients receive a single injection of 250 milligrams of ceftriaxone followed by one gram orally of azithromycin as directly observed therapy. Lastly, for syphilis, clients receive a single intramuscular injection of 2.4 million units of benzathine penicillin G. For clients who received presumptive treatment during their initial STI test, the clients are asked to return to AHF Wellness Center for a follow-up test-of-cure three to four weeks after STI treatment to ensure the treatment was successful and no resistant bacteria remains. For all STI treatments, AHF Wellness Center staff members document the date and time of STI antibiotic treatment in the Centricity Practice Solution software.

Outcome variables

There are four outcome variables for this dissertation for four separate analyses: days between STI test and STI treatment, days between STI test and STI notification, days between STI notification and STI treatment, and Healthvana opt-in status.

Days between STI test and STI treatment: AHF Wellness Center staff members documented the date a client sought STI testing and the date that client returned for STI treatment by entering the dates in the Centricity Practice Solution software, an electronic medical record software used in all AHF Wellness Centers. The number of days between STI test and STI treatment is based on how quickly a client returned for STI treatment (Figure 5.2). In this dissertation analysis, zero days between STI test and STI treatment means that a client was presumptively treated on the day of the STI test and is therefore not included in this analysis.

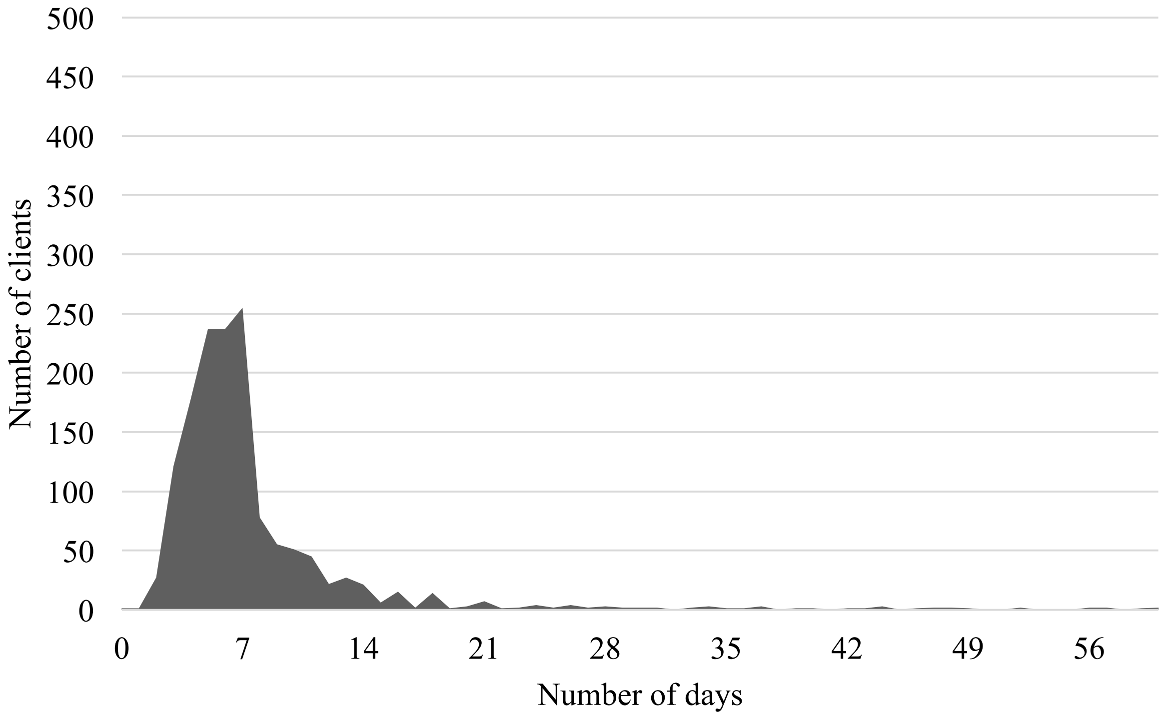
Figure 5.2: Client number of days between STI test and STI treatment (n = 1,460)



STI: Sexually transmitted infection

Days between STI test and STI notification: AHF Wellness Center staff members documented the date a client sought STI testing and the date that client was notified of a positive STI test by telephone call by entering the dates in the Centricity Practice Solution software. For clients who were notified by Healthvana, Healthvana's software documented the date the client checked his Healthvana account after receiving email notification that his STI test results were available. The date of STI notification is the earliest date a client was notified of their positive STI test, either by Healthvana or by telephone call (Figure 5.3). If a client who opted in to Healthvana is first notified by telephone call, the date of the telephone call will be used as the STI notification date.

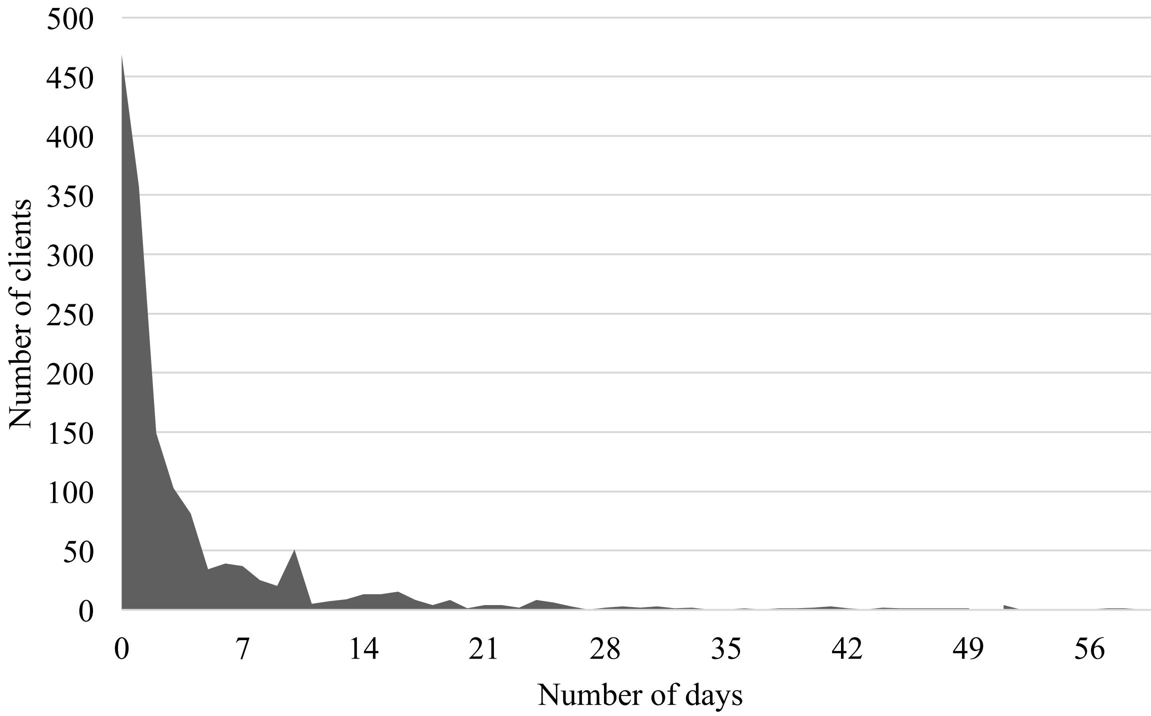
Figure 5.3 Client number of days between STI test and STI notification (n = 1,460)



STI: Sexually transmitted infection

Days between STI notification and STI treatment: AHF Wellness Center staff members documented the date a client was notified of a positive STI test by telephone call and the date that client returned for STI treatment by entering the dates in the Centricity Practice Solution software. For clients who were notified by Healthvana, Healthvana's software documented the date the client checked his Healthvana account. The date of STI notification is the earliest date a client was notified of their positive STI test, either by Healthvana or by telephone call (Figure 5.4). If a client who opted in to Healthvana is first notified by telephone call, the date of the telephone call will be used as the STI notification date.

Figure 5.4 Client number of days between STI notification and STI treatment (n = 1,460)



STI: Sexually transmitted infection

Healthvana opt-in status: AHF Wellness Center staff members offered Healthvana to clients who sought STI testing. Clients who opted in to Healthvana are defined in this dissertation analysis as opted in to Healthvana clients. Clients who chose not to receive their STI test results by Healthvana or were not offered to receive their STI test results by Healthvana—therefore receiving positive STI test results only by telephone call—are defined as did not opt in to Healthvana clients. It is important to note that a client who opted in to Healthvana was also notified of a positive STI test result by telephone call during Healthvana's rolling implementation at each AHF Wellness Center. Therefore, clients who opted in to Healthvana may not be the same clients who were successfully notified by Healthvana following a positive STI test.

Predictor variables

There are two types of predictor variables in this dissertation analysis: clinic level predictor variables and client level predictor variables. The clinic level predictor variables are based on services offered at AHF Wellness Centers, such as whether Healthvana was implemented at an AHF Wellness Center when a client sought STI testing (referred to as Healthvana implementation status) or whether a client was notified by Healthvana or by telephone call (referred to as notification type status). The client level predictor variables are based on the client risk assessment data that include questions on demographics (predisposing factors) and risky sexual behaviors (need factors). While the risk assessment contains many important variables, only the variables addressed in the theoretical framework from Chapter 3 and the literature review from Chapter 4 will be included in the analysis.

Healthvana implementation status: As discussed in Chapter 2, 16 of the 18 AHF Wellness Center implemented Healthvana on a rolling basis between July 7, 2014 and November 18, 2015; two clinics—Dallas and Jacksonville—did not offer Healthvana at all during the study period. For this predictor variable, clients will be separated into one of two categories: before Healthvana was implemented (pre-Healthvana) or after Healthvana was implemented (post-Healthvana). Since Healthvana was implemented on a rolling basis, the categories are based on both the date each AHF Wellness Center implemented Healthvana and the date each client sought STI testing.

Notification type status: As discussed in Chapter 2, each AHF Wellness Center notified clients of positive STI test results by Healthvana or by telephone call. For this predictor variable, clients will be separated into notified by telephone call or notified by Healthvana. The categories are based on whether the client was first notified of their positive STI test result by telephone call or by Healthvana, since all clients who test positive are still notified by telephone call regardless of opting in to Healthvana due to legal disclosure laws.

Demographics: Four constructs that are associated with STI acquisition and healthcare utilization include age, race, ethnicity, and sexual orientation. This section will discuss how these four constructs are operationalized using data from AHF Wellness Centers. Demographics are based on predisposing factors outlined in the behavioral model of health service utilization and the theoretical framework discussed in Chapter 3.

Age is operationalized as a client's numerical age on the date he sought STI testing at any of the 18 AHF Wellness Centers. Age is calculated by subtracting a client's date of birth reported on their registration form from the date that client sought STI testing at any of the 18 AHF Wellness Centers. Clients are asked to identify their date of birth on their registration form using the month, day, and year of their date of birth. Each client's age on the date they sought STI testing will be rounded down due to the nature of how age is calculated in the United States.

Race is operationalized as a client's self-identification of his race. Clients are asked to identify their race on their registration form using the following five options: "American Indian or Alaska Native," "Asian," "Black or African American," "Native Hawaiian or Pacific Islander," "White," and "Other." In the analysis, no changes will be made to the race variable. Race is operationalized based on the categories outlined in the United States Census.

Ethnicity is operationalized as a client's self-identification of his ethnicity. Clients are asked to identify their ethnicity on their registration form using the following two options: "Hispanic or Latino" and "not Hispanic or Latino." In the analysis, no changes will be made to the ethnicity variable.

Sexual orientation is operationalized as a client's self-identification of his sexual orientation. Clients are asked to identify their sexual orientation on their registration form using the following three options: "heterosexual," "homosexual," and "bisexual." In the analysis, clients will be placed into one of two strata based on each client's self-identified responses: "gay, bisexual, and other men who have sex with men (MSM)" and "heterosexual."

Risky sexual behaviors: Three constructs that are associated with STI acquisition and healthcare utilization include having a history of STIs, number of partners in the past year, and condom use during last sex. This section will discuss how these three constructs are operationalized using data from AHF Wellness Centers. Risky sexual behaviors are based on need factors outlined in the behavioral model of health service utilization and the theoretical framework discussed in Chapter 3.

Having a history of STIs is operationalized based on a client's self-identification of testing positive for chlamydia, gonorrhea, and/or syphilis prior to his current AHF Wellness Center visit. Clients are asked in-person by an AHF Wellness Center counselor about having a history of STIs using the following nine options: "chlamydia," "gonorrhea," "syphilis," "human immunodeficiency virus (HIV)," "human papillomavirus (HPV)," "herpes," "venereal warts," and "hepatitis." In the analysis, only clients who self-identified as having tested positive for chlamydia, gonorrhea, and/or syphilis in the past will be included in the history of STIs predictor variable because only clients who sought STI testing for chlamydia, gonorrhea, and/or syphilis are included in the analysis.

Number of partners in the past year is operationalized based on a client's self-identification of his number of partners in the past 12 months. Clients are asked in-person by an AHF Wellness Center counselor about their number of partners in the past 12 months. The client provides the number of partners to the counselor. In this analysis, clients who self-reported as having ten or more partners in the past 12 months will be collapsed into a single response, "10+." In the analysis, no changes will be made to clients who self-reported fewer than 10 partners in the past 12 months.

Condom use during last sex is operationalized based on a client's self-identification of his condom use during his last anal sex, vaginal sex, and/or oral sex. Clients are asked in-person by an AHF Wellness Center counselor about their condom use during last sex using the following three options: "condoms during last anal sex," "condoms during last vaginal sex," and "condoms during last oral sex." In the analysis, no changes will be made to the condom use variable.

Study population analytical procedure

The study population contains 1,460 unique male clients who were tested, notified, and treated for chlamydia, gonorrhea, and/or syphilis at any of the 18 AHF Wellness Centers between January 1, 2014 and December 31, 2015 (two years of data). There are three ways to separate the 1,460 clients into two groups in order to address the study objectives, research questions, and hypotheses from Chapter 2: Healthvana implementation status, notification type status, and Healthvana opt-in status.

Healthvana implementation status: Healthvana implementation status is a predictor variable created to address Study Objective 1, Research Question 1, and Hypotheses 1-3. Among the 1,460 clients, 779 clients (53.36 percent) were tested before Healthvana was implemented (pre-Healthvana) and 681 clients (46.64 percent) were tested after Healthvana was implemented (post-Healthvana).

Notification type status: Notification type status is a predictor variable created to address Study Objective 1, Research Question 1, and Hypotheses 4-6. Among the 1,460 clients, 1,101 clients (75.41 percent) were notified by telephone call and 359 clients (24.59 percent) were notified by Healthvana.

Healthvana opt-in status: Healthvana opt-in status is an outcome variable created to address Study Objective 2, Research Question 2, and Hypotheses 7-13. Among the 1,460 clients, 854 clients (58.49 percent) did not opt in to Healthvana and 606 clients (41.51 percent) opted in to Healthvana.

Statistical tests

Pearson's chi-squared tests: Pearson's chi-squared tests will be conducted throughout the analysis to test independence between the clients who are included in the study population and the clients who are excluded from the study population based on the four steps discussed earlier in this chapter. Pearson's chi-squared tests will be used to determine whether clients differed by age, race, ethnicity, sexual orientation, having a history of STIs, number of partners in the past year, and condom use during last sex. The chi-squared test is a non-parametric test in which the data are not assumed to reflect a normal distribution and the variables are either nominal or ordinal.

Ordinary least squares regression: An ordinary least squares (OLS) regression is a model that states an outcome (Y) is linearly related to predictor (X) with a typical value of Y for a given X. The equation is written as $\beta_0 + \beta_1X + \varepsilon$, where β_0 is the intercept parameter, β_1 is the slope parameter, and ε allows for individual variability about that typical value. Simply put, a simple linear regression provides the mean value of Y associated with a given X in the study population. For the purposes of this analysis, the slope, β_1, of the estimated regression line is measured in days.

Three OLS regression models will be created to evaluate the relationship between the number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment for clients before Healthvana was implemented (pre-Healthvana) compared to clients after Healthvana was implemented (post-Healthvana) (Table 5.1). In the model, cluster robust standard errors will be applied to correct for non-independence within AHF Wellness Centers. It is important to note that the three OLS regression models do not take into consideration whether a client opted-in to Healthvana; rather, the model separates clients by whether Healthvana was implemented at the AHF Wellness Center at time of each client's STI test.

Three additional OLS regression models will be created to evaluate the relationship between the mean number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment for clients for clients who were notified by telephone call compared to clients who were notified by Healthvana (Table 5.1). In the model, cluster robust standard errors will be applied to correct for non-independence within AHF Wellness Centers. It is important to note that the three OLS regression models do not take into consideration whether a client opted in to Healthvana; rather, the model separates clients by whether they were notified by Healthvana. For example, a client may have opted in to Healthvana, but was initially notified by telephone call of a positive STI test result; that client is therefore defined as being notified by telephone call.

