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# Applying the Diffusion of Innovation Model to HIV Testing in Two African Cities

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# Applying the Diffusion of Innovation Model to HIV Testing in Two African Cities

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B.A.
University of Arizona
2010

Thesis Committee Chair: Dr. Susan Allen, M.D. MPH

An abstract of
A thesis submitted to the Faculty of the
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## Abstract

# Applying the Diffusion of Innovation Model to HIV Testing in Two African Cities

By Jennifer Reid

Objectives: The purpose of this study was to determine the effectiveness of the INA promotional strategy in promoting couples' voluntary counseling and testing in Lusaka, Zambia and Kigali, Rwanda. The INA model was based in the diffusions of innovation model. Secondary objectives were to determine the spread of CVCT through the cities, explore the difference in decision to test between couples with invites and those without, and the effect of other promotional strategies.

Design: INAs were recruited from faith-based, health, private, and community-based organizations. INAs were given training in CVCT methodology and given invitations to give to potential clients.

Methods: All couples attending CVCT clinics were given in taken surveys. A subset of couples were also given more detailed surveys. Descriptive statistics and chi-squared tests were calculated based on these data.

Results: In Kigali, 43% of couples attending CVCT clinics had INA invitations. Among couples with invites, 91% decided to test compared to 84% among couples without testing (p-value <0.001). Previous individual HIV testing increased between 2003-2008, from 37 to 53% in men and from 45 to 71% in women. Additionally, prior joint testing also increased from 6% in 2005 to 28% in 2008.
In Lusaka, 68% of couples attending CVCT clinics had INA invitations. Among couples with invites, 79% decided to test compared to 88% among couples without testing (p-value <0.001). Prior individual HIV testing increased between 2005 and 2009, from 24 to 33% in men and from 38 to 63% in women but joint HIV testing remained the same at around 4%.

Conclusions: The INA promotional strategy was important for attracting couples to attend CVCT clinics in both cities. In Kigali, those with INA invites were more likely to test than those without invites while in Lusaka the reverse was true. The increase in joint testing over the years in Kigali demonstrates the diffusion of the CVCT model through the city. The low numbers in Lusaka demonstrate the lack of diffusion. A possible explanation is that Lusaka is a much larger and more heterogeneous city than Kigali which makes it harder for a new idea to spread.

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# Table of Contents

# Chapter 1:

# Introduction

Although HIV prevalence is increasing across the globe, Africa still carries the bulk of infections with an estimated 64% of the HIV infected burden[1]. Two southern African countries, Rwanda and Zambia, still have high HIV rates, especially among pregnant women in their capital cities. The prevalence of HIV among pregnant women in Kigali, Rwanda in 2005 was between 7.5 and 18.4% [2]. Lusaka, Zambia's capital city, has a much higher HIV prevalence with an estimated 25.9 to 29.7 % of pregnant women testing positive [3].

In an effort to prevent new HIV infections, the Rwanda Zambia HIV Research Group has implemented and evaluated a couples voluntary counseling and testing program (CVCT). This intervention strategy was based on evidence that demonstrated that most new HIV infections occur within a marriage [4]. In this intervention, couples come to the testing center and are tested and counseled on HIV prevention as a couple [1]. Evaluations of couples voluntary counseling and testing programs have demonstrated significant decreases in transmission [4].

As with any new public health intervention, promotional strategies need to be used in order to get people to participate in the intervention. During the years 2003 to 2009, Influence Network Agents (INAs) were used to promote CVCT to the residents of Kigali and Lusaka. INAs went into their respective communities and invited community members to come receive CVCT. In addition to this promotional strategy; newspaper, television, radio, and billboard ads were also placed around the city. We predict that INAs were successful in convincing couples to come for CVCT but that couples who came without an invitation were more likely to test for HIV than couples with an invitation. We believe this to be the case because someone who did not directly speak to an INA had to go out of their way to find out about CVCT and get to the clinic and they would not do this unless they were already motivated to test. Additionally we predict that couples counseling will overall be more popular in Kigali than in Lusaka. We believe this to be the case because Kigali is a much smaller more homogenous city than Lusaka. According to

the diffusion of innovation model, it is much easier to reach the population and spread the word about a new innovation in this sort of city than in a larger and more heterogeneous city like Lusaka.

# Chapter 2:

# Comprehensive Review of the Literature

**HIV and Couples Voluntary Counseling in Rwanda and Zambia**

Sub-Saharan Africa has the highest incidence and prevalence of HIV infection in the world, with most new infections a result of heterosexual transmission [5]. Several studies have documented a high percentage of HIV discordance (where one partner is positive and the other is negative) among heterosexual couples [4]. One study documented that as many as 1 in 2 HIV infected individuals live in a discordant relationship in Sub-Saharan Africa [6]. Transmission among discordant couples in Rwanda and Zambia is responsible for an estimated 55.1 to 92.7% of new heterosexual HIV infections [4].

