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The Peer Context: Relationship Analysis to Inform Peer Education Programs in Fort Portal, Uganda

by

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Abstract

Uganda has a predominantly young population, and there is a need for targeted HIV/AIDS prevention programming. Peer education is a health intervention style that has been used with appreciable success in adolescent groups, but some issues exist. We hypothesize that more can be done in the program planning stages to increase the chances of sustained success, and have completed two different types of cross-sectional analyses to investigate this aspect. We used Social Network Analysis to examine the social structure of two secondary schools in Fort Portal, Uganda. We identified existing modes of influence and natural channels of communication, and used these to create a feasible model of peer educator selection. We also studied present levels of communication about sexual and reproductive health within youth relationships, and found that youth are willing to talk to their friends, but high levels of communication do not generally occur. This provides an important point of entry for health promotion programs.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Recognizing the importance of social relationships to adolescent behaviour, social network analysis is an analytic technique that is being used with increasing frequency to characterize youth personal networks, interpersonal communication, and group norms. A better understanding of these networks and environments can allow researchers and program planners to utilize the natural flow of communication within groups to more effectively plan and implement health promotion and social change interventions (Bond, 2003).

Peer education programs are a common approach to try to affect social and behavioural change in adolescents (Campbell, 2005; Cartagena et al, 2005; Caron, Godin, Otis, and Lambert, 2004; Agha & Van Rossem, 2004; Kinsler, Sneed, Moriksy & Ang, 2004; Visser, 2007; Merakou & Kourea-Kremastinou, 2006). Peer education programs, which use individuals specifically selected from the target population to act as educators, role models, and leaders, are generally the preferred approach for health promotion interventions when working with adolescent populations. This is due to a few key factors, namely that the approach can be developed and implemented in a manner that is culturally appropriate, community-based, and widely accepted by target audiences (Ross & Williams, 2002; Campbell, 2005). An additional advantage is the perceived credibility of the peer educators in the eyes of the target group. These individuals are integrated within the target group and can identify with the community of interest. The use of social network analysis (SNA) to identify natural opinion leaders, perceived norms and behaviours, and characteristics of peer influences before the development of an intervention program is being reported more and more often in the literature as a

successful way to optimize peer educator selection, improve program design, and ensure community appropriateness (Bond, 2003; Feinberg, Riggs, & Greenberg, 2005; Wiist & Snider, 1991; Buller et al, 1999; Valente & Davis, 1999).

A growing body of evidence suggests that young people's behaviours and beliefs are shaped positively and negatively by their interpersonal relationships and by the social environments in which they are embedded (Bond, 2003; Feinberg, Riggs, & Greenberg, 2005; Wiist & Snider, 1991). Recent research findings indicate that the ability to successfully undergo the transition from childhood to adolescence and on to adulthood is highly dependent on the presence of social connections (Bond, 2003). During adolescence, health behaviours that will last long into adulthood can be strongly influenced, thereby forming the basis of primary prevention efforts. To understand and be able to positively influence young people's relationships and behaviours, researchers and program staff can conduct SNA, an analytic approach that is being used more frequently in social research and program evaluation (Bond, 2003; Feinberg, Riggs, & Greenberg, 2005; Wiist & Snider, 1991). A social network consists of all of the informal relationships among members of a particular social system (Wasserman & Faust, 1994). Social network analysis is an approach to help understand patterns of social relationships and communications to learn who has contact with whom and how these channels may be accessed (Knipscheer & Antoucci, 1990). By analyzing these patterns, we can learn how relationships constrain or encourage social behaviour and result in societal change (Bond, 2003; Wolf & Tawfik, 2000). More specifically, we can analyze how an individual's interactions with others can affect his or her views, beliefs, and behaviours (Wasserman

& Faust, 1994). An individual's perception about the behaviours of their peers can be one of the strongest influences on their own health decisions (WHO, 2004).