Poisson regression: Poisson regression is similar to OLS regression except that the outcome (Y) is count data with a discrete probability distribution. In a Poisson regression, the unit change in the predictor leads to a percentage change in the outcome. While OLS regression is appropriate for this analysis, there are issues associated with OLS regression such as loss of data due to taking the log of zero. The Poisson regressions is appropriate for this analysis because the number of days between STI test, notification, and treatment can be counted in whole numbers, the number of days are independent, the mean number of days are known, and it is possible to count how many days have occurred.

Poisson regression models will be created to evaluate the relationship between the number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment for clients before Healthvana was implemented (pre-Healthvana) compared to clients after Healthvana was implemented (post-Healthvana) (Table 5.1). Three additional Poisson regression models will be created to evaluate the relationship between the mean number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment for clients for clients who were notified by telephone call compared to clients who were notified by Healthvana (Table 5.1). The Poisson regression models will obtain robust standard errors for the parameter estimates to in order to control for violations of underlying assumptions.

Logistic regression: Logistic regressions are utilized to model the probability of an outcome based on predictor variables. For a logistic regression, the outcome distribution (Y) is assumed to be binomial. The coefficients in a logistic regression provide the same information as they do in an OLS regression except that the coefficients are interpreted on the odds scale.

Individual logistic regressions will be created to evaluate demographics (predisposing factors) and risky sexual behaviors (need factors) for clients who did not opt in to Healthvana compared to clients who opted in to Healthvana (Table 5.1). Demographics (predisposing factors) include age, race, ethnicity, and sexual orientation. Risky sexual behaviors (need factors) include having a history of STIs, number of partners in the past year, and condom use during last sex. Therefore, seven individual logistic regressions will be created to measure the odds of the predictor variables on Healthvana opt-in status.

Summary

Four statistical tests will be conducted in this dissertation analysis: Pearson's chi-squared tests, OLS regressions, Poisson regressions, and logistic regressions. At the end of this chapter, an analysis is conducted for each of the steps taken to reach the study population of 1,460 clients who met the inclusion criteria for this dissertation. Descriptive statistics and Pearson's chi-squared tests are provided in order to better understand the makeup of the 1,460 clients included in this dissertation. Chapter 6 includes descriptive statistics, OLS regressions, and Poisson regressions based on Healthvana implementation status. In other words, Chapter 6 addresses Healthvana at the clinic level in order to measure whether the implementation of Healthvana reduced the time between STI test, notification, and treatment. Chapter 7 includes descriptive statistics, OLS regressions, and Poisson regressions based on notification type status. In other words, Chapter 7 addresses Healthvana at the individual level in order to measure whether whether notification by Healthvana reduced the time between STI test, notification, and treatment. Lastly, Chapter 8 includes descriptive statistics and logistic regressions based on Healthvana opt-in status. In other words, Chapter 8 addresses Healthvana as an outcome variable in order to measure which types of clients opted in to Healthvana.

Table 5.1: Summary of hypotheses and associated regressions

Hypotheses	Statistical test(s)
Healthvana implementation status	
Hypothesis 1: STI test to STI treatment	OLS regression, Poisson regression
Hypothesis 2: STI test to STI notification	OLS regression, Poisson regression
Hypothesis 3: STI notification to STI treatment	OLS regression, Poisson regression
Notification type status	
Hypothesis 4: STI test to STI treatment	OLS regression, Poisson regression
Hypothesis 5: STI test to STI notification	OLS regression, Poisson regression
Hypothesis 6: STI notification to STI treatment	OLS regression, Poisson regression
Healthvana opt-in status	
Hypothesis 7: Age	Logistic regression
Hypothesis 8: Race	Logistic regression
Hypothesis 9: Ethnicity	Logistic regression
Hypothesis 10: Sexual orientation	Logistic regression
Hypothesis 11: Having a history of STIs	Logistic regression
Hypothesis 12: Number of partners in the past year	Logistic regression
Hypothesis 13: Condom use during last sex	Logistic regression

STI: Sexually transmitted infection; OLS: Ordinary least squares

Preliminary analysis of inclusion criteria for study population

Pearson's chi-squared tests were conducted during the four steps to include the 1,460 clients in the study population who met the inclusion criteria for this dissertation. The study population of 1,460 clients will be utilized in Chapters 6, 7, and 8. This section analyzes the steps that were taken to parse out the 1,460 clients. Specifically, clients who tested positive for chlamydia, gonorrhea, and/or syphilis (Step 1), who were not presumptively treated at the time of their initial visit (Step 2), who were successfully notified of their positive STI test result (Step 3), and who successfully returned for STI treatment following notification (Step 4) were included in the study population. The tests were conducted using the following predictor variables: AIDS Healthcare Foundation (AHF) Wellness Center, age, race, ethnicity, sexual orientation, having a history of sexually transmitted infections (STIs), number of partners in the past year, and condom use during last sex. Using a significance level of $\alpha = 0.05$, Pearson's chi-squared tests were calculated to determine whether there is a difference between clients who were included in the study population and clients who were excluded from the study population at each step. (Please refer to Table 5.2 for a summary of Pearson's chi-squared test results.)

Step 1: Clients were separated by STI test result status into either tested negative for chlamydia, gonorrhea, and/or syphilis (n = 30,036) or tested positive for chlamydia, gonorrhea, and/or syphilis (n = 8,137). According to Table 5.2, clients who tested negative and clients who tested positive are statistically different in AHF Wellness Center, age, race, ethnicity, sexual orientation, having a history of STIs, number of partners in the past year, and condom use during last sex ($p < 0.05$). This is expected because the scientific literature suggests these seven factors are predictors of STI acquisition. It is also expected that clients would differ by AHF Wellness Center due to the separated geographic locations.

Step 2: Clients were separated by presumptive STI treatment status into either presumptively treated (n = 2,904) or not presumptively treated (n = 5,233). According to Table 5.2, clients who were presumptively treated and clients who were not presumptively treated are different in AHF Wellness Center, race, ethnicity, sexual orientation, having a history of STIs, number of partners in the past year, and condom use during last sex ($p < 0.05$). On the other hand, there is no statistically significant difference in age ($p = 0.619$). It is expected that the clients would differ by AHF Wellness Center because presumptive treatment guidelines may vary by local health jurisdiction. In terms of race, ethnicity, and sexual orientation, there may be non-measured predictors of STI-related symptoms among certain populations. In addition, certain populations experience high rates of STI acquisition, which may be associated with high rates of presumptive treatment. In terms of having a history of STIs, number of partners in the past year, and condom use during last sex, these three risky sexual behaviors contribute to high rates of STI acquisition, which again may be associated with high rates of symptoms and subsequent presumptive treatment.

Step 3: Clients were separated by STI notification status into either not notified (n = 2,283) or successfully notified (n = 2,950). According to Table 5.2, clients who were not notified and clients who were successfully notified are different in age, race, ethnicity, sexual orientation, having a history of STIs, and number of partners in the past year ($p < 0.05$). On the other hand, there is no statistically significant difference in condom use during last sex ($p = 0.104$). In terms of age, race, ethnicity, and sexual orientation, certain populations experience high rates of STI acquisition, which may be associated with high rates of STI notification. In terms of having a history of STIs and number of partners in the past year, these three risky sexual behaviors contribute to high rates of STI acquisition, which again may be associated with high rates of notification.

Step 4: Lastly, clients were separated by STI treatment status into not treated (n = 1,490) and successfully treated (n = 1,460). According to Table 5.2, clients who were not treated and clients who were successfully treated are different by age, race, ethnicity, sexual orientation, having a history of STIs, and number of partners in the past year ($p < 0.05$). On the other hand, there is no statistically significant difference in condom use during last sex ($p = 0.094$). In terms of age, race, ethnicity, and sexual orientation, certain populations experience high rates of STI acquisition, which may be associated with high rates of STI treatment. In terms of having a history of STIs and number of partners in the past year, these three risky sexual behaviors contribute to high rates of STI acquisition, which again may be associated with high rates of STI treatment.

Table 5.2: Pearson's chi-squared test summary for study population inclusion criteria steps by STI test result status (Step 1), presumptive STI treatment status (Step 2), STI notification status (Step 3), and returned for STI treatment status (Step 4)

	STI test result status	Presumptive STI treatment status	STI notification status	Returned for STI treatment status
Location				
AHF Wellness Center	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
Demographics				
Age	$p < 0.001$	$p = 0.619$	$p < 0.001$	$p < 0.001$
Race	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
Ethnicity	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p = 0.002$
Sexual orientation	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
Risky sexual behaviors				
Having a history of STIs	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
Number of partners in the past year	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
Condom use during last sex	$p < 0.001$	$p < 0.001$	$p = 0.104$	$p = 0.094$

AHF: AIDS Healthcare Foundation; STI: Sexually transmitted infection

The study population consists of 1,460 male clients who sought STI testing at any of the 18 AHF Wellness Centers between January 1, 2014 and December 31, 2015; tested positive for chlamydia, gonorrhea, and/or syphilis; were not presumptively treated on the day of their STI test; were successfully notified of their positive STI test result; and returned for STI treatment. Most clients sought STI testing at Broward (n = 457) and Hollywood (n = 358) (Table 5.3).

In terms of predisposing factors, most clients were under 25 years old (n = 536), self-identified as White (n = 587), self-identified as not Hispanic or Latino (n = 850), and self-identified as heterosexual (n = 691) (Table 5.2). In terms of need factors, most clients did not report having a history of STIs (n = 1,384), self-reported having two partners in the past year (n = 240), and self-reported condom use during last anal sex only (n = 104) (Table 5.5). In terms of positive STI test results, most clients tested positive for chlamydia only (n = 777), followed by gonorrhea only (n = 356), and syphilis only (n = 157) (Figure 5.5).

Table 5.3: Study population client location (n = 1,460)

	n
AHF Wellness Center	
Benning Road	0
Biscayne	96
Brooklyn	1
Broward	457
Carl Bean	77
Chicago	2
Columbus	13
Dallas	23
Hollywood	358
Jackson	57
Jacksonville	118
Long Beach	11
Oakland	66
San Diego	0
San Fernando Valley	28
San Francisco	2
South Beach	80
Wilton Manors	71
Total	1,460

AHF: AIDS Healthcare Foundation

Figure 5.5: Study population client chlamydia, gonorrhea, and/or syphilis infections (n = 1,460)

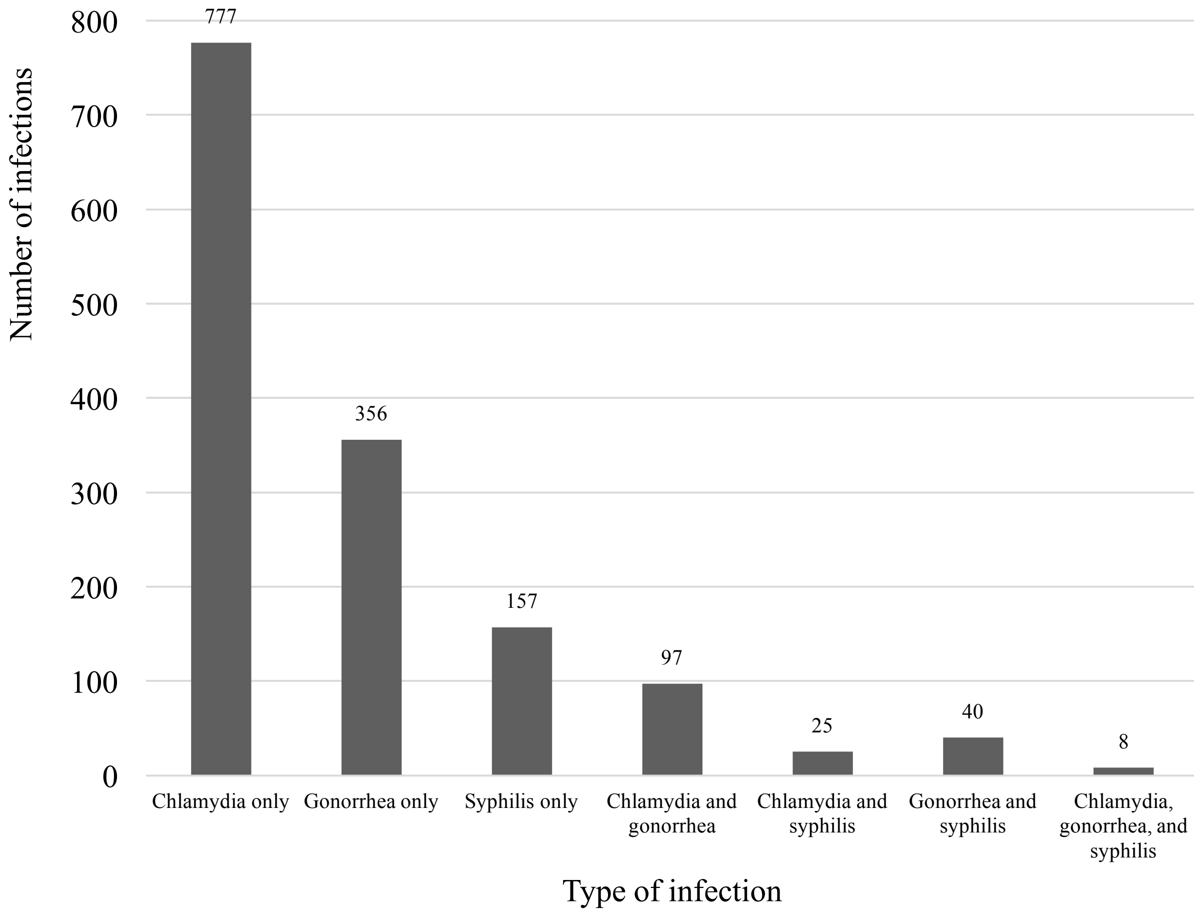


Table 5.4: Study population client demographics by Healthvana implementation status (n = 1,460)

	n
Age	
< 25 years old	536
25-29 years old	395
30-39 years old	312
40+ years old	217
Race	
American Indian/Alaska Native	2
Asian	61
Black/African American	517
Native Hawaiian/Pacific Islander	5
White	587
Other	32
Missing	*256*
Ethnicity	
Hispanic/Latino	418
Not Hispanic/Latino	850
Missing	*192*
Sexual orientation	
Heterosexual	691
MSM	591
Missing	*178*
Total	1,460

MSM: Men who have sex with men; STI: Sexually transmitted infection

Table 5.5: Study population client risky sexual behaviors (n = 1,460)

	n
Having a history of STIs	
Yes	76
No response	*1,384*
Number of partners in the past year	
0	5
1	157
2	240
3	203
4	153
5	124
6	79
7	26
8	30
9	7
10+	212
Missing	*224*
Condom use during last sex	
Anal only	104
Vaginal only	89
Oral only	2
Anal and vaginal	11
Anal and oral	5
Vaginal and oral	1
Anal, vaginal, and oral	0
Missing	*1,248*
Total	1,460

STI: Sexually transmitted infection

CHAPTER 6: HEALTHVANA IMPLEMENTATION STATUS ANALYSIS

Descriptive statistics

As discussed in Chapter 5, Healthvana implementation status is a predictor variable created to address Hypotheses 1-3. Healthvana implementation status is based on whether a client sought sexually transmitted infection (STI) testing at AIDS Healthcare Foundation (AHF) Wellness Centers before Healthvana was implemented (pre-Healthvana) or after Healthvana was implemented (post-Healthvana). Among the 1,460 clients, 779 (53.36 percent) were tested pre-Healthvana and 681 (46.64 percent) were tested post-Healthvana (Table 6.1). (See Figure 1.4 for a visualization of Healthvana implementation dates at the 18 AIDS Healthcare Foundation Wellness Centers.)

Predisposing factors: Clients pre-Healthvana and post-Healthvana shared similar predisposing factors (demographics). Most clients pre-Healthvana were under 25 years old (n = 285), self-identified as White (n = 294), self-identified as not Hispanic or Latino (n = 482), and self-identified as heterosexual (n = 357) (Table 6.2). Most clients post-Healthvana were also under 25 years old (n = 251), self-identified as White (n = 587), self-identified as not Hispanic or Latino (n = 368), and self-identified as heterosexual (n = 334) (Table 6.2). Most clients pre-Healthvana tested positive for chlamydia only (n = 408), then gonorrhea only (n = 215), and then syphilis only (n = 77) (Table 6.2). Most clients post-Healthvana also tested positive for chlamydia only (n = 369), then gonorrhea only (n = 141), and then syphilis only (n = 80) (Figure 6.1).

Need factors: Clients pre-Healthvana and clients post-Healthvana shared similar need factors (risky sexual behaviors). Most clients pre-Healthvana did not report having a history of STIs (n = 733), self-reported having two partners in the past year (n = 129), and self-reported using a condom during last anal sex (n = 70) (Table 6.3). Most clients post-Healthvana did not report having a history of STIs (n = 651), self-reported having two partners in the past year (n = 111), but self-reported using a condom during last vaginal sex (n = 36) (Table 6.3).