Based on DHS data, estimates of discordant couples in both Rwanda and Zambia can be made. In Zambia among cohabitating couples 9.4% of couples had an HIV+ female partner and HIV- male partner; 7.9% of couples had an HIV – female partner and an HIV+ male partner. In Rwanda, among cohabitating couples, 6.5% had an HIV+ female partner and HIV- male partner; 5.8% of couples had an HIV- female partner and an HIV+ male partner [4]. Among these couples, HIV transmission per year is estimated to be 20-25% per year [4].

Couples voluntary counseling and testing aims to identify discordant couples and help them prevent HIV transmission through counseling. Couples interested in learning about CVCT are invited to a testing center located at government health clinics throughout the city [1]. In the morning interested couples receive information about HIV transmission by a trained nurse counselor. After this session couples discuss with a nurse counselor whether to test or not. Couples are given informed consent, an HIV test, and post-test counseling from a nurse counselor. All couples receive transportation, childcare, lunch, and counseling regardless of whether they decided to test or not [1]. Couples that are discordant receive counseling on how to maintain the partner's negative status and are invited to return to the clinic at regular intervals to test again [1].

Several evaluations of CVCT have proven this intervention effective in preventing HIV transmission among discordant couples. One evaluation conducted in Kigali followed 60 discordant couples for two years. Before CVCT only 4% of couples reported condom use, after counseling 57% reported condom use. In the two year follow up the seroconversion rate was 4 per 100 person years for men and 9 per 100 person years for women [7]. A separate study conducted on a similar CVCT intervention conducted in Zaire (Democratic Republic of Congo) followed 149 discordant couples. Prior to counseling less than 5% of couples used condoms, one month after counseling and testing 70.7% of couples reported using condoms. The seroconversion rate among these couples following counseling was 3.1 per 100 person years [8].

These evaluations have demonstrated the effectiveness of intervening at the couple level to prevent HIV transmission, but in order to have a successful intervention the target population must place value on the intervention. Several generalized mass media promotional strategies were used in both Kigali and Lusaka between 2002 and 2010 including radio and television commercials, billboards, and posters. The major promotional push was through the use of influence network agents (INAs) whose use and development was based on the diffusion of innovations theory.

**Diffusion of Innovations**

The diffusion of innovations theory is a model that seeks to explain how new ideas are spread and then adopted or rejected [9]. In this model diffusion is defined as a specific kind of communication of new ideas along existing social structures. How well an innovation is spread along these social channels determines whether the community will adopt or reject an innovation. There are four main elements that impact diffusion; the innovation, communication channels, time, and the social system [9].

The innovation is the new idea or practice that is suggested for adoption. The innovation can be a completely new idea/practice or simply the resurgence of a forgotten idea/practice [9]. The adoption of new ideas can take several years, for example the use of mobile phones, or decades such as the adoption of seat belt use in cars. There are five important characteristics of innovations that help to determine a good innovation from bad one. These are relative advantage, compatibility, complexity, observability, and trialabilty[9].Relative advantage describes the degree to which a new idea is believed to be better than the previous idea. Relative advantage can be measured economically but more commonly social prestige, convenience, and satisfaction are more important aspects. Compatibility refers to how compatible a new idea is within existing social structures[9]. Innovations that are viewed as incompatible with local values and norms will take much longer for local adoption. Complexity refers to how difficult the population feels the innovation is to use or understand. If the population does not understand the intended purpose of an innovation or it takes too long to explain how to use a new innovation, the idea will be quickly discarded. Observability refers to how well the results of a particular innovation can be seen and shared with the rest of the population. If the result of an innovation cannot be seen or shared, the innovation will spread more slowly[9]. Trialabiliy refers to the ability for individuals to try out a new innovation[9]. Innovations that meet these five components will diffuse through a population faster and with higher rates of adoption than innovations that do not.

The next element of diffusion is the communication channel. A communication channel is defined as the way in which a message travels from one individual to another[9]. There are two main communication channels, the first is through mass media and the second is through interpersonal channels. Mass media is effective at quickly reaching large segments of the population but interpersonal communication is more effective in actually persuading an

individual to adopt a new idea. Research on diffusion has demonstrated that most individuals do not objectively evaluate a new idea but instead rely on a subjective evaluation from individuals similar to themselves who have already adopted the innovation [9]. Thus while mass media may be a quick and easy way to reach the population, interpersonal channels may be more effective for inducing actual change.

The time component of diffusion is an important part of the process that is often over-looked. When an individual is presented with a new idea they go through an innovation-decision process. This process is characterized by five main steps: 1) knowledge, when an individual first learns of the idea; 2) persuasion, when a positive or negative opinion is formed of the idea; 3) decision, an individual engages in activities that either lead to the adoption or rejection of the idea; 4) implementation, when an individual begins to use the idea; and 5) confirmation, when an individual seeks validation for their decision[9]. The innovation-decision process involves time at each step and attempts to force a new innovation without allowing for all of the steps can lead to the rejection of the idea.

The final element in the diffusion process is the social system. In order to lead to a successful adoption of an innovation the change agency needs to be careful to select the right individuals to promote the innovation. Often the individuals that seem the most innovative to outsiders are viewed as deviant among the target audience [9]. Selection of these individuals to promote the intervention can lead to a rejection by the majority. The change agency needs to select opinion leaders to promote their innovation. Opinion leaders are high standing individuals who have the ability to influence the opinions and actions of others[9]. Encouraging opinion leaders to adopt a new idea and then promote that idea among their community can lead to adoption of the idea by the majority of the community.