This information can be applied to peer program analysis in several ways. In the initial intervention design stage, the information can help programs assess youth risks, communications, and behaviours to improve program design, targeting, and selection (Bond, 2003). An effective program is one that is able to target services and activities to those most in need, and directs these services to where they can have the greatest impact. Many programs are designed to increase knowledge and promote healthy behaviours, targeting young people in several arenas, but primarily these initiatives are through school-based programs. For examples, see Cartagena et al, 2006; Agha & Van Rossem, 2004, and Visser, 2007. By engaging in an assessment of youth networks and behaviours and being able to describe a more complete social environment (Okonkwo, Fatusi, & Ilika, 2005), programs can improve their targeting strategies and increase their range (Hawe & Ghali, 2007). SNA also allows for an exploration of the contextual and environmental factors that are relevant to understanding relationships and social structures found in given research geographies and settings.

Sub-Saharan Africa is the focal point for the worldwide epidemic of HIV/AIDS. Uganda is one country in East Africa that has demonstrated some success in addressing the epidemic and reducing the burden of HIV/AIDS on some demographics of the population. However, one of the more promising interventions that addresses the needs of adolescents, peer education, has not been widely used in Uganda (Mayega, *personal communication,* May 2008), though recent national policy officially supports this type of endeavour (Uganda Ministry of Education and Sports, 2006). The primary purpose of

this study is to conduct a social network analysis of youth in senior secondary schools in the Kabarole District of western Uganda. The goal is to inform future efforts to implement peer education programs in the rural African setting targeting sexual health promotion and HIV prevention.

1.2 Context

Africa accounts for 70% of the world's HIV/AIDS burden, despite have only 10% of the world's population (Logie, 2004). Starting in 1986, the Ugandan government created a structured, multi-sectoral response to assisting its citizens in the fight against HIV/AIDS (National Aids Documentation Centre, 2009). Yet, an estimated 1.1 million people currently living in Uganda have HIV/AIDS (out of a population of 30 million), and incidence has increased by between 120,000 to 150,000 each year since 2004(NADC, 2009). Nearly 80% of those infected with HIV are between the ages of 15-45 years (NADC, 2009). Of particular concern is the adolescent population, whose knowledge and understanding of sexuality has the potential to determine sexual practices over the course of their lifetime (Machal, 2001). Uganda has a predominantly young population, with the age group of 10-19 making up 23.3% of the population, and young people 10-24 comprising 33.5% of the population (Uganda Ministry of Health). Other sexual and reproductive issues may exist, with the World Bank (2003) reporting that 21-29% of females drop out of school due to pregnancy, and in some cases are expelled from school if they become pregnant (Kiapi-iwa & Hart, 2004).

The Kabarole District is split into 3 administrative districts of Kyenjojo, Kamwenge, and Kabarole. Because of its location in the south west of the country,

amidst the fertile land surrounding the Rwenzori Mountains, the primary economic activity of the Kabarole district is agriculture. Kabarole has an estimated population of 497, 422 (Uganda District Information Portal, 2007). Kabarole has a fertility rate of 8.03 and a total literacy rate of 49%. The most prominent ethnic groups include the Batooro, Bakiga, Bakonyo and Bamba. The primary languages besides English include Rutooro, Rukiga, and Runyankole. There are three hospitals in the Kabarole district, all of which are government-aided. There are also 119 primary schools and 24 secondary schools in this region. The District headquarters are located in Fort Portal, about 300 kilometres west of the capital city of Kampala.

With the risks of HIV infection and unwanted pregnancy, adolescents in Uganda face a formidable double threat. Knowledge of condoms, STI's, and HIV/AIDS have all been measured in past surveys (African Youth Alliance, 2002), however, this knowledge does not seem to be practiced, as the same surveys measure adolescents as making up over 50% of new HIV infections in 2001. There appears to be significant potential for the introduction of a peer education program in the Kabarole District to reduce the burden of STIs (including HIV) and teen pregnancy.

In Uganda, surveys of AIDS-related knowledge and sexual attitudes and practices have been carried out since 1989 (O'Connor, 1999; Konde-lulu, Berkley, & Downing, 1989; Forster & Furley, 1989). In the Kabarole and Bundibugyo Districts of Uganda biannual sentinel surveillance of HIV sero-prevalence in pregnant women at their first ante-natal care visit has been carried out since 1991. The data have revealed a significant decline in the HIV prevalence rate in pregnant women between the ages of 15 and 19 years in the Kabarole District (O'Connor, 1999). The findings of these surveys indicate

an increase in the sexual activity of secondary school students in the Kabarole District, as well as in the number of sexual partners reported by students. In addition, the age at which students are beginning to be sexually active fluctuates from year to year.