Table 6.1: Client location by Healthvana implementation status (n = 1,460)

	Pre-Healthvana		Post-Healthvana		Total
	n	%	n	%	n
AHF Wellness Center					
Benning Road	0	0.00%	0	0.00%	0
Biscayne	23	23.96%	73	76.04%	96
Brooklyn	1	100.00%	0	0.00%	1
Broward	188	41.14%	269	58.86%	457
Carl Bean	43	55.84%	34	44.16%	77
Chicago	0	0.00%	2	100.00%	2
Columbus	0	0.00%	13	100.00%	13
Dallas	23	100.00%	0	0.00%	23
Hollywood	230	64.25%	128	35.75%	358
Jackson	16	28.07%	41	71.93%	57
Jacksonville	118	100.00%	0	0.00%	118
Long Beach	4	36.36%	7	63.64%	11
Oakland	40	60.61%	26	39.39%	66
San Diego	0	0.00%	0	0.00%	0
San Fernando Valley	21	75.00%	7	25.00%	28
San Francisco	1	50.00%	1	50.00%	2
South Beach	27	33.75%	53	66.25%	80
Wilton Manors	44	61.97%	27	38.03%	71
Total	779	53.36%	681	46.64%	1,460

AHF: AIDS Healthcare Foundation

Figure 6.1: Client chlamydia, gonorrhea, and/or syphilis infections by Healthvana implementation status (n = 1,460)

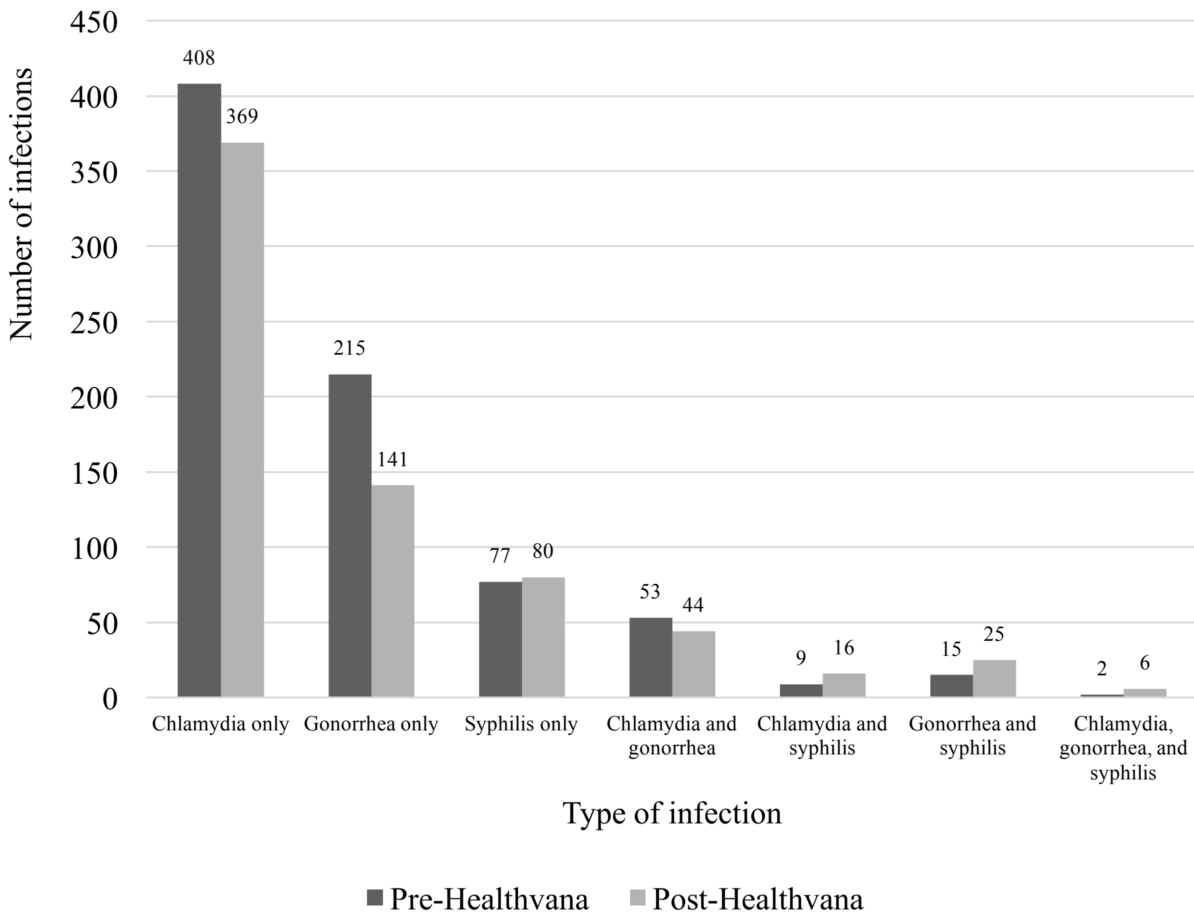


Table 6.2: Client demographics by Healthvana implementation status (n = 1,460)

	Pre-Healthvana		Post-Healthvana		Total
	n	%	n	%	n
Age					
< 25 years old	285	53.17%	251	46.83%	536
25-29 years old	209	52.91%	186	47.09%	395
30-39 years old	165	52.88%	147	47.12%	312
40+ years old	120	55.30%	97	44.70%	217
Race					
American Indian/Alaska Native	0	0.00%	2	100.00%	2
Asian	32	52.46%	29	47.54%	61
Black/African American	287	55.51%	230	44.49%	517
Native Hawaiian/Pacific Islander	2	40.00%	3	60.00%	5
White	294	50.09%	293	49.91%	587
Other	22	68.75%	10	31.25%	32
Missing	*142*	*55.47%*	*114*	*44.53%*	*256*
Ethnicity					
Hispanic/Latino	197	47.13%	221	52.87%	418
Not Hispanic/Latino	482	56.71%	368	43.29%	850
Missing	*100*	*52.08%*	*92*	*47.92%*	*192*
Sexual orientation					
Heterosexual	357	51.66%	334	48.34%	691
MSM	333	56.35%	258	43.65%	591
Missing	*89*	*50.00%*	*89*	*50.00%*	*178*
Total	779	53.36%	681	46.64%	1,460

MSM: Men who have sex with men; STI: Sexually transmitted infection

Table 6.3: Client risky sexual behaviors by Healthvana implementation status (n = 1,460)

	Pre-Healthvana		Post-Healthvana		Total
	n	%	n	%	n
Having a history of STIs					
Yes	46	60.53%	30	39.47%	76
No response	*733*	*52.96%*	*651*	*47.04%*	*1,384*
Number of partners in the past year					
0	2	40.00%	3	60.00%	5
1	93	59.24%	64	40.76%	157
2	129	53.75%	111	46.25%	240
3	118	58.13%	85	41.87%	203
4	72	47.06%	81	52.94%	153
5	68	54.84%	56	45.16%	124
6	41	51.90%	38	48.10%	79
7	11	42.31%	15	57.69%	26
8	18	60.00%	12	40.00%	30
9	3	42.86%	4	57.14%	7
10+	107	50.47%	105	49.53%	212
Missing	*117*	*52.23%*	*107*	*47.77%*	*224*
Condom use during last sex					
Anal only	70	67.31%	34	32.69%	104
Vaginal only	53	59.55%	36	40.45%	89
Oral only	2	100.00%	0	0.00%	2
Anal and vaginal	4	36.36%	7	63.64%	11
Anal and oral	3	60.00%	2	40.00%	5
Vaginal and oral	1	100.00%	0	0.00%	1
Anal, vaginal, and oral	0	0.00%	0	0.00%	0
Missing	*646*	*51.76%*	*602*	*48.24%*	*1,248*
Total	779	53.36%	681	46.64%	1,460

STI: Sexually transmitted infection

Pearson's chi-squared tests

According to Table 6.4, pre-Healthvana clients and post-Healthvana clients are different in ethnicity, and condom use during last sex ($p < 0.05$). On the other hand, there is no statistically significant difference in age ($p = 0.941$), race ($p = 0.140$), sexual orientation ($p = 0.156$), having a history of STIs ($p = 0.198$), and number of partners in the past year ($p = 0.533$). Regarding ethnicity, it appears that the number of clients self-identified as not Hispanic or Latino pre-Healthvana decreased post-Healthvana; conversely, the number of clients self-identified as Hispanic or Latino pre-Healthvana increased post-Healthvana (Table 6.2). It is difficult to interpret the statistically significant difference in condom use during last sex between pre-Healthvana clients and post-Healthvana clients due to missing responses and small sample sizes. This difference may be attributed to the fact that condom use during last sex includes seven response options (Table 6.3).

Table 6.4: Pearson's chi-squared test results summary by Healthvana implementation status (n = 1,460)

	Pearson's chi-squared test results
Location	
AHF Wellness Center	p < 0.001
Demographics	
Age	p = 0.941
Race	p = 0.140
Ethnicity	p = 0.005
Sexual orientation	p = 0.156
Risky sexual behaviors	
Having a history of STIs	p = 0.198
Number of partners in the past year	p = 0.533
Condom use during last sex	p = 0.022

AHF: AIDS Healthcare Foundation; STI: Sexually transmitted infection

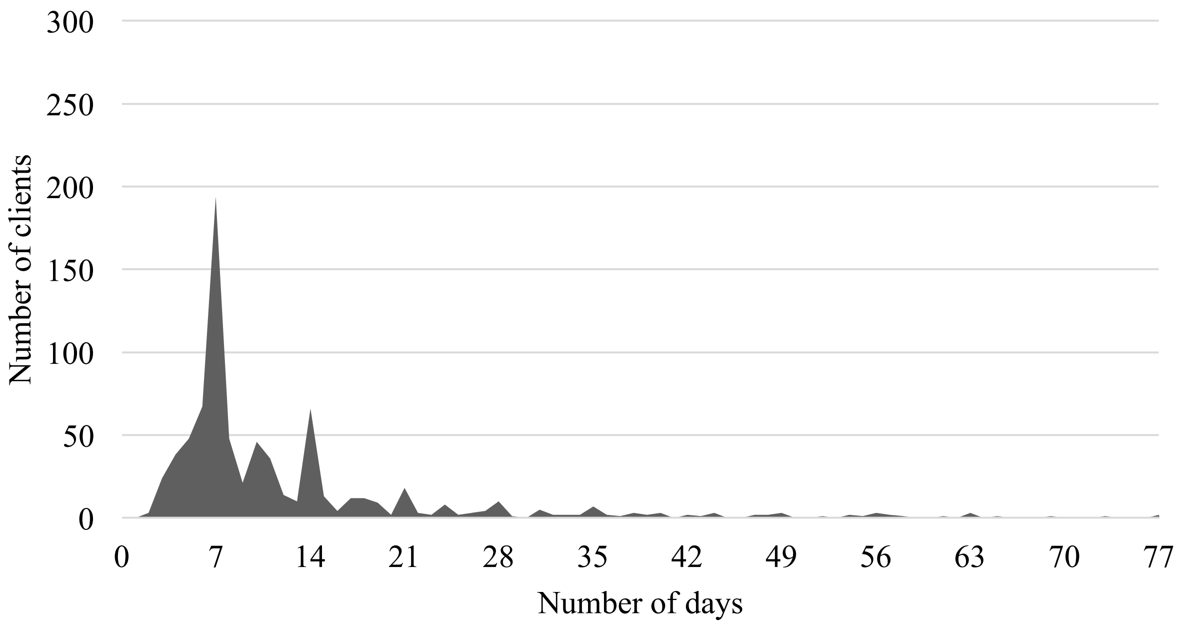
Ordinary least squares regression

According to Table 6.5, the mean number of days between STI test and STI treatment is 11.68 days for all clients (n = 1,460). By separating clients by Healthvana implementation status, there is a visible difference in the mean number of days between STI test and STI treatment (Figures 6.2 and 6.3). Before Healthvana was implemented (pre-Healthvana), clients experienced a mean of 12.55 days (n = 779) between STI test and STI treatment (Table 6.5). After Healthvana was implemented (post-Healthvana), clients experienced a mean of 10.68 days (n = 681) between STI test and STI treatment (Table 6.5).

According to Table 6.5, the mean number of days between STI test and STI notification is 7.86 days for all clients (n = 1,460). By separating clients by Healthvana implementation status, there is a visible difference in the mean number of days between STI test and STI notification. Before Healthvana was implemented (pre-Healthvana), clients experienced a mean of 8.77 days (n = 779) between STI test and STI treatment (Table 6.5). After Healthvana was implemented (post-Healthvana), clients experienced a mean of 6.82 days (n = 681) between STI test and STI treatment (Table 6.5).

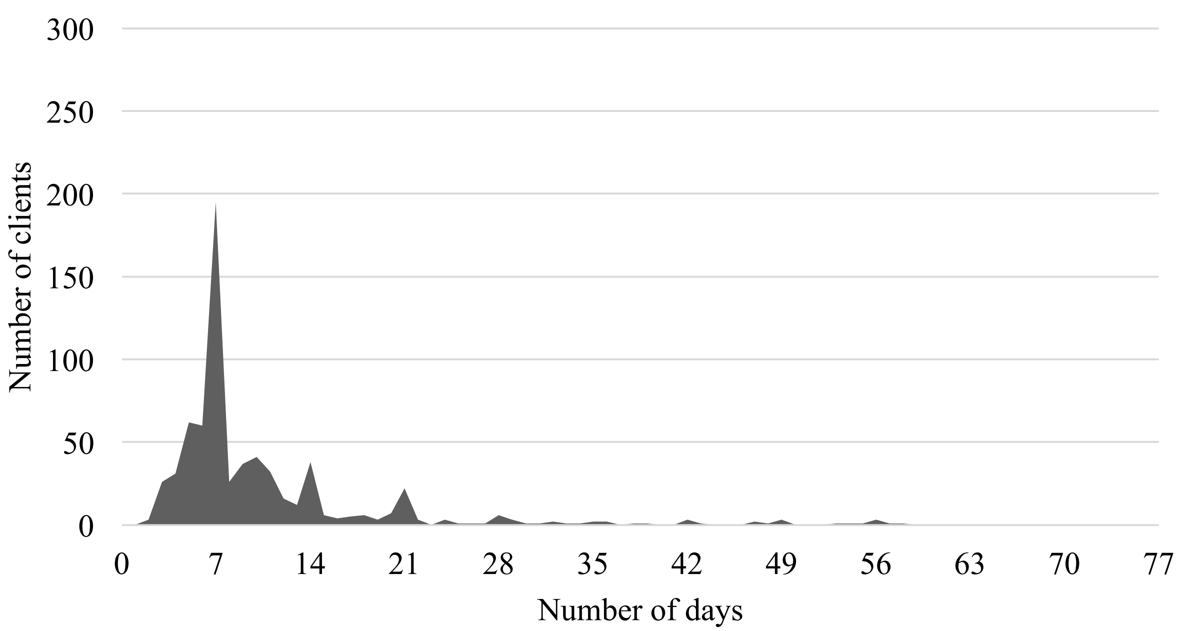
According to Table 6.5, the mean number of days between STI notification and STI treatment is 3.82 days for all clients (n = 1,460). By separating clients by Healthvana implementation status, there does not appear to be a major difference in the mean number of days between STI notification and STI treatment. Clients pre-Healthvana experienced a mean of 3.79 days (n = 779) and clients post-Healthvana experienced a mean of 3.86 days (n = 681) between STI notification and STI treatment (Table 6.5).

Figure 6.2: Clients pre-Healthvana number of days between STI test and STI treatment (n = 779)



STI: Sexually transmitted infection

Figure 6.3: Clients post-Healthvana number of days between STI test and STI treatment (n = 681)



STI: Sexually transmitted infection

Table 6.5: Mean number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment by Healthvana implementation status (n = 1,460)

	Pre-Healthvana (n = 779) Mean (days)	Post-Healthvana (n = 681) Mean (days)	Total (n = 1,460) Mean (days)
Categories			
STI test to STI treatment	12.55	10.68	11.68
STI test to STI notification	8.77	6.82	7.86
STI notification to STI treatment	3.79	3.86	3.82

STI: Sexually transmitted infection

A total of 1,460 clients are included in the ordinary least squares (OLS) regression model where the number of days between STI test and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI test and STI treatment for clients pre-Healthvana compared to clients post-Healthvana is $p = 0.022$ ($t = -2.56$) (Table 6.6). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI treatment is significantly associated with Healthvana implementation status. According to the model, Healthvana implementation is associated with a mean reduction of 1.87 days between STI test and STI treatment (Table 6.6). There is enough evidence to reject the null in Hypothesis 1 and conclude that there is a difference in the mean number of days between STI test and STI treatment before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

A total of 1,460 clients are included in the OLS regression model where the number of days between STI test and STI notification is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI test and STI notification for clients pre-Healthvana compared to clients post-Healthvana is $p = 0.001$ ($t = -3.93$) (Table 6.6). Since the p-value is less than $\alpha =$

0.05, the mean number of days between STI test and STI notification is significantly associated with Healthvana implementation status. According to the model, Healthvana implementation is associated with a mean reduction of 1.95 days between STI test and STI treatment (Table 6.6). There is enough evidence to reject the null in Hypothesis 2 and conclude that there is a difference in the mean number of days between STI test and STI notification before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

A total of 1,460 clients are included in the OLS regression model where the number of days between STI notification and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI notification and STI treatment for clients pre-Healthvana compared to clients post-Healthvana is $p = 0.810$ ($t = 0.25$) (Table 6.6). Since the p-value is greater than $\alpha = 0.05$, the mean number of days between STI notification and STI treatment is not significantly associated with Healthvana implementation status. There is insufficient evidence to reject the null in Hypothesis 3.