**Diffusion of Innovations in Public Health**

The diffusion of innovation model is used in a variety of ways in public health and medicine. Often it is used to explain the spread of a new intervention idea to improve health such as the use of a nutritious leaf to decrease undernutrition[10]. The Moringaoliefera leaf is a valuable source of macro and micro nutrients and grows in tropical and subtropical regions around the world. Studies have documented its positive effects on animals but no studies have been conducted on humans. The new innovation, human consumption of the Moringaoliefera leaf, meets all of Rogers' successful innovation requirements and has spread around the world [10].

In the medical field, the diffusion of innovations model is often applied to a new technology and its spread through the medical staff. In addition to public health, the diffusion of innovations model is also applied in social psychology, communication, public relations, advertising, marketing, consumer behavior, rural sociology, and others [9]. The table below shows recent health related articles that have used the diffusion of innovation model.

Table A: Recent articles using the Diffusion of Innovations Model

| Authors | Title | Journal | Year |
|---|---|---|---|
| Vedel I, Lapoint L, Lussier MT, Richard C, Goudreau J, Lalonda L, Turcotte A | Healthcare professionals' adoption and use of a clinical information system (CIS) in Primary care: Insights from the Da Vinci Study | International Journal of Medical Informatics | 2012 |
| Herie M, Connolly H, Voci S, Dragonetti R, Selby P | Changing practitioner behavior and building capacity in tobacco cessation treatment: the TEACH project | Patient Education and Counseling | 2012 |
| McConnell ES, Corazzini KN, Lekan D, Bailey DE, Sloane R, Landerman LR, Champagne MT | Diffusion of Innovations in Long-Term Care Measurement Battery | Research in Gerontological Nursing | 2012 |
| Savage SA, Abraham AJ, Knudsen HK, Rothrauff TC, Roman PM | Timing of buprenorphine adoption by privately funded substance abuse treatment programs: The role of institutional and resource | Journal of Substance Abuse Treatment | 2012 |

| | | | |
|---|---|---|---|
| | based interorganizational linkages | | |
| Troncoso K, Castillo A, Merino L, Lazos E, Masera OR | Understanding an improved cookstove program in rural Mexico: An analysis from the implementers' perspective | Energy Policy | 2011 |
| Dickson KE, Tran NT, Samuelson JL, Njeuhmeli E, Cherutich P, Dick B, Farley T, Ryan C, Hankins CA | Voluntary Medical Male Circumcision: A Framework Analysis of Policy and Program Implementation in Eastern and Southern Africa | PLOS Medicine | 2011 |

**Criticisms of Diffusion Research**

The diffusion of innovation model was first developed in the 1950s. Since then it has been used to study, explain, and promote innovation in many disciplines around the world. Many of the criticisms are due to the biases found in among diffusion researchers and are not criticisms of the model itself. One of the criticisms is discussed below.

One criticism of diffusion research is the *Pro-innovation bias*[9]. This bias implies that every innovation is a good innovation which should be diffused and adopted and that innovations should not be re-invented or rejected. This bias has caused diffusion researchers to overlook or fail to study re-invention, ignorance of innovations, and "antidiffusion" programs (programs designed to counter bad diffusions such as smoking). Rogers believes that there are two main reasons why this bias exists and diffusion researchers tend to overlook diffusion failures. The first is that change agencies often fund diffusion research and typically they do not want to study a project that failed. The second reason is that it is much easier to study a successful diffusion project than an unsuccessful diffusion project. A successful project leaves visible signs that the researcher can follow whereas an unsuccessful one usually disappears [9]. Although unsuccessful diffusion projects are harder to studies new methods need to be developed in order to overcome this bias and better understand all aspects of diffusion.

**Diffusion of Innovation applied to HIV Testing**

For this project the "innovation" is testing couples instead of individuals. Does this innovation meet Rogers' five requirements for a successful diffusion? The innovation has relative advantage; in an area where HIV prevalence is high it is advantageous to know the serostatus of the person that you are having sex with. Additionally, it is convenient; you can both be tested and counseled at the same time. It can even be economically beneficial; in

Lusaka, couples receive bus passes for attending the clinic. This innovation does not have compatibility. While it makes sense to test and counsel couples together many people, including important funders in the US, believe that this is an invasion of privacy. Couples' testing goes against social norms which will make its diffusion more challenging. This innovation is complex. While the act itself of going to the clinic is not complex, the understanding of discordancy and the need for follow-ups is complex. This innovation is somewhat observable. For many getting HIV tested is private, although we will see later that people do talk about it which does lead to some visibility for this innovation. This innovation is triable. A couple may attend the clinic, listen to the presentation and make a decision about whether or not to receive HIV testing. If the couple does not like their experience with the innovation, they may choose to not come back. Overall, this innovation meets three of the five requirements; relative advantage, observability, and trialability. It does not meet compatibility or complexity. This could lead to some difficulty in the uptake of this innovation.