There have been several youth specific programs implemented in Uganda, but there are few that use a true peer education approach. The Baaba Project, initiated in 2001 by GOAL, an Irish organization, uses elements of peer education to teach street youth life skills that are believed to reduce the risk of contracting STIs. Older street youth are trained as peer educators and run formal workshops and activities. The Straight Talk Foundation also runs several youth programs, including a radio series, in the country. They do not use peer education (World Bank, 2003).

1.3 Social Network Analysis

SNA is the study of the relationship structure of a defined group. A social network exists wherever there are relationships or connections – such as friendships between individuals or knowledge sharing amongst institutions. SNA will create a map of specified connections between members of a community, allowing researchers and programmers to identify areas of interest. For example, prominent individuals, flows of resources and information, or isolated groups may be discovered using the SNA techniques. SNA has applications in a variety of settings, but its potential usefulness in health promotion programs is of particular interest.

SNA is a tool that can help facilitate understanding of the dynamics of peer-led health promotion programs (Hawe, Webster, and Shiell, 2004). A few examples include influencing fruit and vegetable intake of an immigrant population in the United States of

America (Buller et al, 1999), reducing HIV transmission in youth in Ghana (Wolf & Tawfik, 2000), and prevention of adolescent smoking in schools in the United Kingdom (Audry, Holliday, Parry-Langdon, & Campbell, 2006). In addition, it has been shown that when peer education programs are developed without consideration of social networks and influence, the program is less successful (Hasan, More, & Chalder, 2005). The type of information gained from social network analysis can be used in several ways, but in this particular Ugandan context, it can provide valuable information that can improve the design and targeting of a peer education program within the schools. Program planners can also use the results to facilitate discussions with students about their relationships and their influences on one another. A better understanding of the social networks of youth in Uganda can inform a variety of processes, especially development and targeting of future youth interventions, and can allow for very powerful descriptions of social structures. There is a current gap in the literature on how knowledge, attitudes, and beliefs about reproductive health are derived, as research tends to focus on quantitative measures and places less effort in describing the contextual factors. Social network analysis will allow us to identify who interacts with whom, who influences whom, who is influenced by whom, and how exploitation of these natural social networks may be incorporated into a peer education effort for optimal success.

Broader social network analysis literature indicates that there may be several social networks within a youth population (Wiist & Snider, 1991; Audry et al, 2006). In many cases these sub-groups are connected through different individuals. Therefore it could be assumed that information planted in key individuals will reach the majority of youth in the larger group (Ross & Williams, 2002; Valente & Fosados, 2006). However,

this evidence also indicates that there are sub-groups that may not be connected to others. In this case, sub-groups of individuals may be missed entirely in the chain of communication and influence unless specific members of that sub-group have been included in the peer education program (Wiist & Snider, 1991). SNA has a critical role to play in elucidating these groupings, and identifying key individuals who have the potential to play important roles in the implementation of peer education intervention programs that are looking for maximal reach and influence.

1.4 Study Design

This study was a cross-sectional survey design, implemented in two schools in Fort Portal, the centre of the Kabarole District in the west of Uganda, during the months of April to June, 2008. The two schools are Mpanga, an urban day school, and Nyakasura, a rural boarding school. Uganda's school system is based on seven years of primary school (primary 1 to 7), four years of lower secondary school (senior 1 to 4) and two years of secondary advanced level (senior 5 to 6). English is the language of instruction in all Ugandan schools, and therefore all students are considered fluent in English. Two types of surveys were used: the Total Network Survey and the Personal Network Survey. In both schools, social network analysis was performed for the purpose of identifying multiple modes of influence, identifying useful subgroups, and mapping social networks. To assess network memberships, **Total Network Analysis** mapping techniques were applied (Appendix C.2), using entire school grades as the unit of analysis. To make this process more manageable, given the scope of the research, the respondents were asked to identify a limited number of individuals with whom they have

relationships. Focus was put on two types of networks: a) a general friendship-based network, and b) an interpersonal communication-based network. This second network type centred on the communication between individuals with respect to the health issues under study. The questions asked of respondents are as follows:

1. In your grade, whom do you like as a friend?
2. In your grade, whom have you talked to about reproductive/sexual health issues with in the last three months?