Table 6.6: Ordinary least squares regression analysis results for mean number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment by Healthvana implementation status (n = 1,460)

	Coefficient (95% CI)	t	p-value
Outcome variables			
STI test to STI treatment	-1.87 (-3.44, -0.31)	-2.56	p = 0.022
STI test to STI notification	-1.95 (-3.00, -0.89)	-3.93	p = 0.001
STI notification to STI treatment	0.07 (-0.55, 0.70)	0.25	p = 0.810

STI: Sexually transmitted infection; CI: Confidence interval

Poisson regression

Poisson regression models described below evaluate the relationship between the number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment for clients before Healthvana was implemented (pre-Healthvana) compared to clients after Healthvana was implemented (post-Healthvana). Unlike an OLS regression, in a Poisson regression the unit change in the predictor leads to a percentage change in the outcome. Percentage change is useful for interpreting the change in the number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment.

A total of 1,460 clients are included in the Poisson regression model where the number of days between STI test and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI test and STI treatment for clients pre-Healthvana compared to clients post-Healthvana is $p = 0.019$ ($z = -2.34$) (Table 6.7). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI treatment is significantly associated with Healthvana implementation status. According to the model, which is interpreted on the log scale, Healthvana implementation is associated with a mean reduction of 0.16 log days between STI test and STI treatment (Table 6.7). To obtain the mean ratio—the percentage change in the mean number of days between STI test and STI treatment associated with the change in Healthvana implementation status—it is helpful to exponentiate the coefficient: $e^{-0.16} = 0.85$. Healthvana implementation is associated with a 15 percent reduction in the mean number of days between STI test and STI treatment. There is enough evidence to once again reject the null in Hypothesis 1 and conclude that there is a difference in the mean number of days between STI test and STI treatment before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

A total of 1,460 clients are included in the Poisson regression model where the number of days between STI test and STI notification is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI test and STI notification for clients pre-Healthvana compared to clients post-Healthvana is $p < 0.001$ ($z = -3.58$) (Table 6.7). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI notification is significantly associated with Healthvana implementation status. According to the model, which is interpreted on the log scale, Healthvana implementation is associated with a mean reduction of 0.25 log days between STI test and STI notification (Table 6.7). To obtain the mean ratio—the percentage change in the mean number of days between STI test and STI notification associated with the change in Healthvana implementation status—it is helpful to exponentiate the coefficient: $e^{-0.25} = 0.78$. Healthvana implementation is associated with a 22 percent reduction in the mean number of days between STI test and STI notification. There is enough evidence to once again reject the null in Hypothesis 2 and conclude that there is a difference in the mean number of days between STI test and STI notification before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

A total of 1,460 clients are included in the Poisson regression model where the number of days between STI notification and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI notification and STI treatment for clients pre-Healthvana compared to clients post-Healthvana is $p = 0.804$ ($z = 0.25$) (Table 6.7). Since the p-value is greater than α = 0.05, the mean number of days between STI notification and STI treatment is not significantly associated with Healthvana implementation status. Once again, there is insufficient evidence to reject the null in Hypothesis 3.

Table 6.7: Poisson regression analysis results for mean number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment by Healthvana implementation status (n = 1,460)

	Coefficient	IRR (95% CI)	z	p-value
Outcome variables				
STI test to STI treatment	-0.16	0.85 (0.74, 0.97)	-2.34	p = 0.019
STI test to STI notification	-0.25	0.78 (0.68, 0.89)	-3.58	p < 0.001
STI notification to STI treatment	0.02	1.02 (0.88, 1.18)	0.25	p = 0.804

STI: Sexually transmitted infection; IRR: Incidence rate ratio; CI: Confidence interval

Sub-analysis including clients who were not successfully notified

In the original Healthvana implementation status analyses, clients who were tested, notified, and treated for STIs were included in the analysis (n = 1,460). In this sub-analysis, 685 additional clients who were not successfully notified of their positive STI test results were added to the 1,460 study population in order to reassure that the original analyses demonstrated a reasonable interpretation of the data set. Therefore, the following sub-analysis measures the mean number of days between STI test and STI treatment for 2,085 clients (1,460 + 685 = 2,085).

Among the 2,085 clients, 1,234 (59.18 percent) were tested pre-Healthvana and 851 (40.82 percent) were tested post-Healthvana (Table 6.8). According to Table 6.8, the mean number of days between STI test and STI treatment is 15.95 days for all clients (n = 2,085). By separating clients by Healthvana implementation status, there is a visible difference in the mean number of days between STI test and STI treatment. Before Healthvana was implemented (pre-Healthvana), clients experienced a mean of 17.56 days (n = 1,234) between STI test and STI treatment (Table 6.8). After Healthvana was implemented (post-Healthvana), clients experienced a mean of 13.63 days (n = 851) between STI test and STI treatment (Table 6.8).

Table 6.8: Mean number of days between STI test and STI treatment by Healthvana implementation status, including clients who were not successfully notified (n = 2,085)

	Pre-Healthvana (n = 1,234) Mean (days)	Post-Healthvana (n = 851) Mean (days)	Total (n = 2,085) Mean (days)
Category			
STI test to STI treatment	17.56	13.63	15.95

STI: Sexually transmitted infection

A total of 2,085 clients are included in the OLS regression model where the number of days between STI test and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI test and STI treatment for clients pre-Healthvana compared to clients post-Healthvana is $p < 0.001$ ($t = -5.55$) (Table 6.9). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI treatment is significantly associated with Healthvana implementation status. According to the model, Healthvana implementation is associated with a mean reduction of 3.93 days between STI test and STI treatment (Table 6.9). There is enough evidence to reject the null and conclude that there is a difference in the mean number of days between STI test and STI treatment before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

Table 6.9: Ordinary least squares regression analysis results for mean number of days between STI test and STI treatment by Healthvana implementation status, including clients who were not successfully notified (n = 2,085)

	Coefficient (95% CI)	t	p-value
Outcome variable			
STI test to STI treatment	-3.93 (-5.43, -2.43)	-5.55	$p < 0.001$

STI: Sexually transmitted infection; CI: Confidence interval

A total of 2,085 clients are included in the Poisson regression model where the number of days between STI test and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI test and STI treatment for clients pre-Healthvana compared to clients post-Healthvana is $p < 0.001$ ($z = -5.34$) (Table 6.10). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI treatment is significantly associated with Healthvana implementation status. According to the model, which is interpreted on the log scale, Healthvana implementation is associated with a mean reduction of 0.25 log days between STI test and STI treatment (Table 6.10). To obtain the mean ratio—the percentage change in the mean number of days between STI test and STI treatment associated with the change in Healthvana implementation status—it is helpful to exponentiate the coefficient: $e^{-0.25} = 0.78$. Healthvana implementation is associated with a 22 percent reduction in the mean number of days between STI test and STI treatment. There is enough evidence to once again reject the null and conclude that there is a difference in the mean number of days between STI test and STI treatment before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

Table 6.10: Poisson regression analysis results for mean number of days between STI test and STI treatment by Healthvana implementation status, including clients who were not successfully notified (n = 2,085)

	Coefficient	IRR (95% CI)	z	p-value
Outcome variable				
STI test to STI treatment	-0.25	0.78 (0.71, 0.85)	-5.34	p < 0.001

STI: Sexually transmitted infection; IRR: Incidence rate ratio; CI: Confidence interval

Based on the results in the above sub-analysis, it appears that including clients who were not successfully notified (n = 685) with the clients who were successfully notified (n = 1,460) demonstrates a statistically significant reduction in the mean number of days between STI test and STI treatment for clients regardless of notification. The mean number of days between STI test and STI treatment decreased 22 percent, from 17.56 days to 13.63 days, in the sub-analysis (n = 2,085); in comparison, the mean number of days between STI test and STI treatment decreased 15 percent, from 12.55 days to 10.68 days, in the original analyses (n = 1,460). Both analyses demonstrated a relatively similar statistically significant reduction in the mean number of days between STI test and STI treatment, which reassures that the original analyses demonstrated a reasonable interpretation of the data set.

Sub-analysis including clients who were not successfully treated

In the original Healthvana implementation status analyses, clients who were tested, notified, and treated for STIs were included in the analysis (n = 1,460). In this sub-analysis, 1,490 additional clients who were successfully notified but did not return for STI treatment were added to the 1,460 study population in order to reassure that the original analyses demonstrated a reasonable interpretation of the data set. Therefore, the following sub-analysis measures the mean number of days between STI test and STI notification for 2,950 clients (1,460 + 1,490 = 2,950).

Among the 2,950 clients, 1,365 (46.27 percent) were tested pre-Healthvana and 1,585 (53.73 percent) were tested post-Healthvana (Table 6.11). According to Table 6.11, the mean number of days between STI test and STI notification is 9.03 days for all clients (n = 2,950). By separating clients by Healthvana implementation status, there is a visible difference in the mean number of days between STI test and STI notification. Before Healthvana was implemented (pre-Healthvana), clients experienced a mean of 10.55 days (n = 1,365) between STI test and STI notification (Table 6.11). After Healthvana was implemented (post-Healthvana), clients experienced a mean of 7.72 days (n = 1,585) between STI test and STI notification (Table 6.11).

Table 6.11: Mean number of days between STI test and STI notification by Healthvana implementation status, including clients who were not successfully treated (n = 2,950)

	Pre-Healthvana (n = 1,365) Mean (days)	Post-Healthvana (n = 1,585) Mean (days)	Total (n = 2,950) Mean (days)
Category			
STI test to STI notification	10.55	7.72	9.03

STI: Sexually transmitted infection

A total of 2,950 clients are included in the OLS regression model where the number of days between STI test and STI notification is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI test and STI notification for clients pre-Healthvana compared to clients post-Healthvana is $p < 0.001$ ($t = -6.40$) (Table 6.12). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI notification is significantly associated with Healthvana implementation status. According to the model, Healthvana implementation is associated with a mean reduction of 2.82 days between STI test and STI notification (Table 6.12). There is enough evidence to reject the null and conclude that there is a difference in the mean number of days between STI test and STI notification before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

Table 6.12: Ordinary least squares regression analysis results for mean number of days between STI test and STI notification by Healthvana implementation status, including clients who were not successfully treated (n = 2,950)

	Coefficient (95% CI)	t	p-value
Outcome variable			
STI test to STI notification	-2.82 (-3.75, -1.89)	-6.40	p < 0.001

STI: Sexually transmitted infection; CI: Confidence interval

A total of 2,950 clients are included in the Poisson regression model where the number of days between STI test and STI notification is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI test and STI notification for clients pre-Healthvana compared to clients post-Healthvana is $p < 0.001$ ($z = -5.86$) (Table 6.13). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI notification is significantly associated with Healthvana implementation status. According to the model, which is interpreted on the log scale, Healthvana implementation is associated with a mean reduction of 0.31 log days between STI test and STI notification (Table 6.13). To obtain the mean ratio—the percentage change in the mean number of days between STI test and STI notification associated with the change in Healthvana implementation status—it is helpful to exponentiate the coefficient: $e^{-0.31} = 0.73$. Healthvana implementation is associated with a 27 percent reduction in the mean number of days between STI test and STI notification. There is enough evidence to once again reject the null and conclude that there is a difference in the mean number of days between STI test and STI notification before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

Table 6.13: Poisson regression analysis results for mean number of days between STI test and STI notification by Healthvana implementation status, including clients who were not successfully treated (n = 2,950)

	Coefficient	IRR (95% CI)	z	p-value
Outcome variable				
STI test to STI notification	-0.31	0.73 (0.66, 0.81)	-5.86	$p < 0.001$

STI: Sexually transmitted infection; IRR: Incidence rate ratio; CI: Confidence interval

Based on the results in the above sub-analysis, it appears that including clients who were successfully notified but did not return for STI treatment (n = 1,490) with the clients who were successfully notified and successfully returned for STI treatment (n = 1,460) demonstrates a statistically significant reduction in the mean number of days between STI test and STI notification for clients regardless of treatment. The mean number of days between STI test and STI notification decreased 27 percent, from 10.55 days to 7.72 days, in the sub-analysis (n = 2,950); in comparison, the mean number of days between STI test and STI notification decreased 22 percent, from 8.77 days to 6.82 days, in the original analyses (n = 1,460). Both analyses demonstrated a relatively similar statistically significant reduction in the mean number of days between STI test and STI notification, which reassures that the original analyses demonstrated a reasonable interpretation of the data set.

Sub-analysis of clients based on sexual orientation

In the original Healthvana implementation status analyses, clients who were tested, notified, and treated for STIs were included in the analysis (n = 1,460). In this sub-analysis, only clients who self-identified their sexual orientation will be included (n = 1,282). Based on sexual orientation, 691 clients self-identified as heterosexual and 591 clients self-identified as gay, bisexual, or other men who have sex with men (MSM). The purpose of this sub-analysis is to measure whether the mean number of days between STI test and STI treatment differed by sexual orientation.

Among the 691 heterosexual clients, 357 (51.66 percent) were tested pre-Healthvana and 334 (48.34 percent) were tested post-Healthvana (Table 6.14). According to Table 6.14, the mean number of days between STI test and STI treatment is 11.29 days for all heterosexual clients (n = 691). By separating heterosexual clients by Healthvana implementation status, there is a visible difference in the mean number of days between STI test and STI treatment. Before Healthvana was implemented (pre-Healthvana), heterosexual clients experienced a mean of 12.60 days (n = 357) between STI test and STI treatment (Table 6.14). After Healthvana was implemented (post-Healthvana), heterosexual clients experienced a mean of 9.89 days (n = 334) between STI test and STI treatment (Table 6.14).

Table 6.14: Heterosexual clients' mean number of days between STI test and STI treatment by Healthvana implementation status (n = 691)

	Pre-Healthvana (n = 357) Mean (days)	Post-Healthvana (n = 334) Mean (days)	Total (n = 691) Mean (days)
Category			
STI test to STI treatment	12.60	9.89	11.29

STI: Sexually transmitted infection

Among the 591 MSM clients, 333 (56.35 percent) were tested pre-Healthvana and 258 (43.35 percent) were tested post-Healthvana (Table 6.15). According to Table 6.15, the mean number of days between STI test and STI treatment is 11.51 days for all MSM clients (n = 591). By separating MSM clients by Healthvana implementation status, there is a visible difference in the mean number of days between STI test and STI treatment. Before Healthvana was implemented (pre-Healthvana), MSM clients experienced a mean of 12.07 days (n = 333) between STI test and STI treatment (Table 6.15). After Healthvana was implemented (post-Healthvana), MSM clients experienced a mean of 10.78 days (n = 258) between STI test and STI treatment (Table 6.15).

Table 6.15: Men who have sex with men clients' mean number of days between STI test and STI treatment by Healthvana implementation status (n = 591)

	Pre-Healthvana (n = 333) Mean (days)	Post-Healthvana (n = 258) Mean (days)	Total (n = 591) Mean (days)
Category			
STI test to STI treatment	12.07	10.78	11.51

STI: Sexually transmitted infection

A total of 691 clients who self-identified as heterosexual are included in the OLS regression model where the number of days between STI test and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI test and STI treatment for heterosexual clients pre-Healthvana compared to heterosexual clients post-Healthvana is $p < 0.001$ ($t = -4.55$) (Table 6.16). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI treatment is significantly associated with Healthvana implementation status. According to the model, Healthvana implementation is associated with a mean reduction of 2.70 days between STI test and STI treatment (Table 6.16). There is enough evidence to reject the null and conclude that there is a difference in the mean number of days between STI test and STI treatment before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

Table 6.16: Heterosexual clients' ordinary least squares regression analysis results for mean number of days between STI test and STI treatment by Healthvana implementation status (n = 691)

	Coefficient (95% CI)	t	p-value
Outcome variable			
STI test to STI treatment	-2.70 (-3.98, -1.43)	-4.55	p < 0.001

STI: Sexually transmitted infection; CI: Confidence interval

A total of 691 clients who self-identified as heterosexual are included in the Poisson regression model where the number of days between STI test and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI test and STI notification for heterosexual clients pre-Healthvana compared to clients post-Healthvana is $p < 0.001$ ($z = -4.13$) (Table 6.17). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI treatment is significantly associated with Healthvana implementation status. According to the model, which is interpreted on the log scale, Healthvana implementation is associated with a mean reduction of 0.24 log days between STI test and STI treatment (Table 6.13). To obtain the mean ratio—the percentage change in the mean number of days between STI test and STI treatment associated with the change in Healthvana implementation status—it is helpful to exponentiate the coefficient: $e^{-0.24} = 0.79$. Healthvana implementation is associated with a 21 percent reduction in the mean number of days between STI test and STI treatment. There is enough evidence to once again reject the null and conclude that there is a difference in the mean number of days between STI test and STI treatment before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

Table 6.17: Heterosexual clients' Poisson regression analysis results for mean number of days between STI test and STI treatment by Healthvana implementation status (n = 691)

	Coefficient	IRR (95% CI)	z	p-value
Outcome variable				
STI test to STI treatment	-0.24	0.79 (0.70, 0.88)	-4.13	p < 0.001

STI: Sexually transmitted infection; IRR: Incidence rate ratio; CI: Confidence interval

A total of 591 clients who self-identified as MSM are included in the OLS regression model where the number of days between STI test and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI test and STI treatment for MSM clients pre-Healthvana compared to heterosexual clients post-Healthvana is $p < 0.078$ ($t = -1.91$) (Table

6.18). Since the p-value is greater than α = 0.05, the mean number of days between STI test and STI treatment among MSM clients is not significantly associated with Healthvana implementation status. There is insufficient evidence to reject the null.