# Chapter 3:
# Manuscript

# Applying the Diffusion of Innovation Model to HIV Testing in Two African Cities

Jennifer Reid, Susan Allen, other authors TBD

## B. Contribution of Student

The data was collected prior to the start of this thesis project. The student was responsible for all data analysis, literature review, writing, and table development with guidance from Dr. Susan Allen.

## C. Abstract

**Objectives:** The purpose of this study was to determine the effectiveness of the INA promotional strategy in promoting couples' voluntary counseling and testing in Lusaka, Zambia and Kigali, Rwanda. The INA model was based in the diffusions of innovation model. Secondary objectives were to determine the spread of CVCT through the cities, explore the difference in decision to test between couples with invites and those without, and the effect of other promotional strategies.

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Prior individual HIV testing increased between 2005 and 2009, from 24 to 33% in men and from 38 to 63% in women but joint HIV testing remained the same at around 4%.

**Conclusions:** The INA promotional strategy was important for attracting couples to attend CVCT clinics in both cities. In Kigali, those with INA invites were more likely to test than those without invites while in Lusaka the reverse was true. The increase in joint testing over the years in Kigali demonstrates the diffusion of the CVCT model through the city. The low numbers in Lusaka demonstrate the lack of diffusion. A possible explanation is that Lusaka is a much larger and more heterogeneous city than Kigali which makes it harder for a new idea to spread.

## D. Introduction

Although HIV prevalence is increasing across the globe, Africa still carries the bulk of infections with an estimated 64% of the HIV infected burden[1].Rwanda and Zambia are among the ten southern African countries hardest hit by the HIV epidemic according to UNAIDS[11].In Kigali, Rwanda an estimated 7.5% of pregnant women were HIV positive in 2005,[2]while Zambia has an even higher prevalence with an estimated 25.9% of pregnant women in major urban centers infected[3].

One major contributing factor to the HIV epidemic in Africa is heterosexual transmissions through discordant couples (one partner is HIV positive and the other is negative)[1, 12]. Individuals often do not know their own HIV status and rarely know their partner's which leads to transmission rates within discordant couples ranging from as low as 30% to as high as 90%[12]. To prevent transmission within discordant couples, the Rwanda-Zambia research group implemented couples' voluntary counseling and testing (CVCT). This testing program allows couples to come into clinics and receive information about HIV transmission, HIV testing, and results and counseling together. A more detailed description of the program has been previously discussed in the literature[1, 12-14].

CVCT works to identify discordant couples and counsel them on ways to prevent transmission. A study on CVCT in Zaire (the Democratic Republic of Congo) found that prior to HIV counseling and testing, only 5% of couples reported ever using a condom. One month after counseling 70.7% of couples reported using a condom for every episode of intercourse[8]. Another study in Rwanda found that HIV transmission rates decreased by more than 50% among women if she and her partner took part in a CVCT program[15]. In Lusaka, HIV incidence among discordant couples who did not know their status was 26% during a one year follow-up (22% in Kigali). After a CVCT program the incidence rate among discordant couples dropped to between 2.3 and 8.6%[1].

In light of these successful evaluations, CVCT services were scaled up in both Lusaka and Kigali. Several promotion strategies were tried between 2002 and 2010 including radio and television ads, billboards, posters, and pamphlets.Another promotional strategy, based on the diffusion of innovation model, has been to use influence network agents (INAs) to invite couples to come to the clinics to receive CVCT[9].

The diffusion of innovation model was developed as a framework for understanding the adoption or rejection of innovations within a specific community. The model itself has four main components; the innovation itself, communication channels, time, and the social network; that define different aspects of the diffusion process. The first three components will not be discussed here but are described in greater detail in Rogers, *Diffusion of Innovation*[9]. The fourth element, social structure, is the basis of the INA promotional strategy and is often the key to a successful diffusion process.

Studies conducted on diffusion of innovation have demonstrated that most individuals do not objectively evaluate a new idea but instead rely on the subjective evaluation of the innovation from an individual similar to them[9]. This idea has led to the development of using

opinion leaders to sway the decision making process of other members of the group. Opinion leaders are individuals with a high social status who have the ability to influence other people's opinions and actions. In order for a change agency to capitalize on opinion leaders' influence among a group, opinion leaders are often introduced to an innovation first. Then a change agency will use an opinion leader's influence to convince others in the society to adopt the innovation. This is believed to encourage a more widespread and sustainable uptake of the innovation[9].

In the current study, the INAs are opinion leaders collected from various social networks such as faith-based, health, private, and other community organizations. INAs were used to promote CVCT by talking to couples within their sphere of influence and inviting them to attend the clinics. The author's hypothesized that INA's would be more successful in convincing couples to come to the clinic itself but that couples who came in without an invitation might be more motivated to test for HIV. From these hypotheses, three main study objectives were developed. The first objective was to determine the overall success of the INA invitation strategy in convincing couples to come to the CVCT. Within this outcome, the general acceptance of couples testing as a whole, even outside of this organization, was examined. The second outcome was to determine if couples with INA invitations decided to test for HIV more often than couples without invitations. The final objective was to determine where couples without invitations heard about CVCT in order to determine other methods to reach people not accessed with the INA promotional strategy.

## E. Methods

This study was conducted by the Rwanda Zambia HIV Research Group (RZHRG) in collaboration with Project San Francisco (PSF), Kigali, Rwanda; and the Zambia Emory HIV Research Project (ZEHRP) in Lusaka, Zambia and approved by the Institutional Review Board in

Rwanda, Zambia, and the US. The study took place from 2002 to 2010 in Lusaka and from 2003 to 2009 in Kigali.

**Recruitment and training of INAs**

The recruitment and training of INAs has been described previously in the literature and is summarized here[1, 12-14]. RZHRG staff worked within existing organizations to identify influential individuals in faith-based, health, private, and community based organizations. Influence Network Leaders (INLs) were recruited first and trained by physicians and counselors. INLs were typically higher level opinion leaders such as a church pastor, whereas INAs might be deacons or other important church volunteers. INLs supervised several INAs and occasionally participated in INA activities such as distributing invitations[1, 12-14]. Individuals who accepted the offer to become INAs received a four day training session. The first two training days were spent in the classroom educating INAs on the project history, testing and counseling procedures as well as the importance of testing couples, and HIV transmission. The third day was spent observing an experienced agent in the community. The fourth day was set aside for couples testing of INAs if they chose to be tested[14].

After training, INAs were given packets with invitations and asked to invite couples who had been cohabiting for at least three months to come for CVCT. INAs were paid based on the number of clients who came to testing with their invitation. If an INA had a success rate of >=10% of invited couples seeking joint testing, their contract was extended for another three months[14].

**Statistical Analysis**

All clients who came to the clinic were given an initial intake survey which recorded basic demographic and health information as well as where they heard about CVCT. Counts were made of all the invitations given, the number of couples coming with invitations, the

number of couples coming without invitations, and the number of couples who decided to test. A smaller subset of couples were given additional questions and asked if they had been previously tested (individually and as a couple) and where they had heard information about CVCT other than from INAs. This subset of data was not used to evaluate INA success but was used to determine the spread of CVCT among the population and how people without invitations may have heard about CVCT. Additionally in 2008 in Lusaka, RZHRG used both fixed and mobile clinics for CVCT. This data is included in the subset of data not in the data used to evaluate INAs. Data was entered into both SAS 9.2 and Access databases and was analyzed using both Access and Openepi. Analysis consisted of calculating frequencies, percents, and chi-squared tests. The alpha level for the chi-squared test was set at 0.05.

## F. Results

**Kigali**

Between 2003 and 2008, the Kigali CVCT clinics saw 48,402 couples with an average of 9,860 couples per year. INAs in Kigali distributed 102,964 total invitations about 20,593 per year with approximately 3 invitations given per couple attending the clinic. Of couples attending CVCT clinics, 43% had invitations with yearly percentages varying from 31-53%. Among all couples (those with and without invites) in the clinics, 89% decided to test for HIV. Among couples with an invitation, 91% decided to test. Among couples without an invitation, 84% decided to test. (table 1) A chi-squared test was performed to determine if there was a difference between those with invites and those without and their decisions to test. The p-value was less than 0.001 indicating that there is a statistical difference between couples with invites and couples without and their decision about HIV testing.

The frequency of men and women receiving both individual and couples testing prior to attending CVCT clinics was also determined. For men the frequency of being individually tested

started off low in 2003 with only 37% of men tested prior to attending CVCT clinics and slowly increased to 53% in 2008. Among women there was also an increase in individual testing over time with 45% of women individually tested in 2003 which increased to 71% in 2008. The percentage of couples jointly testing before attending CVCT clinics increased over time with a low of 6% in 2005 to 28% in 2008. (table 2)

A subset of couples who attended CVCT clinics were also asked about other places where they may have heard about CVCT. The three most common promotion strategies other than INAs were couples who had previously tested with RZHRG (49%), radio advertising (41%), and other friends (12%). (table 3)

**Lusaka**

Between 2003 and 2010, the CVCT clinics in Lusaka saw 30,942 couples with an average of 3,868 couples per year. In Lusaka, INAs distributed 207,395 total invitations or about 25,924 per year with approximately 7 invitations given per couple attending the clinic. Of couples attending CVCT clinics, 68%hadinvitations. Among couples attending CVCT clinics 81% decided to test for HIV. 79% of couples with an invitation decided to test while 88% of couples without an invitation decided to test. (table 4) A chi-squared test was performed to determine if there was a difference between those with invites and those without and their decisions to test. The p-value was less than 0.001 indicating that there is a statistical difference between couples with invites and couples without and their decision about HIV testing.

Frequencies were also calculated for both men and women who had been individually and jointly tested. Both men and women demonstratedincreases in individual testing over time from 2005-2008. Individual testing in men increased from 24% in 2005 to 33% in 2009. Individual testing in women increased from 38% in 2005 to 63% in 2009. Couples jointly tested

however remains the same from year to year with an average of 4% of couples jointly tested prior to attending CVCT. (table 2)

Additional data on couples without invitations was also collected in order to determine where they heard about CVCT. In Lusaka, the three most common sources were friends (19%), radio (18%), and television (10%). (table 5)

## G. Discussion

This study used the diffusion of innovation model to develop their Influence Network Agent (INA) promotional strategy for couples voluntary counseling and testing (CVCT). There were three main objectives in this study. The first objective was to determine the success of the INA promotional strategy and to determine if couples' testing was becoming a norm in the community. The second objective was to determine if couples with an invitation from an INA decided to test for HIV more often than couples without an invitation. The final objective was to determine which other promotional strategies reached couples who did not have an invitation.