Table 6.18: Men who have sex with men clients' ordinary least squares regression analysis results for mean number of days between STI test and STI treatment by Healthvana implementation status (n = 591)

	Coefficient (95% CI)	t	p-value
Outcome variable			
STI test to STI treatment	-1.30 (-2.76, 0.17)	-1.91	p = 0.078

STI: Sexually transmitted infection; CI: Confidence interval

A total of 591 clients who self-identified as MSM are included in the Poisson regression model where the number of days between STI test and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI test and STI notification for MSM clients pre-Healthvana compared to clients post-Healthvana is $p < 0.064$ ($z = -1.86$) (Table 6.19). Since the p-value is greater than α = 0.05, the mean number of days between STI test and STI treatment among MSM clients is not significantly associated with Healthvana implementation status. There is insufficient evidence to reject the null.

Table 6.19: Men who have sex with men clients' Poisson regression analysis results for mean number of days between STI test and STI treatment by Healthvana implementation status (n = 591)

	Coefficient	IRR (95% CI)	z	p-value
Outcome variable				
STI test to STI treatment	-0.11	0.89 (0.79, 1.00)	-1.86	p = 0.064

STI: Sexually transmitted infection; IRR: Incidence rate ratio; CI: Confidence interval

A total of 1,282 clients are included in the OLS regression model where the number of days between STI test and STI treatment is the outcome variable. The predictor variables in this model include Healthvana implementation status, sexual orientation, and an interaction effect between Healthvana implementation status and sexual orientation. The p-value for the OLS regression for Healthvana implementation status is $p < 0.001$ ($t = -2.70$), the p-value for sexual orientation is $p = 0.349$ ($t = -0.52$), and the p-value for the interaction effect between the two is $p = 0.039$ ($t = 2.26$) (Table 6.20). Based on the interaction effect between Healthvana implementation status and sexual orientation, there is a statistically significant difference between clients who self-identified as heterosexuals and clients who self-identified as MSM (Table 6.20).

Table 6.20: Ordinary least squares regression analysis results for mean number of days between STI test and STI treatment by Healthvana implementation status, sexual orientation, and the interaction effect between Healthvana implementation status and sexual orientation (n = 1,282)

	Coefficient (95% CI)	t	p-value
Predictor variables			
Healthvana implementation status	-2.70 (-3.97, -1.44)	-4.55	p < 0.001
Sexual orientation	-0.52 (-1.68, -0.63)	-0.97	p = 0.349
Interaction variable	1.41 (0.08, 2.73)	2.26	p = 0.039

STI: Sexually transmitted infection; CI: Confidence interval

A total of 1,282 clients are included in the Poisson regression model where the number of days between STI test and STI treatment is the outcome variable. The predictor variables in this model include Healthvana implementation status, sexual orientation, and an interaction effect between Healthvana implementation status and sexual orientation. The p-value for the OLS regression for Healthvana implementation status is $p < 0.001$ ($z = -4.13$), the p-value for sexual orientation is $p = 0.327$ ($z = -0.98$), and the p-value for the interaction effect between the two is $p = 0.015$ ($z = 2.43$) (Table 6.21). Based on the interaction effect between Healthvana implementation status and sexual orientation, there is a statistically significant difference between clients who self-identified as heterosexuals and clients who self-identified as MSM (Table 6.21).

Table 6.21: Poisson regression analysis results for mean number of days between STI test and STI treatment by Healthvana implementation status, sexual orientation, and the interaction effect between Healthvana implementation status and sexual orientation (n = 1,282)

	Coefficient	IRR (95% CI)	z	p-value
Predictor variables				
Healthvana implementation status	-0.24	0.79 (0.70, 0.88)	-4.13	$p < 0.001$
Sexual orientation	-0.04	0.96 (0.88, 1.04)	-0.98	$p = 0.327$
Interaction effect	0.13	1.14 (1.03, 1.26)	2.43	$p = 0.015$

STI: Sexually transmitted infection; IRR: Incidence rate ratio; CI: Confidence interval

Based on the interaction effect between Healthvana implementation status and sexual orientation in both the OLS regression model and the Poisson regression model, there is a statistically significant difference between AHF Wellness Center clients who self-identified as heterosexuals and AHF Wellness Center clients who self-identified as MSM. For heterosexual clients only, both the OLS regression model (Table 6.16) and the Poisson regression model (Table 6.17) demonstrated a statistically significant decrease in the number of days between STI test and STI treatment pre-Healthvana versus post-Healthvana, from 12.60 to 9.89 days. On the other hand, for MSM clients only, both the OLS regression model (Table 6.18) and the Poisson regression model (Table 6.19) did not demonstrate a statistically significant decrease in the number of days between STI test and STI treatment pre-Healthvana versus post-Healthvana. However, the inclusion of an interaction effect in a new OLS regression model (Table 6.20) and a new Poisson regression model (Table 6.21) demonstrated a statistically significant difference between heterosexual clients and MSM clients based on Healthvana implementation status.

Given the fact that the STI testing recommendations from the Centers for Disease Control and Prevention (CDC) for heterosexual men is only one human immunodeficiency virus (HIV) test in their lifetime, it appears that Healthvana implementation status was significantly more effective in reducing the number of days between STI test and STI treatment for clients who self-identified as heterosexual.

Sub-analysis of clients for AHF Wellness Centers that implemented Healthvana

In the original Healthvana implementation status analyses, clients who were tested, notified, and treated for STIs were included in the analysis (n = 1,460). In this sub-analysis, only clients who sought STI testing services at any of the 16 AHF Wellness Centers that implemented Healthvana will be included (n = 1,319). Clients who sought STI testing services at the Dallas AHF Wellness Center (n = 28) and clients who sought STI testing services at the Jacksonville AHF Wellness Center (n = 118) will not be included because both Dallas and Jacksonville did not implement Healthvana during the study time period (January 1, 2014 to December 31, 2015). Based on the remaining 16 AHF Wellness Centers (n = 1,319), 638 clients received STI testing services pre-Healthvana and 681 clients received STI testing services post-Healthvana. The purpose of this sub-analysis is to reassure that the original analyses demonstrated a reasonable interpretation of the data set by excluding two AHF Wellness Centers that did not implement Healthvana.

According to Table 6.22, the mean number of days between STI test and STI treatment is 11.55 days for all clients (n = 1,319). By separating clients by Healthvana implementation status, there is a visible difference in the mean number of days between STI test and STI treatment. Before Healthvana was implemented (pre-Healthvana), clients experienced a mean of 12.47 days (n = 638) between STI test and STI treatment (Table 6.22). After Healthvana was implemented (post-Healthvana), clients experienced a mean of 10.68 days (n = 681) between STI test and STI treatment (Table 6.22).

Table 6.22: Clients' mean number of days between STI test and STI treatment by Healthvana implementation status for AHF Wellness Centers that implemented Healthvana (n = 1,319)

	Pre-Healthvana (n = 638) Mean (days)	Post-Healthvana (n = 681) Mean (days)	Total (n = 1,319) Mean (days)
Category			
STI test to STI treatment	12.47	10.68	11.55

STI: Sexually transmitted infection

A total of 1,319 clients are included in the OLS regression model where the number of days between STI test and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI test and STI treatment for clients pre-Healthvana compared to clients post-Healthvana is p = 0.024 (t = -2.55) (Table 6.23). Since the p-value is less than α = 0.05, the mean number of days between STI test and STI treatment is significantly associated with Healthvana implementation status. According to the model, Healthvana implementation is associated with a mean reduction of 1.79 days between STI test and STI treatment (Table 6.23). There is enough evidence to reject the null and conclude that there is a difference in the mean number of days between STI test and STI treatment before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

Table 6.23: Ordinary least squares regression analysis results for mean number of days between STI test and STI treatment by Healthvana implementation status for AHF Wellness Centers that implemented Healthvana (n = 1,319)

	Coefficient (95% CI)	t	p-value
Outcome variable			
STI test to STI treatment	-1.79 (-3.31, -0.27)	02.55	p = 0.024

STI: Sexually transmitted infection; CI: Confidence interval

A total of 1,319 clients are included in the Poisson regression model where the number of days between STI test and STI treatment is the outcome variable and Healthvana implementation status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI test and STI treatment for clients pre-Healthvana compared to clients post-Healthvana is $p = 0.020$ ($z = -2.33$) (Table 6.24). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI treatment is significantly associated with Healthvana implementation status. According to the model, which is interpreted on the log scale, Healthvana implementation is associated with a mean reduction of 0.16 log days between STI test and STI treatment (Table 6.24). To obtain the mean ratio—the percentage change in the mean number of days between STI test and STI treatment associated with the change in Healthvana implementation status—it is helpful to exponentiate the coefficient: $e^{-0.16} = 0.85$. Healthvana implementation is associated with a 15 percent reduction in the mean number of days between STI test and STI treatment. There is enough evidence to once again reject the null and conclude that there is a difference in the mean number of days between STI test and STI treatment before Healthvana was implemented (pre-Healthvana) compared to after Healthvana was implemented (post-Healthvana).

Table 6.24: Poisson regression analysis results for mean number of days between STI test and STI treatment by Healthvana implementation status for AHF Wellness Centers that implemented Healthvana (n = 1,319)

	Coefficient	IRR (95% CI)	z	p-value
Outcome variable				
STI test to STI treatment	-0.16	0.86 (0.75, -0.98)	-2.33	p = 0.020

STI: Sexually transmitted infection; IRR: Incidence rate ratio; CI: Confidence interval

Based on the results in the above sub-analysis, it appears that excluding clients who received STI testing services at the Dallas AHF Wellness Center and the Jacksonville AHF Wellness Center does not affect the statistically significant reduction in the mean number of days between STI test and STI treatment for clients based on Healthvana implementation status. The mean number of days between STI test and STI treatment decreased 16 percent, from 12.47 days to 10.68 days, in the sub-analysis (n = 1,319); in comparison, the mean number of days between STI test and STI treatment decreased 15 percent, from 12.55 days to 10.68 days, in the original analyses (n = 1,460). Both analyses demonstrated a relatively similar statistically significant reduction in the mean number of days between STI test and STI treatment, which reassures that the original analyses demonstrated a reasonable interpretation of the data set.

CHAPTER 7: NOTIFICATION TYPE STATUS ANALYSIS

Descriptive statistics

As discussed in Chapter 5, notification type status is a predictor variable created to address Hypotheses 4-6. Notification type status is based on whether a client was successfully notified of a positive sexually transmitted infection (STI) test result by telephone call or by Healthvana from AIDS Healthcare Foundation (AHF) Wellness Centers. Among the 1,460 clients, 1,101 (75.41 percent) were notified by telephone call and 359 (24.59 percent) were notified by Healthvana (Table 7.1).

Predisposing factors: In terms of predisposing factors (demographics), clients notified by telephone call and clients notified by Healthvana shared similar characteristics. Most clients who were notified by telephone call were under 25 years old (n = 401), self-identified as White (n = 409) self-identified as not Hispanic or Latino (n = 659), and self-identified as heterosexual (n = 507) (Table 7.2). Most clients notified by Healthvana were also under 25 years old (n = 135), self-identified as White (n = 178), self-identified as not Hispanic or Latino (n = 191), and self-identified as heterosexual (n = 184) (Table 7.2). Most clients notified by telephone call tested positive for chlamydia only (n = 579), followed by gonorrhea only (n = 280), and then syphilis only (n = 119) (Figure 7.1). Most clients notified by Healthvana also tested positive for chlamydia only (n = 198), followed by gonorrhea only (n = 76), and then syphilis only (n = 38) (Figure 7.1).

Need factors: In terms of need factors (risky sexual behaviors), clients notified by telephone call and clients notified by Healthvana shared similar risky sexual behaviors. Most clients notified by telephone call did not report having a history of STIs (n = 1,041), self-reported having two partners in the past year (n = 176), and self-reported using a condom during last anal sex (n = 90) (Table 7.3). Most clients notified by Healthvana also did not report having a history of STIs (n = 343) and self-reported having two partners in the past year (n = 64) (Table 7.3). However, most clients notified by Healthvana self-reported using a condom during last vaginal sex (n = 25) rather than anal sex (n = 14) (Table 7.3).

Table 7.1: Client location by notification type status (n = 1,460)

	Notified by telephone call		Notified by Healthvana		Total
	n	%	n	%	n
AHF Wellness Center					
Benning Road	0	0.00%	0	0.00%	0
Biscayne	53	55.21%	43	44.79%	96
Brooklyn	1	100.00%	0	0.00%	1
Broward	286	62.58%	171	37.42%	457
Carl Bean	60	77.92%	17	22.08%	77
Chicago	0	0.00%	2	100.00%	2
Columbus	8	61.54%	5	38.46%	13
Dallas	23	100.00%	0	0.00%	23
Hollywood	309	86.31%	49	13.69%	358
Jackson	40	70.18%	17	29.82%	57
Jacksonville	118	100.00%	0	0.00%	118
Long Beach	6	54.55%	5	45.45%	11
Oakland	56	84.85%	10	15.15%	66
San Diego	0	0.00%	0	0.00%	0
San Fernando Valley	28	100.00%	0	0.00%	28
San Francisco	1	50.00%	1	50.00%	2
South Beach	55	68.75%	25	31.25%	80
Wilton Manors	57	80.28%	14	19.72%	71
Total	1,101	75.41%	359	24.59%	1,460

AHF: AIDS Healthcare Foundation

Figure 7.1: Client chlamydia, gonorrhea, and/or syphilis infections by notification type status (n = 1,460)

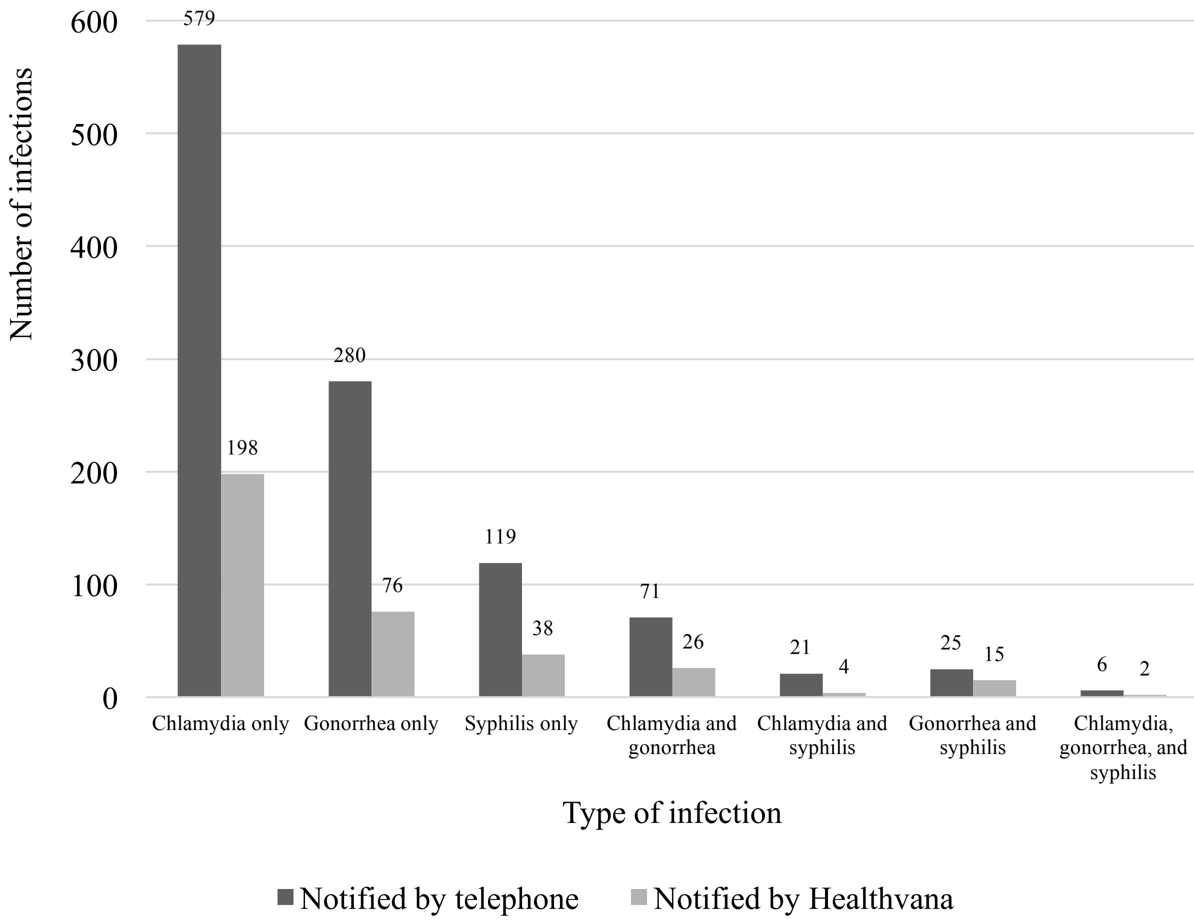


Table 7.2: Client demographics by notification type status (n = 1,460)

	Notified by telephone call		Notified by Healthvana		Total
	n	%	n	%	n
Age					
< 25 years old	401	74.81%	135	25.19%	536
25-29 years old	291	73.67%	104	26.33%	395
30-39 years old	246	78.85%	66	21.15%	312
40+ years old	163	75.12%	54	24.88%	217
Race					
American Indian/Alaska Native	2	100.00%	0	0.00%	2
Asian	43	70.49%	18	29.51%	61
Black/African American	405	78.34%	112	21.66%	517
Native Hawaiian/Pacific Islander	4	80.00%	1	20.00%	5
White	409	69.68%	178	30.32%	587
Other	28	87.50%	4	12.50%	32
Missing	*210*	*82.03%*	*46*	*17.97%*	*256*
Ethnicity					
Hispanic/Latino	286	68.42%	132	31.58%	418
Not Hispanic/Latino	659	77.53%	191	22.47%	850
Missing	*156*	*81.25%*	*36*	*18.75%*	*192*
Sexual orientation					
Heterosexual	507	73.37%	184	26.63%	691
MSM	454	76.82%	137	23.18%	591
Missing	*140*	*78.65%*	*38*	*21.35%*	*178*
Total	1,101	75.41%	359	24.59%	1,460

MSM: Men who have sex with men; STI: Sexually transmitted infection

Table 7.3: Client risky sexual behaviors by notification type status (n = 1,460)

	Notified by telephone call		Notified by Healthvana		Total
	n	%	n	%	n
Having a history of STIs					
Yes	60	78.95%	16	21.05%	76
No response	*1,041*	*75.22%*	*343*	*24.78%*	*1,384*
Number of partners in the past year					
0	3	60.00%	2	40.00%	5
1	121	77.07%	36	22.93%	157
2	176	73.33%	64	26.67%	240
3	159	78.33%	44	21.67%	203
4	117	76.47%	36	23.53%	153
5	94	75.81%	30	24.19%	124
6	55	69.62%	24	30.38%	79
7	17	65.38%	9	34.62%	26
8	23	76.67%	7	23.33%	30
9	6	85.71%	1	14.29%	7
10+	149	70.28%	63	29.72%	212
Missing	*181*	*80.80%*	*43*	*19.20%*	*224*
Condom use during last sex					
Anal only	90	86.54%	14	13.46%	104
Vaginal only	64	71.91%	25	28.09%	89
Oral only	2	100.00%	0	0.00%	2
Anal and vaginal	8	72.73%	3	27.27%	11
Anal and oral	3	60.00%	2	40.00%	5
Vaginal and oral	1	100.00%	0	0.00%	1
Anal, vaginal, and oral	0	0.00%	0	0.00%	0
Missing	*933*	*74.76%*	*315*	*25.24%*	*1,248*
Total	1,101	75.41%	359	24.59%	1,460

STI: Sexually transmitted infection

Pearson's chi-squared tests

According to Table 7.4, pre-Healthvana clients and post-Healthvana clients are different in race and ethnicity ($p < 0.05$). On the other hand, there is no statistically significant difference in age ($p = 0.433$), sexual orientation ($p = 0.203$), having a history of STIs ($p = 0.462$), number of partners in the past year ($p = 0.345$), and condom use during last sex ($p = 0.148$). Regarding AHF Wellness Centers, most clients notified by telephone call sought STI testing at Hollywood ($n = 309$), while most clients notified by Healthvana sought STI testing at Broward ($n = 171$) (Table 7.1). Regarding race, this difference may be due to the fact that there were almost as many clients who were notified by telephone call who self-identified as Black or African American as there were clients who self-identified as White, while this was not the case for clients who were notified by Healthvana (Table 7.2). Regarding ethnicity, the ratio of clients notified by telephone call who self-identified as not Hispanic or Latino was more than twice the number of clients notified by telephone call who self-identified as Hispanic or Latino; conversely, the number of clients notified by Healthvana who self-identified as not Hispanic or Latino was less than 1.5-times the number of clients notified by Healthvana who self-identified as Hispanic or Latino (Table 7.2).

Table 7.4: Pearson's chi-squared test results summary by notification type status (n = 1,460)

	Pearson's chi-squared test results
Location	
AHF Wellness Center	$p < 0.001$
Demographics	
Age	$p = 0.433$
Race	$p = 0.001$
Ethnicity	$p < 0.001$
Sexual orientation	$p = 0.203$
Risky sexual behaviors	
Having a history of STIs	$p = 0.462$
Number of partners in the past year	$p = 0.345$
Condom use during last sex	$p = 0.148$

AHF: AIDS Healthcare Foundation; STI: Sexually transmitted infection

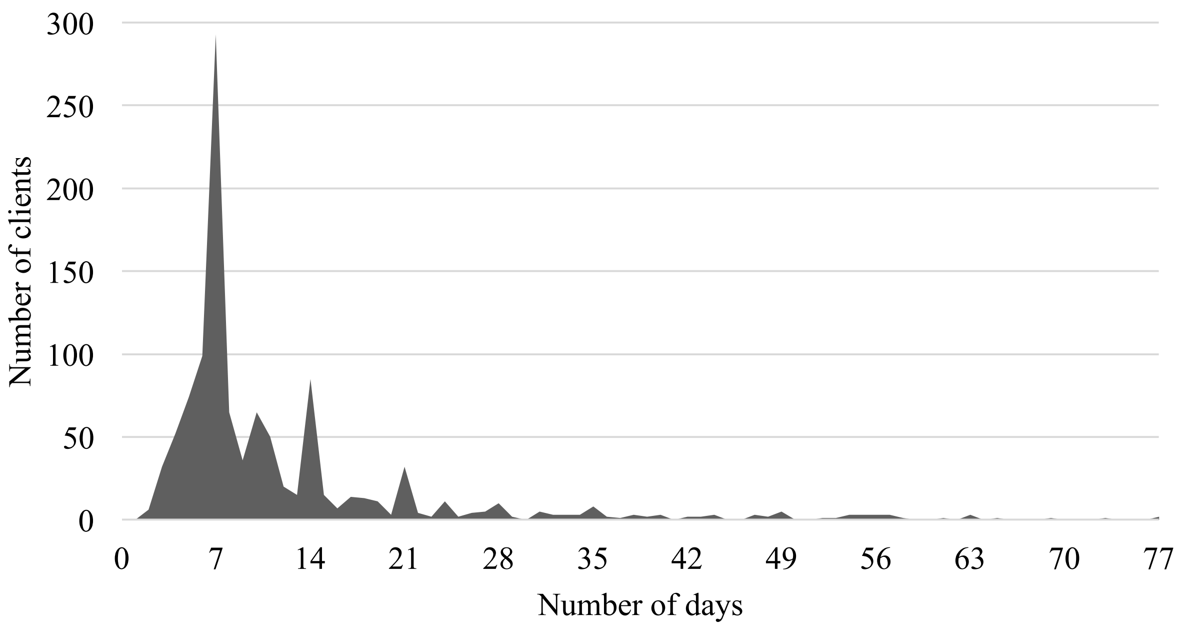
Ordinary least squares regression

According to Table 7.5, the mean number of days between STI test and STI treatment is 11.68 days for all clients (n = 1,460). By separating clients by notification type status, there is a visible difference in the mean number of days between STI test and STI treatment (Figures 7.2 and 7.3). Clients who were notified by telephone call experienced a mean of 11.95 days (n = 1,101) between STI test and STI treatment (Table 7.5). Clients who were notified by Healthvana experienced a mean of 10.86 days (n = 359) between STI test and STI treatment (Table 7.5).

According to Table 7.5, the mean number of days between STI test and STI notification is 7.86 days for all clients (n = 1,460). By separating clients by notification type status, there is a visible difference in the mean number of days between STI test and STI notification. Clients who were notified by telephone call experienced a mean of 8.40 days (n = 1,101) between STI test and STI notification (Table 7.5). Clients who were notified by Healthvana experienced a mean of 6.20 days (n = 359) between STI test and STI notification (Table 7.5).

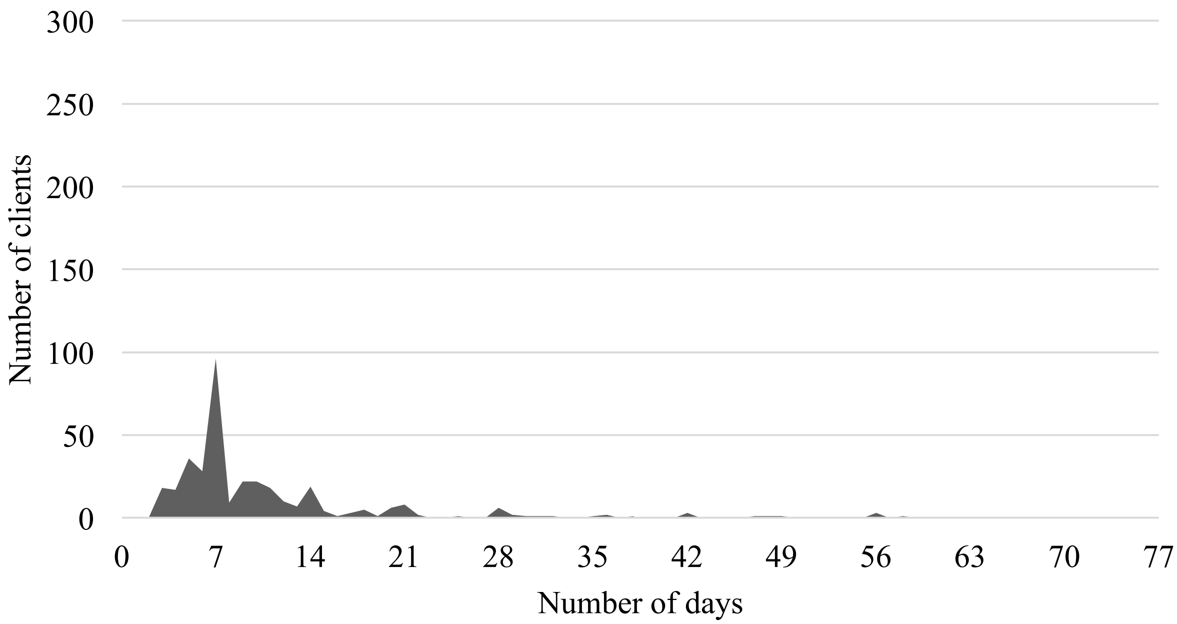
According to Table 7.5, the mean number of days between STI notification and STI treatment is 3.82 days for all clients (n = 1,460). By separating clients by notification type status, there appears to be an inverse difference in the mean number of days between STI notification and STI treatment. Clients who were notified by telephone call experienced a mean of 3.55 days (n = 1,101) while clients who were notified by Healthvana experienced a mean of 4.66 days (n = 359) between STI test and STI notification (Table 7.5).

Figure 7.2: Clients notified by telephone call number of days between STI test and STI treatment (n = 1,101)



STI: Sexually transmitted infection

Figure 7.3: Clients notified by Healthvana number of days between STI test and STI treatment (n = 359)



STI: Sexually transmitted infection

Table 7.5: Mean number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment by notification type status (n = 1,460)

	Notified by telephone call (n = 1,101) Mean (days)	Notified by Healthvana (n = 359) Mean (days)	Total (n = 1,460) Mean (days)
Category			
STI test to STI treatment	11.95	10.86	11.68
STI test to STI notification	8.40	6.20	7.86
STI notification to STI treatment	3.55	4.66	3.82

STI: Sexually transmitted infection

A total of 1,460 clients are included in the ordinary least squares (OLS) regression model where the number of days between STI test and STI treatment is the outcome variable and notification type status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI test and STI treatment for clients notified by telephone call compared to clients notified by Healthvana is $p = 0.019$ ($t = -2.62$) (Table 7.6). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI treatment is significantly associated with notification type status. According to the model, notification type is associated with a mean reduction of 1.08 days between STI test and STI treatment (Table 7.6). There is enough evidence to reject the null in Hypothesis 4 and conclude that there is a difference in the mean number of days between STI test and STI treatment for clients who were notified by telephone call compared to clients who were notified by Healthvana.

A total of 1,460 clients are included in the OLS regression model where the number of days between STI test and STI notification is the outcome variable and notification type status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI test and STI notification for clients notified by telephone call compared to clients notified by Healthvana is $p < 0.001$ ($t = -5.80$) (Table 7.6). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI notification is significantly associated with notification type status. According to the model, notification type is associated with a mean reduction of 2.19 days between STI test and STI notification (Table 7.6). There is enough evidence to reject the null in Hypothesis 5 and conclude that there is a difference in the mean number of days between STI test and STI notification for clients who were notified by telephone call compared to clients who were notified by Healthvana.

A total of 1,460 clients are included in the OLS regression model where the number of days between STI notification and STI treatment is the outcome variable and notification type status is the predictor variable. The p-value for the OLS regression for the mean number of days between STI test and STI notification for clients notified by telephone call compared to clients notified by Healthvana is $p = 0.026$ ($t = 2.46$) (Table 7.6). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI notification and STI treatment is significantly associated with notification type status. According to the model, notification type is associated with a mean increase of 1.11 more days between STI notification and STI treatment (Table 7.6). There is enough evidence to reject the null in Hypothesis 6 and conclude that there is a difference in the mean number of days between STI notification and STI treatment for clients who were notified by telephone call compared to clients who were notified by Healthvana. It is important to note, however, that this analysis contradicts the previous two analyses where clients who were notified by Healthvana had fewer days between STI test and STI treatment as well as STI test and STI notification compared to clients who were notified by telephone call.

Table 7.6: Ordinary least squares regression analysis results for mean number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment by notification type status (n = 1,460)

	Coefficient (95% CI)	t	p-value
Outcome variables			
STI test to STI treatment	-1.08 (-1.97, -0.20)	-2.62	p = 0.019
STI test to STI notification	-2.19 (-3.00, -1.39)	-5.80	p < 0.001
STI notification to STI treatment	1.11 (0.15, 2.07)	2.46	p = 0.026

STI: Sexually transmitted infection; CI: Confidence interval

Poisson regression

Poisson regression models described below evaluate the relationship between the mean number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment for clients notified by telephone call compared to clients notified by Healthvana. Unlike an OLS regression, in a Poisson regression the unit change in the predictor leads to a percentage change in the outcome. Percentage change is useful for interpreting the change in the mean number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment.

A total of 1,460 clients are included in the Poisson regression model where the number of days between STI test and STI treatment is the outcome variable and notification type status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI test and STI treatment for clients notified by telephone call compared to clients notified by Healthvana is $p = 0.014$ ($z = -2.46$) (Table 7.7). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI treatment is significantly associated with notification type status. According to the model, which is interpreted on the log scale, notification by Healthvana is associated with a mean reduction of 0.10 log days between STI test and STI treatment (Table 7.7). To obtain the mean ratio—the percentage change in the mean number of days between STI test and STI treatment associated with the change in notification type status—it is helpful to exponentiate the coefficient: $e^{-0.10} = 0.90$. Notification by Healthvana is associated with a 10 percent reduction in the mean number of days between STI test and STI treatment. There is enough evidence to once again reject the null in Hypothesis 4 and conclude that there is a difference in the mean number of days between STI test and STI treatment for clients notified by telephone call compared to clients notified by Healthvana.

A total of 1,460 clients are included in the Poisson regression model where the number of days between STI test and STI notification is the outcome variable and notification type status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI test and STI notification for clients notified by telephone call compared to clients notified by Healthvana is $p < 0.001$ ($z = -5.28$) (Table 7.7). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI test and STI notification is significantly associated with notification type status. According to the model, which is interpreted on the log scale, notification by Healthvana is associated with a mean of 0.30 fewer log days between STI test and STI notification (Table 7.7). To obtain the mean ratio—the percentage change in the mean number of days between STI test and STI notification associated with the change in notification type status—it is helpful to exponentiate the coefficient: $e^{-0.30} = 0.74$. Notification by Healthvana is associated with a 26 percent reduction in the mean number of days between STI test and STI notification. There is enough evidence to once again reject the null in Hypothesis 5 and conclude that there is a difference in the mean number of days between STI test and STI notification for clients notified by telephone call compared to clients notified by Healthvana.

A total of 1,460 clients are included in the Poisson regression model where the number of days between STI notification and STI treatment is the outcome variable and notification type status is the predictor variable. The p-value for the Poisson regression for the mean number of days between STI notification and STI treatment for clients notified by telephone call compared to clients notified by Healthvana is $p = 0.011$ ($z = 0.27$) (Table 7.7). Since the p-value is less than $\alpha = 0.05$, the mean number of days between STI notification and STI treatment is significantly associated with notification type status. According to the model, which is interpreted on the log scale, notification by Healthvana is associated with a mean of 0.27 more log days between STI notification and STI treatment (Table 7.7). To obtain the mean ratio—the percentage change in the mean number of days between STI notification and STI treatment associated with the change in notification type status—it is helpful to exponentiate the coefficient: $e^{0.27} = 1.31$. Notification by Healthvana is associated with a 31 percent increase in the mean number of days between STI notification and STI treatment. There is enough evidence to once again reject the null in Hypothesis 6 and conclude that there is a difference in the mean number of days between STI notification and STI treatment for clients notified by telephone call compared to clients notified by Healthvana.