The overall effectiveness of the INA promotional strategy varied between the two cities. Lusaka INAs distributed many more invitations than Kigali INAs and a greater percentage of couples in the clinics in Lusaka had invitations when compared to Kigali. On the other hand, Lusaka INAs had to distribute more invitations for every one couple at that came to the clinic compared to Kigali INAs: 7 invitations per couple in Lusaka compared to 3 in Kigali. Based on this information it appears that the INAs in Kigali were more persuasive in convincing couples who received invitations to attend the clinic. At the start of the INA project, INAs in Lusaka had a much higher invitations per couple compared to at the end of the study. This indicates that the INAs in Lusaka improved over the life of the project and if the project continued could potentially have reached the lower invitations per couple level of Kigali INAs. INAs in Kigali had

a much more constant invitation per couple and did not show the kind of improvement seen in Lusaka.

The structure of the two cities is a contributing factor that could help explain some of the differences in success of the INAs. Kigali is a much smaller, denser city (population 800,000) with one primary language compared to Lusaka with a population of close to two million and many different languages. INAs in Kigali would not have to deal with a diverse population and language barriers that INAs in Lusaka would have had to deal with. This could explain why INAs in Lusaka had to hand out many more invitations than their Kigali counterpartsfor each couple who sought testing.

In Lusaka, the majority of couples at the clinic had an INA invitation (68%) compared to Kigali where only about half of the couples had an invitation. This indicates that the INA promotional strategy was of greater importance in bringing couples to the CVCT services in Lusaka than in Kigali. This could be attributed to less knowledge of CVCT services in Lusaka than in Kigali which is most likely due to the fact that CVCT has existed for a longer time period in Kigali than in Lusaka. A recent study found that couples in Kigali were more aware of HIV testing sites, the existence of discordance among couples, and a greater willingness to participate in CVCT than couples in Lusaka [11].

This has important public health implications because it highlights an important aspect of the diffusions of innovations model; the most effective communication occurs when individuals are more similar.[10] In a city that has a diverse population, such as Lusaka, INAs are more likely to come across individuals that are not similar to them linguistically or culturally. They may be able to communicate with them and even give them an invitation, but they will not be as successful in convincing them to attend CVCT. Whereas in a city that has a much more homogenous population such as Kigali, INAs are more likely to find individuals similar to

themselves and will have an easier time convincing people to attend CVCT. This suggests that using promotional agents in large cities with heterogeneous populations might not be the most effective way to promote health interventions. Perhaps, a future study in Lusaka could attempt to segment the population into smaller more homogenous segments (such as religion, neighborhood, and dialect) and try to recruit INAs and clients in that manner to see if that strategy is more successful.

An analysis was also conducted to determine how many couples had been individually and jointly tested prior to coming to RZHRG for CVCT. In both Lusaka and Kigali the percentages of individual testing among men and women increased over time. This was probably a result of recent efforts encouraging individuals to get tested. Joint couples testing increases over time in Kigali but it does not increase over time in Lusaka. This is important because it shows the diffusion of the CVCT innovation in Kigali but not in Lusaka. An important reason behind the spread in Kigali is buy-in from the government. In 2005, the Rwandan Ministry of Health declared CVCT to be the standard of care in all government clinics. Every year after 2005 there is an increase in the number of couples who receive joint testing prior to attending CVCT. This shows that the diffusion was so successful in Rwanda that the government began to act on it. On the other hand, the low and consistent rates of joint testing in Lusaka show that the innovation of couples testing is not spreading in this city.

The second objective was to determine whether couples with invitations decided to test more often than couples without invitations. It was hypothesized that couples without invitations had heard about CVCT on their own and made the effort to seek out testing and were therefore more motivated to test than those without invitations. This was true in Lusaka, where 79% of couples with invites decided to test compared to 88% of couples without (p-value <0.001). This was not true in Kigali where couples with invites (91%) were more likely to test

than couples without invites (84%, p-value <0.001). In Lusaka, it appears that couples who hear about CVCT and come into the clinic on their own are more motivated to test for HIV than those who are invited than INAs whereas in Kigali this is not the case.

Couples without invitations heard about CVCT from similar sources in both Lusaka and Kigali but with differing proportions. In Kigali, many more couples reported hearing about CVCT from other couples who had previously tested. This again indicates that this innovation is spreading successfully through the population. Additionally, CVCT services have been available longer in Kigali and there are more couples in a smaller city who can talk about their experiences.

The radio was also cited by couples in both cities although twice as many people in Kigali cited radio as in Lusaka. This again is probably due to differences in city characteristics. There are three radio stations in Kigali that all broadcast in the same language. Public service messages (such as CVCT messages) are free and could be played more often. In Lusaka, there are multiple radio stations playing in various languages depending on the target audience. Advertising is not free and messages are run less often due to budget constraints. The differences due to frequency of advertising and language that the message was played in made an impact in people hearing about CVCT on their own and discussing it with their friends in Lusaka.