Table 7.7: Poisson regression analysis results for mean number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment by notification type status (n = 1,460)

	Coefficient	IRR (95% CI)	z	p-value
Outcome variables				
STI test to STI treatment	-0.10	0.91 (0.84, 0.98)	-2.46	p = 0.014
STI test to STI notification	-0.30	0.74 (0.66, 0.83)	-5.28	p < 0.001
STI notification to STI treatment	0.27	1.31 (1.06, 1.62)	2.54	p = 0.011

STI: Sexually transmitted infection; IRR: Incidence rate ratio; CI: Confidence interval

CHAPTER 8: HEALTHVANA OPT-IN STATUS ANALYSIS

Descriptive statistics

As discussed in Chapter 5, Healthvana opt-in status is a predictor variable created to address Hypotheses 7-13. Healthvana opt-in status is based on whether a client did not opt in to Healthvana or opted in to Healthvana. Among the 1,460 clients, 854 (58.49 percent) did not opt in to Healthvana and 606 (41.51 percent) opted in to Healthvana (Table 8.1).

Predisposing factors: In terms of predisposing factors (demographics), clients who did not opt in to Healthvana and clients who opted in to Healthvana shared similar demographics. Most clients who did not opt in to Healthvana were under 25 years old (n = 300), self-identified as White (n = 320) self-identified as not Hispanic or Latino (n = 521), and self-identified as heterosexual (n = 389) (Table 8.2). Most clients who opted in to Healthvana were also under 25 years old (n = 236), self-identified as White (n = 267), self-identified as not Hispanic or Latino (n = 329), and self-identified as heterosexual (n = 302) (Table 8.2). Most clients who did not opt in to Healthvana tested positive for chlamydia only (n = 441), followed by gonorrhea only (n = 234), and then syphilis only (n = 87) (Figure 8.1). Most clients who opted in to Healthvana also tested positive for chlamydia only (n = 336), followed by gonorrhea only (n = 122), and then syphilis only (n = 70) (Figure 8.1).

Need factors: In terms of need factors (risky sexual behaviors), clients who did not opt in to Healthvana and clients who opted in to Healthvana shared similar risky sexual behaviors. Most clients who did not opt in to Healthvana did not report having a history of STIs (n = 805), self-reported having two partners in the past year (n = 135), and self-reported using a condom during last anal sex (n = 75) (Table 8.3). Most clients who opted in to Healthvana also did not report having a history of STIs (n = 579) and self-reported having two partners in the past year (n

= 240). However, most clients who opted in to Healthvana self-reported using a condom during last vaginal sex (n = 35) rather than anal sex (n = 29) (Table 8.3).

Table 8.1: Client location by Healthvana opt-in status (n = 1,460)

	Did not opt in to Healthvana		Opted in to Healthvana		Total
	n	%	n	%	n
AHF Wellness Center					
Benning Road	0	0.00%	0	0.00%	0
Biscayne	29	30.21%	67	69.79%	96
Brooklyn	1	100.00%	0	0.00%	1
Broward	203	44.42%	254	55.58%	457
Carl Bean	47	61.04%	30	38.96%	77
Chicago	0	0.00%	2	100.00%	2
Columbus	1	7.69%	12	92.31%	13
Dallas	23	100.00%	0	0.00%	23
Hollywood	254	70.95%	104	29.05%	358
Jackson	25	43.86%	32	56.14%	57
Jacksonville	118	100.00%	0	0.00%	118
Long Beach	5	45.45%	6	54.55%	11
Oakland	49	74.24%	17	25.76%	66
San Diego	0	0.00%	0	0.00%	0
San Fernando Valley	21	75.00%	7	25.00%	28
San Francisco	1	50.00%	1	50.00%	2
South Beach	31	38.75%	49	61.25%	80
Wilton Manors	46	64.79%	25	35.21%	71
Total	854	58.49%	606	41.51%	1,460

AHF: AIDS Healthcare Foundation

Figure 8.1: Client chlamydia, gonorrhea, and/or syphilis infections by Healthvana opt-in status (n = 1,460)

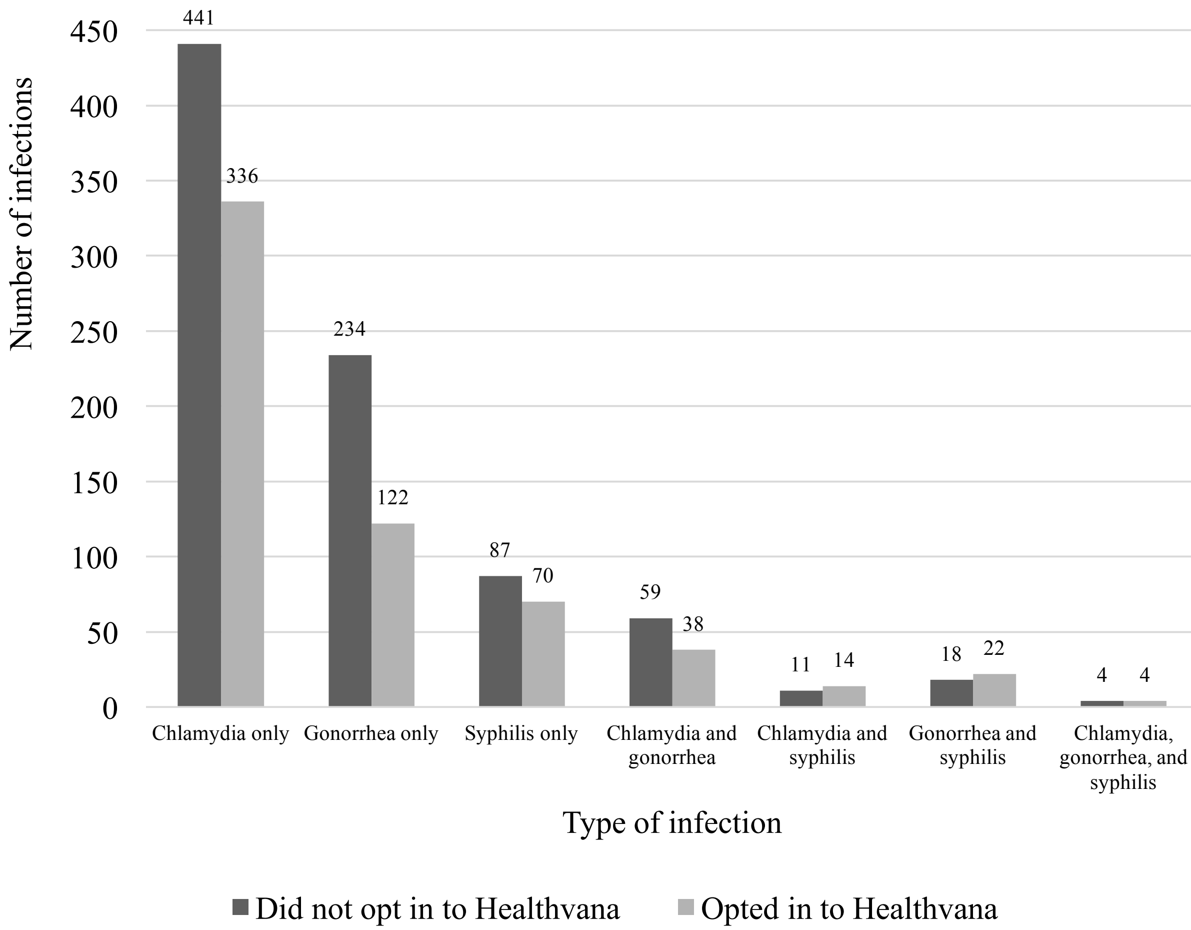


Table 8.2: Client demographics by Healthvana opt-in status (n = 1,460)

	Did not opt in to Healthvana		Opted in to Healthvana		Total
	n	%	n	%	n
Age					
< 25 years old	300	55.97%	236	44.03%	536
25-29 years old	232	58.73%	163	41.27%	395
30-39 years old	188	60.26%	124	39.74%	312
40+ years old	134	61.75%	83	38.25%	217
Race					
American Indian/Alaska Native	0	0.00%	2	100.00%	2
Asian	32	52.46%	29	47.54%	61
Black/African American	312	60.35%	205	39.65%	517
Native Hawaiian/Pacific Islander	2	40.00%	3	60.00%	5
White	320	54.51%	267	45.49%	587
Other	23	71.88%	9	28.12%	32
Missing	*165*	*64.45%*	*91*	*35.55%*	*256*
Ethnicity					
Hispanic/Latino	221	52.87%	197	47.13%	418
Not Hispanic/Latino	521	61.29%	329	38.71%	850
Missing	*112*	*58.33%*	*80*	*41.67%*	*192*
Sexual orientation					
Heterosexual	389	56.30%	302	43.70%	691
MSM	365	61.76%	226	38.24%	591
Missing	*100*	*56.18%*	*78*	*43.82%*	*178*
Total	854	58.49%	606	41.51%	1,460

MSM: Men who have sex with men; STI: Sexually transmitted infection

Table 8.3: Client risky sexual behaviors by Healthvana opt-in status (n = 1,460)

	Did not opt in to Healthvana		Opted in to Healthvana		Total
	n	%	n	%	n
Having a history of STIs					
Yes	49	64.47%	27	35.53%	76
No response	*805*	*58.16%*	*579*	*41.84%*	*1,384*
Number of partners in the past year					
0	3	60.00%	2	40.00%	5
1	102	64.97%	55	35.03%	157
2	135	56.25%	105	43.75%	240
3	126	62.07%	77	37.93%	203
4	78	50.98%	75	49.02%	153
5	75	60.48%	49	39.52%	124
6	45	56.96%	34	43.04%	79
7	11	42.31%	15	57.69%	26
8	19	63.33%	11	36.67%	30
9	6	85.71%	1	14.29%	7
10+	117	55.19%	95	44.81%	212
Missing	*137*	*61.16%*	*87*	*38.84%*	*224*
Condom use during last sex					
Anal only	75	72.12%	29	27.88%	104
Vaginal only	54	60.67%	35	39.33%	89
Oral only	2	100.00%	0	0.00%	2
Anal and vaginal	5	45.45%	6	54.55%	11
Anal and oral	3	60.00%	2	40.00%	5
Vaginal and oral	1	100.00%	0	0.00%	1
Anal, vaginal, and oral	0	0.00%	0	0.00%	0
Missing	*714*	*57.21%*	*534*	*42.79%*	*1,248*
Total	854	58.49%	606	41.51%	1,460

STI: Sexually transmitted infection

Logistic regression

Logistic regressions are utilized to model the probability of an outcome based on predictor variables. For a logistic regression, the distribution of the outcome (Y) is assumed to be binomial. In this case, the binomial outcome is either did not opt in to Healthvana or opted in to Healthvana. The coefficients in a logistic regression provide the same information as they do in an ordinary least squares (OLS) regression except that the coefficients are interpreted on the odds scale.

Individual logistic regressions based on demographics (predisposing factors) and risky sexual behaviors (need factors) were run to determine what type of clients opted in to Healthvana. Based on the tables below, there does not appear to be enough evidence to suggest a relationship between whether a client opted in to Healthvana and race (Table 8.4), ethnicity (Table 8.4), sexual orientation (Table 8.4), or having a history of STIs (Table 8.5). On the other hand, there were statistically significant relationships between whether a client opted in to Healthvana and age (Table 8.4), number of partners in the past year (Table 8.5), and condom use during last sex (Table 8.5).

According to Table 8.4, clients who are 30-39 years old have a 16 percent reduced odds (1 - 0.84 = 0.16) of opting in to Healthvana compared to clients who are under 25 years old ($p = 0.027$). To add, clients who are 40 years old or older have a 21 percent reduced odds (1 - 0.79 = 0.21) of opting in to Healthvana compared to clients who are under 25 years old ($p = 0.004$) (Table 8.4). There is enough evidence to reject the null in Hypothesis 7 and conclude that there are some differences in age between clients who did not opt in to Healthvana and clients who opted in to Healthvana.

According to Table 8.5, clients who self-reported two partners in the past year had a 44 percent increased odds of opting in to Healthvana compared to clients who self-reported one partner in the past year ($p = 0.017$). In addition, clients who self-reported seven partners in the past year had a 2.53-times increased odds of opting in to Healthvana compared to clients who self-reported one partner in the past year ($p = 0.022$). Conversely, clients who self-reported nine partners in the past year had a 69 percent reduced odds ($1 - 0.31 = 0.69$) of opting in to Healthvana compared to clients who self-reported one partner in the past year ($p = 0.016$). It is important to note the small sample size among clients who self-reported nine partners ($n = 7$). In addition, it is important to be cautious when interpreting the odds ratio for clients who self-reported seven partners in the past year ($n = 26$) and clients who reported nine partners in the past year ($n = 7$) due to the small sample sizes (Table 8.3). While there is some evidence to reject the null in Hypothesis 12 and conclude that there are some differences in number of partners in the past year for clients who did not opt in to Healthvana and clients who opted in to Healthvana, this dissertation will not include number of partners in the past year as a successful predictor of opting in to Healthvana in order to be cautious of missing values and small sample sizes.

According to Table 8.5, clients who self-reported condom use during last anal sex only had a 68 percent reduced odds ($1 - 0.32 = 0.68$) of opting in to Healthvana compared to clients who self-reported condom use during last anal and vaginal sex ($p = 0.030$). There was insufficient evidence to suggest an odds ratio of opting in to Healthvana for the remaining categories surrounding condom use during last sex. In addition, it is important to be cautious when comparing the clients who self-reported condom use during last anal sex only ($n = 104$) with the clients who self-reported condom use during last anal and vaginal sex ($n = 11$) considering the very small sample size (Table 8.3). While there is some evidence to reject the null in Hypothesis 13 and conclude that there are some differences in condom use during last sex between clients who did not opt in to Healthvana and clients who opted in to Healthvana, this dissertation will not include condom use during last sex as a successful predictor of opting in to Healthvana in order to be cautious of the sample size in the analysis.

In terms of race (Hypothesis 8), ethnicity (Hypothesis 9), sexual orientation (Hypothesis 10), and having a history of sexually transmitted infections (STIs) (Hypothesis 11), there is insufficient evidence to suggest differences in the odds between clients who did not opt in to Healthvana and clients who opted in to Healthvana (Tables 8.4 and 8.5).

Table 8.4: Logistic regression test results for demographics by Healthvana opt-in status

	Coefficient	OR (95% CI)	z	p-value
Age				
< 25 years old	Reference group	-	-	-
25-29 years old	-0.11	0.89 (0.71, 1.12)	-0.99	p = 0.320
30-39 years old	-0.18	0.84 (0.72, 0.98)	-2.21	p = 0.027
40+ years old	-0.24	0.79 (0.67, 0.93)	-2.85	p = 0.004
Race				
Asian	0.08	1.09 (0.60, 1.95)	0.28	p = 0.782
Black/African American	-0.24	0.79 (0.45, 1.37)	-0.84	p = 0.398
White	Reference group	-	-	-
Other*	-0.40	0.67 (0.17, 2.66)	-0.57	p = 0.570
Ethnicity				
Hispanic/Latino	Reference group	-	-	-
Not Hispanic/Latino	0.34	1.41 (0.82, 2.43)	1.24	p = 0.214
Sexual orientation				
Heterosexual	Reference group	-	-	-
MSM	-0.23	0.80 (0.45, 1.40)	-0.79	p = 0.432

MSM: Men who have sex with men; OR: Odds ratio; CI: Confidence interval

**Due to the small sample sizes, American Indian/Alaska Native and Native Hawaiian/Pacific Islander are included as "Other"*

Table 8.5: Logistic regression test results for risky sexual behaviors by Healthvana opt-in status

	Coefficient	OR (95% CI)	z	p-value
Having a history of STIs				
Yes	-0.27	0.77 (0.34, 1.74)	-0.64	p = 0.523
No response	*Reference group*	-	-	-
Number of partners in the past year				
0	0.21	1.24 (0.34, 4.56)	0.32	p = 0.750
1	Reference group	-	-	-
2	0.37	1.44 (1.07, 1.95)	2.39	p = 0.017
3	0.13	1.13 (0.76, 1.69)	0.62	p = 0.538
4	0.58	1.78 (0.91, 3.48)	1.69	p = 0.090
5	0.19	1.21 (0.66, 2.21)	0.63	p = 0.532
6	0.34	1.40 (0.71, 2.77)	0.97	p = 0.331
7	0.93	2.53 (1.14, 5.60)	2.29	p = 0.022
8	0.07	1.07 (0.36, 3.24)	0.13	p = 0.900
9	-1.17	0.31 (0.11, 0.81)	-2.40	p = 0.016
10+	0.41	1.51 (0.78, 2.92)	1.21	p = 0.227
Condom use during last sex				
Anal only	-1.13	0.32 (0.12, 0.90)	-2.17	p = 0.030
Vaginal only	-0.62	0.54 (0.08, 3.46)	-0.65	p = 0.515
Oral only	-	-	-	-
Anal and vaginal	Reference group	-	-	-
Anal and oral	-0.59	0.56 (0.20, 1.54)	-1.13	p = 0.257
Vaginal and oral	-	-	-	-
Anal, vaginal, and oral	-	-	-	-

MSM: Men who have sex with men; OR: Odds ratio; CI: Confidence interval

CHAPTER 9: DISCUSSION

Summary of the results

This dissertation included a cross-sectional analysis of retrospective data from 1,460 male clients who were tested, notified, and treated for sexually transmitted infection (STI) testing at any of the 18 AIDS Healthcare Foundation (AHF) Wellness Centers between January 1, 2014 and December 31, 2015 (two years of data). Ordinary least squares (OLS) and Poisson regressions were utilized to measure the number of days between STI test, notification, and treatment based on Healthvana implementation status and notification type status. In addition, the theoretical framework discussed in Chapter 3 provided a guideline to select demographics (predisposing factors) and risky sexual behaviors (need factors) for seven variables that were operationalized and measured based on Healthvana opt-in status using logistic regression.

Thirteen hypotheses were addressed using four outcome variables and nine predictor variables. In terms of Healthvana implementation status, there are statistically significant differences in the days between STI test and STI treatment (Hypothesis 1) and in the days between STI test and STI notification (Hypothesis 2); there was no statistically significant difference in the days between STI notification and STI treatment (Hypothesis 3) (Table 9.1). In terms of notification type status, there are statistically significant differences in the days between STI test and STI treatment (Hypothesis 4), STI test and STI notification (Hypothesis 5), and STI notification and STI treatment (Hypothesis 6). Lastly, in terms of Healthvana opt-in status, there are statistically significant differences in age (Hypothesis 7); there are cautiously statistically significant differences in the number of partners in the past year (Hypothesis 12), and condom use during last sex (Hypothesis 13); and there were no statistically significant differences in race

(Hypothesis 8), ethnicity (Hypothesis 9), sexual orientation (Hypothesis 10), or having a history of STIs (Hypothesis 11) (Table 9.1).

Table 9.1: Summary of hypotheses and results

Hypotheses	Results
Healthvana implementation status	
Hypothesis 1: STI test to STI treatment	Reject the null; there is a difference
Hypothesis 2: STI test to STI notification	Reject the null; there is a difference
Hypothesis 3: STI notification to STI treatment	Failure to reject the null
Notification type status	
Hypothesis 4: STI test to STI treatment	Reject the null; there is a difference
Hypothesis 5: STI test to STI notification	Reject the null; there is a difference
Hypothesis 6: STI notification to STI treatment	Reject the null; there is a difference
Healthvana opt-in status	
Hypothesis 7: Age	Reject the null; there is a difference
Hypothesis 8: Race	Failure to reject the null
Hypothesis 9: Ethnicity	Failure to reject the null
Hypothesis 10: Sexual orientation	Failure to reject the null
Hypothesis 11: Having a history of STIs	Failure to reject the null
Hypothesis 12: Number of partners in the past year	Cautiously reject the null
Hypothesis 13: Condom use during last sex	Cautiously reject the null

STI: Sexually transmitted infection

Healthvana implementation status

In the analysis that separated clients by Healthvana implementation status, 779 clients (53.36 percent) were tested before Healthvana was implemented (pre-Healthvana) and 681 clients (46.64 percent) were tested after Healthvana was implemented (post-Healthvana). It is important to note that Healthvana implementation status as a predictor variable does not take into account whether a client was notified by telephone call or Healthvana; rather, this predictor variable is interested in whether the overall implementation of Healthvana at each AHF Wellness Center is associated with a change in the number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment.

The mean number of days between STI test and STI treatment was 12.55 days for pre-Healthvana clients and 10.68 days for post-Healthvana clients. According to the OLS and

Poisson regression models, the difference in the mean number of days between STI test and STI treatment by Healthvana implementation status was statistically significant, representing a reduction in the number of days between STI test and STI treatment by 1.87 days or 15 percent ($p = 0.022$ and $p = 0.019$, respectively).

The mean number of days between STI test and STI notification was 8.77 days for pre-Healthvana clients and 6.82 days for post-Healthvana clients. According to the OLS and Poisson regression models, the difference in the mean number of days between STI test and STI notification by Healthvana implementation status was statistically significant, representing a reduction in the number of days between STI test and STI notification by 1.95 days or 22 percent ($p = 0.001$ and $p < 0.001$, respectively).

The mean number of days between STI notification and STI treatment was 3.79 days for pre-Healthvana clients and 3.86 days for post-Healthvana clients. According to the OLS and Poisson regression models, the difference in the mean number of days between STI notification and STI treatment by Healthvana implementation status was not statistically significant ($p = 0.810$ and $p = 0.804$, respectively).

The statistically significant decrease in the mean number of days between STI test and STI treatment and the statistically significant decrease in the mean number of days between STI test and STI notification based on Healthvana implementation status is encouraging for AHF Wellness Centers. It is not surprising that the difference in the mean number of days between STI notification and STI treatment based on Healthvana implementation status was not statistically significant; clients were likely seeking STI treatment immediately after being notified of a positive STI test result, regardless of how the notification was delivered.

Notification type status

In the analysis that separated clients by notification type status, 1,101 clients (75.41 percent) were notified by telephone call and 359 clients (24.59 percent) were notified by Healthvana. It is important to note that notification type status as a predictor variable does not address whether a client opted in to Healthvana; rather, this predictor variable is interested in whether the client was first successfully notified by telephone call or by Healthvana and whether notification type is associated with a change in the number of days between STI test and STI treatment, STI test and STI notification, and STI notification and STI treatment.

The mean number of days between STI test and STI treatment was 11.95 days for clients notified by telephone call and 10.86 days for clients notified by Healthvana. According to the OLS and Poisson regression models, the difference in the mean number of days between STI test and STI treatment by notification type status was statistically significant, representing a reduction in the number of days between STI test and STI treatment by 1.08 days or 10 percent ($p = 0.019$ and $p = 0.014$, respectively).

The mean number of days between STI test and STI notification was 8.40 days for clients notified by telephone call and 6.20 days for clients notified by Healthvana. According to the OLS and Poisson regression models, the difference in the mean number of days between STI test and STI notification by notification type status was statistically significant, representing a reduction in the number of days between STI test and STI notification by 2.19 days or 26 percent ($p < 0.001$ and $p < 0.001$, respectively).

The mean number of days between STI notification and STI treatment was 3.55 days for clients notified by telephone call and 4.66 days for clients notified by Healthvana. According to the OLS and Poisson regression models, the difference in the mean number of days between STI notification and STI treatment by notification type status was statistically significant, representing an increase—rather than reduction—in the number of days between STI notification and STI treatment by 1.10 days or 31 percent ($p = 0.026$ and $p = 0.011$, respectively).

The statistically significant decrease in the mean number of days between STI test and STI treatment and the statistically significant decrease in the mean number of days between STI test and STI notification based on notification type status is encouraging for AHF Wellness Centers. It is surprising that the difference in the mean number of days between STI notification and STI treatment based on notification type status was statistically significant and in the opposite direction. Clients who were notified by Healthvana experienced a mean of one day extra between STI notification and STI treatment compared to clients who were notified by telephone call. This difference contradicts the results from the data analyses surrounding Healthvana implementation status. There are factors that may have contributed to this one-day increase in the number of days between STI notification and STI treatment, such as the demographics or risky sexual behaviors of the clients, the number of days each AHF Wellness Center is open, the date Healthvana was implemented, or external factors such as social marketing campaigns that occurred near each AHF Wellness Center before Healthvana was implemented. Regardless, the most important test result pertains to the number of days between STI test and STI treatment, which represents a statistically significant overall mean reduction of two days.

Healthvana opt-in status

In the analysis that separated clients by Healthvana opt-in status, 854 clients (58.49 percent) did not opt in to Healthvana and 606 clients (41.51 percent) opted in to Healthvana. While Healthvana implementation status and notification type status were utilized as predictor variables to measure the number of days between STI test, notification, and treatment, Healthvana opt-in status is an outcome variable in order to better understand what predictors are associated with whether a client opted in to Healthvana. It is also important to note that Healthvana opt-in status as an outcome variable does not address whether a client was notified of a positive STI test result by Healthvana; rather, this outcome variable is interested in whether the client opted in to Healthvana at the time of their STI test at an AHF Wellness Center.

Seven predictor variables were included in the analysis in order to determine which types of factors are associated with whether a client opted in to Healthvana. These seven predictor variables are based on the theoretical framework outlined in Chapter 3 surrounding demographics (predisposing factors) and risky sexual behaviors (need factors). Predisposing factors—age, race, ethnicity, and sexual orientation—represent demographics that may predict STI acquisition and healthcare services. Need factors—having a history of STIs, number of partners in the past year, and condom use during last sex—represent risky sexual behaviors that may also predict STI acquisition and healthcare services.

According to the logistic regressions, the predictor variables that were significantly associated with Healthvana opt-in status included age, number of partners in the past year, and condom use during last sex. Clients under the age of 25 years experienced greater odds of opting in to Healthvana than clients who were 30-39 years old ($p = 0.027$) and clients who were aged 40 years and older ($p = 0.004$). Clients who self-reported two partners in the past year had a 44 percent increased odds of opting in to Healthvana compared to clients who self-reported one partner in the past year ($p = 0.017$) and clients who self-reported seven partners in the past year had a 2.53-times increased odds of opting in to Healthvana compared to clients who self-reported one partner in the past year ($p = 0.022$). Conversely, clients who self-reported nine partners in the past year had a 69 percent reduced odds (1 - 0.31 = 0.69) of opting in to Healthvana compared to clients who self-reported one partner in the past year ($p = 0.016$). Lastly, clients who self-reported condom use during last anal and vaginal sex experienced greater odds of opting in to Healthvana than clients who self-reported condom use during last anal sex only ($p = 0.030$). In terms of race, ethnicity, sexual orientation, and having a history of STIs, there was insufficient evidence to suggest these predictor variables were significantly associated with Healthvana opt-in status. In terms of the two statistically significant need factors—number of partners in the past year and condom use during last sex—there are concerns surrounding the sample size that suggest the interpretation of the odds ratios should be cautiously considered.

Research questions

Research Question 1 aimed to measure the net effect of Healthvana on the number of days between STI test, notification, and treatment. The results suggest that a statistically significant relationship exists between Healthvana and the number of days between STI test and treatment. In addition, a statistically significant relationship exists between Healthvana and the number of days between STI test and notification. There is conflicting evidence surrounding the relationship between Healthvana and the number of days between STI notification and treatment. However, the overall net effect of Healthvana is a reduction of two days between when a client seeks STI testing at AHF Wellness Centers and when a client returns for STI treatment.

Research Question 2 aimed to measure the demographics (predisposing factors) and risky sexual behaviors (need factors) as predictors of opting in to Healthvana. The results suggest that a statistically significant relationship exists between Healthvana and age. Younger clients had a greater odds of opting in to Healthvana compared to older clients, which is consistent with the scientific literature surrounding smartphone users.

Study objectives

The Primary Study Objective of this dissertation was to retrospectively analyze STI test, notification, and treatment data from 18 AHF Wellness Centers in order to determine whether Healthvana reduced the number of days between STI test, notification, and treatment for clients. This study objective was completed, and as a result it was determined that Healthvana reduced the number of days between STI test, notification, and treatment by two days. Healthvana implementation at AHF Wellness Centers demonstrates a significant reduction in the number of days between STI test, notification, and treatment, a critical component of STI testing.

The Secondary Study Objective was to better understand what type of AHF Wellness Center clients opted in to Healthvana. This study objective was completed, and as a result it was determined that younger clients had greater odds of opting in to Healthvana than older clients. The fact that younger clients opted in to Healthvana is a significant find; adolescents and young adults are most at-risk for STI acquisition in the United States and would therefore benefit from Healthvana's reduction in the number of days between STI test, notification, and treatment.

Limitations

There are several limitations in this dissertation analysis that must be addressed in order to better understand the potential generalizability of the results. It is first important to note that this dissertation evaluated Healthvana's efficiency in delivering STI notification to clients; this dissertation was not intended to evaluate whether or not a client was more likely to be notified of a positive STI test result by Healthvana compared to telephone calls. In addition, this dissertation was not intended to evaluate whether clients were more likely to return for STI treatment following notification by Healthvana compared to telephone calls. In other words, only clients who were already successfully notified and returned for treatment were included in the dissertation analysis. Therefore, the first limitation is that there may be selection bias between the study population (n = 1,460) and the clients who were removed from the analysis. As summarized in Chapter 5, the raw data set included 38,173 male clients who sought STI testing at AHF Wellness Centers. Four steps were taken to only include clients who met the STI test, notification, and treatment criteria for the analysis. Ultimately, the study population of 1,460 clients represents four percent of the clients in the raw data set in order to address Healthvana's effect on the number of days between STI test, notification, and treatment. Therefore, there may be a selection bias based on the demographics (predisposing factors) and risky sexual behaviors (need factors) discussed in this dissertation. Such a selection bias should be kept in mind when evaluating the generalizability of the results.

The second limitation is that the data set does not include additional predictors of STI acquisition such as illicit drug use, physical assault, and economic vulnerability (Bazzi et al. 2015). While additional predictor variables would enhance any analysis surrounding STI testing, notification, and treatment, the omission of these predictor variables does not likely detract from the results of this dissertation.

The third limitation is that much of the demographics and risky sexual behaviors data are collected by AHF Wellness Center counselors during in-person interviews. Studies have found in-person interviews surrounding sexual health may inhibit the client to disclose risky sexual behaviors compared to audio and computer-assisted self-interviews (Ghanem et al. 2015, Adebajo 2014). The data set utilized in this dissertation may therefore include data that are biased towards the null. In addition, many clients refused to answer questions about demographics and risky sexual behaviors, which means many responses were missing. This is particularly of concern during the Healthvana opt-in status logistic regression analyses because some of the statistically significant results included very small sample sizes. Therefore, the statistically significant results surrounding logistic regressions for the number of partners in the past year and condom use during last sex should be interpreted cautiously.

The fourth limitation revolves around client recall bias regarding risky sexual behaviors (Graham et al. 2003). This data set's inclusion of a client's risky sexual behaviors relies on that client's ability to recall detailed past experiences. Clients may be susceptible to recall bias when asked questions surrounding having a history of STIs, number of partners in the past year, and condom use during last sex.

The fifth limitation is that the data set may not be representative of the population who would benefit the most from Healthvana. Clients who are successfully notified of a positive STI test result may seek STI testing from other providers in the area. As a result, these clients are not included in the study population because they were not treated at AHF Wellness Centers. A large proportion of clients did not return for STI treatment at AHF Wellness Centers; it is unknown if the clients sought STI treatment from other providers or did not receive any treatment. Another concern surrounding representation of the population is that men are often asymptomatic when infected with chlamydia, gonorrhea, and/or syphilis, which means this data set does not take into account the men who do not seek STI testing. In other words, this data set may be omitting a subgroup of undiagnosed men.

Strengths

The first strength is that this dissertation analyzes a data set provided by AHF, one of the largest HIV and STI testing organizations in the world. The size of the study population allows for sufficient analysis power for the major statistical tests conducted, particularly OLS and Poisson regressions. In addition, the 18 AHF Wellness Centers are spread out across the United

States: California, District of Columbia, Florida, Illinois, Ohio, New York, and Texas. It is rare to be able to evaluate STI clinics that offer standardized care throughout the United States.

The second strength is that this dissertation is grounded in theory. Utilizing the behavioral model of health service utilization, the social cognitive theory, and the uses and gratifications theory, this dissertation provides results in line with well-established and popular theories in the public health and media literature. Adapting these three theories ensures this dissertation embraces the social, behavioral, and biological determinants of health.

The third strength is that this dissertation is part of the initial body of research regarding smartphone applications and STI testing. While the scientific literature surrounding novel approaches to STI testing include the use of text messaging, this dissertation addresses the effects of newer technology: the smartphone application.

Conclusion

This dissertation found statistically significant associations between Healthvana and a reduction in the number of days between STI test, notification, and treatment at AHF Wellness Centers. This dissertation represents the first quantifiable analysis of Healthvana's impact on client services for AHF, which is timely as Healthvana moves forward with streamlining AHF Wellness Centers' electronic medical records.

This dissertation contributes to the scientific literature surrounding novel approaches to STI notification because the findings suggest that smartphone applications may help reduce the number of days between STI test and STI treatment. While these results are significant, they also set the groundwork for future research surrounding Healthvana client satisfaction, STI test result sharing with partners, and—most importantly—returning to AHF Wellness Centers for regular STI testing every three months for clients most at-risk for STI acquisition.

Smartphone applications like Healthvana have the potential to reframe STI testing in the United States and curb the rising rates of chlamydia, gonorrhea, and syphilis among men. Reducing the time to STI treatment is an essential component of health promotion and disease prevention to reduce the risk of HIV acquisition, stop future STI transmissions to others, and prevent long-term health complications caused by untreated STIs. The medium is the message, which means the smartphone application medium leads clients to faster STI treatment and greater public health.

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