The main limitation of this study is that only a subset of couples coming in for CVCT were asked the additional questions of where they had heard about the couples' testing and if they had received HIV testing before. This is a problem because we are not sure if the subset was representative and therefore we do not know how the rest of the couples would have answered.

Future studies should be conducted on couples who receive invitations for CVCT and decided to not attend. Some studies have begun to evaluate knowledge of CVCT and feelings

toward s the program such as Kelley's household survey [11]. A greater understanding of their reasons for not attending could lead to an improvement in services that result in higher attendance and lower invitations per couple ratios. Future studies could also be conducted with INAs and testing recruitment with more careful selection of INAs. Due to the large diversity of Lusaka more attention needs to be paid to the language spoken, ethnicity, and neighborhood/district where the INA is from. Perhaps paying more attention to social aspects of the INAs, they may be able to be more successful at inviting couples for CVCT.

In conclusion, the INA promotional strategy is important in bringing couples to the CVCT servicesin Kigali and Lusaka. In Kigali 43% of couples attending CVCT had invitations whereas in Lusaka almost 68% had invitations. In Kigali, couples with invites were more likely to test, whereas in Lusaka, couples without invites were more likely to test. Couples in Kigali heard about CVCT in other ways, primarily from other couples who had been tested and on the radio; in Lusaka, INAs remain the main source of promotion. This analysis would indicate that an INA promotional strategy is critical to set the stage for diffusion, and can lead to successful diffusion in a few years in relatively small homogeneous target populations. In large, multilingual cities, a more sustained and large-scale promotional effort will be needed to reach the critical mass of couples and set the stage for diffusion.

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# I. Tables

Table 1: Kigali invitation and testing counts for 2003-2008

| Year | Invitations Given by INAs (N) | Total Couples at CVCT (N) | Invitations given per CVCT couple | Couples with Invitations (%) | % of Couples who tested | % of couples with invite who tested | % of couples without invite who tested |
|---|---|---|---|---|---|---|---|
| 2003 | 6,640 | 3,261 | 2 | 47 | 88 | 92 | 85 |
| 2004 | 16,684 | 11,098 | 2 | 33 | 86 | 87 | 86 |
| 2005 | 28,521 | 14,578 | 2 | 31 | 90 | 91 | 89 |
| 2006 | 21,670 | 8,094 | 3 | 45 | 82 | 90 | 76 |
| 2007 | 18,458 | 5,711 | 3 | 53 | 84 | 92 | 75 |
| 2008 | 10,991 | 5,660 | 2 | 49 | 92 | 94 | 90 |
| Total | 102,964 | 48,402 | | | | | |
| Yearly Average | 20,593 | 9,860 | 3 | 43 | 89 | 91 | 84 |

Values are rounded to the nearest whole number

Table 2: Previous HIV testing in both Lusaka and Kigali

| City | Year | Total N | % Men Previously Tested | Of men tested, % who were HIV + | % Women Previously Tested | Of women tested, % who were HIV+ | % Previously Tested Together |
|---|---|---|---|---|---|---|---|
| Lusaka | 2005 | 4327 | 24 | 26 | 38 | 0 | 4 |
| | 2006 | 2035 | 23 | 30 | 42 | 29 | 4 |
| | 2007 | 1778 | 20 | 34 | 45 | 29 | 5 |
| | 2008 | 5352 | 24 | 33 | 53 | 31 | 5 |
| | 2009 | 4315 | 33 | 32 | 63 | 38 | 0 |
| | Average | 3561 | 25 | 30 | 48 | 25 | 4 |
| Kigali | 2003 | 2778 | 37 | 16 | 45 | 14 | NA |
| | 2004 | 9698 | 32 | 8 | 42 | 10 | NA |
| | 2005 | 13116 | 39 | 7 | 50 | 9 | 6 |
| | 2006 | 6701 | 45 | 7 | 60 | 8 | 13 |
| | 2007 | 4826 | 46 | 7 | 64 | 9 | 23 |
| | 2008 | 4771 | 53 | 7 | 71 | 8 | 28 |
| | Average | 6982 | 42 | 9 | 55 | 10 | 18 |

Values are rounded to whole numbers

NA means no data available

Table 3: Where couples who did not receive an invite heard about CVCT in Kigali Rwanda

| Year (N) | Community Health Worker (%) | Doctor/Nurse (%) | Religious Official (%) | Government Official (%) | NGO/CBO Employee (%) | Friends (%) | Family (%) | Other couple who previously tested (%) | Radio (%) | Television (%) | Newspaper (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003 (2778) | NA | NA | NA | NA | NA | 16 | 3 | 28 | 13 | NA | NA |
| 2004 (9698) | 2 | 1 | 0 | 2 | 0 | 14 | 5 | 51 | 37 | 3 | 1 |
| 2005 (13116) | 1 | 1 | 0 | 1 | 0 | 12 | 4 | 60 | 55 | 4 | 2 |
| 2006 (6701) | 0 | 0 | 0 | 0 | 0 | 9 | 3 | 55 | 51 | 1 | 1 |
| 2007 (4826) | 0 | 0 | 0 | 0 | 0 | 10 | 3 | 51 | 47 | 0 | 0 |
| 2008 (4771) | 0 | 0 | 0 | 0 | 0 | 12 | 6 | 51 | 40 | 0 | 0 |
| Yearly Average | 2 | 1 | 0 | 2 | 0 | 12 | 4 | 49 | 41 | 3 | 1 |

Values rounded to the nearest whole number

NA means no value available

Table 4: Lusaka invitation and testing counts for 2003-2010

| Year | Invitations Given by INAs (N) | Total Couples at CVCT (N) | Invitations given per CVCT couple | Couples with Invitations (%) | % of Couples who tested | % of couples with invite who tested | % of couples without invite who tested |
|---|---|---|---|---|---|---|---|
| 2003 | 29,385 | 3,276 | 9 | 55 | 79 | 71 | 88 |
| 2004 | 53,213 | 3,625 | 15 | 77 | 68 | 64 | 83 |
| 2005 | 37,163 | 6,250 | 6 | 68 | 67 | 60 | 83 |
| 2006 | 14,887 | 2,742 | 5 | 61 | 76 | 69 | 86 |
| 2007 | 9,661 | 2,210 | 4 | 67 | 80 | 75 | 89 |
| 2008 | 3,955 | 2,357 | 2 | 55 | 84 | 91 | 89 |
| 2009 | 29,431 | 4,450 | 6 | 75 | 98 | 99 | 92 |
| 2010 | 29,700 | 6,032 | 5 | 85 | 99 | 100 | 93 |
| Total | 207,395 | 30,942 | | | | | |
| Yearly Average | 25,924 | 3,868 | 7 | 68 | 81 | 79 | 88 |

Values are rounded to the nearest whole number

Table 5: Where couples without an invite heard about CVCT in Lusaka Zambia

| Year (N) | Community Health Worker (%) | Doctor/Nurse (%) | Religious Official (%) | Government Official (%) | NGO/CBO Employee (%) | Friends (%) | Family (%) | Other couple who previously tested (%) | Radio (%) | Television (%) | Newspaper (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 (4327) | 3 | 5 | 2 | 0 | 0 | 15 | 0 | 0 | 27 | 18 | 0 |
| 2006 (2035) | 2 | 3 | 1 | 0 | 0 | 24 | 1 | 11 | 26 | 12 | 0 |
| 2007 (1778) | NA | NA | NA | NA | NA | 29 | 8 | 10 | 18 | NA | NA |
| 2008 (405) | NA | NA | NA | NA | NA | 28 | 4 | 15 | 17 | NA | NA |
| 2009 (401) | NA | NA | NA | NA | NA | 0 | 0 | 0 | 0 | 0 | NA |
| Yearly Average | 2 | 4 | 2 | 0 | 0 | 19 | 3 | 7 | 18 | 10 | 0 |

Values rounded to the nearest whole number

NA means data was not collected

# Chapter 4:

# Discussion, Conclusion, and Recommendations

This study used the diffusion of innovation model to develop the Influence Network Agent (INA) promotional strategy for couples voluntary counseling and testing (CVCT). There were three main objectives in this study. The first object was to determine the success of the INA promotional strategy and to determine if couples' testing was becoming a norm in the community. The second objective was to determine if couples with an invitation decided to test for HIV more often than couples without an invitation. The final objective was to determine which other promotional strategies reached couples who did not have an invitation.

Analysis determined that the INA promotional strategy was important for encouraging couples to attend CVCT in both Kigali and Lusaka. Couples with INA invitations made up 43% of total couples in Kigali clinics and 68% in Lusaka clinics. The percent of couples having received joint testing and counseling prior to coming to CVCT was low, although the percentage rose each year in Kigali. Additionally, there was no difference between couples with invites and those without in regards to their decision to test for HIV. Besides INAs, other popular promotional strategies in Kigali included other couples who had previously tested and the radio while in Lusaka they included friends and the radio.

There are several important public health implications from this study. The first is that the diffusion of innovation model can be used to design and plan promotional interventions. Often the diffusion of innovations model is used after the fact to explain why things worked or didn't work within an intervention. This study demonstrates that deliberately planning to include influential people to go into their community and talk about an intervention with their community members works to promote a new testing strategy like CVCT.

Another important public health implication is the importance of government buy-in for the intervention program. With the promotional strategies, RZHRG was attempting to make CVCT a norm in these two cities. As the data demonstrated, few couples in both cities had been

jointly tested prior to their arrival in the clinic. In 2005 in Kigali, the Ministry of Health made CVCT the standard of care in all government clinics. From this point the number of couples who received joint testing began to go up whereas the numbers in Lusaka remained low. While this was an incredible amount of support and not every intervention can expect to receive this level of support, even acknowledgement from the local government can boost participation from the community.

The final important public health implication is that the innovation of CVCT is beginning to spread in Rwanda. Through the efforts of RZHRG and now with the assistance of the government joint testing of couples is beginning to increase slowly among couples in Kigali. The same, unfortunately, cannot be said of Lusaka.

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