These questions have undergone content analysis and were carefully pretested for comprehension and clarity in our target audience. To provide a richer interpretation of data, basic information was collected on each respondent, including gender and age.

To characterize these relationships and examine the communication, norms, and leadership, mapping techniques are enhanced by additional use of a detailed **Personal Network Survey** (Appendix C.1). This instrument is composed of questions that have been collected from a variety of surveys and validated in different countries. The survey has been adapted from *Building Connections: Understanding relationships and networks to improve adolescent sexual and reproductive health programs*, a publication of the Program for Appropriate Technology (PATH) in Health in Seattle Washington (2003). This resource has informed several peer program evaluations (for example, in Ghana and Thailand, as described by Bond, 2003). In order to make these resources specific to Ugandan youth, the general question framework was fully adapted in close collaboration with our Ugandan research partners. As for the previous survey, these questions have also undergone thorough evaluation for content validity from experts before being pre-

tested with a small sample of Ugandan youth. In this type of analysis, respondents nominate specific people who are in some way related to the respondent.

1.5 Research Objectives

Objective #1: Who are the leaders who influence the transmission or adoption of innovations or norms? Identification of these individuals as peer educators has the potential of creating a more efficient peer education program. Secondarily, knowledge about the network and community structure may inform other aspects of a peer education or health promotion program for youth.

Objective #2: What are the supportive relationships that exist amongst youth? How do young people feel about communicating with their friends? What are the behaviours taking place in relationships? The characterization of friendships and supportive relationships in an adolescent school population will help provide insight into communication patterns and possibly behavioural choices.

1.6 Chapter Overviews

This publication contains five chapters, followed by appendices. The present chapter introduces the study and contains the majority of the contextual information about the setting and provides a study overview. Chapter 2 deals with the literature surrounding the peer context of health behaviour and examines the evidence that supports the idea that an adolescent's social environment can have profound effects on their actions and decisions. The second chapter will also link these ideas with social network analysis, and describe how social network analysis can give an alternate picture of the social environment, and how structurally we can identify areas of a community that are a

source of influence, power, vulnerability, and constraint. The chapter will conclude with an in-depth picture of present peer education, and will present further evidence that suggests that social network analysis can directly inform peer education programs. Chapter 3 is the manuscript that evaluates the social network analysis data from the total network survey. The total network survey provides information on the social structure of the two schools. Within this manuscript, we identify potentially effective ways of choosing appropriate peer educators, and provide information about the school networks that may be valuable to program planners. Chapter 4 contains the manuscript that analyzes the personal network survey data and identifies important aspects of youth relationships that helps us understand more about their friendships, and the communication that occurs within these relationships. The fifth chapter contains overall conclusions about the combined work and identifies areas of further research. References follow each chapter, immediately following all figures and tables. Appendices occur after the last chapter, and contain fieldwork particulars, data analysis information, data collection tools, information letters, letters of consent, and the research assistant training manual.

1.7 Strengths and Limitations

This study is descriptive and exploratory and will provide a solid basis for further research and intervention with Ugandan youth, and the results will be able to provide unique insight to program planners and policy makers when dealing with adolescents and youth culture. The study is innovative and novel, and draws on a solid foundation of evidence of the importance of relationships and social environment to youth behaviour.

The results of this study will contribute to the growing body of knowledge about "what works" with regards to peer program targeting, planning, implementing, and evaluating.

The main limitation of this study is that it has limited external validity. Methods used during this study are widely applicable, but the results generated are inherently designed to provide insight into a particular group of people. Our study was of secondary school students in Uganda – a resource poor setting. Our results are therefore most applicable to similar settings, such as other to other schools within the same country, or perhaps even Aboriginal youth in Canada. Local research assistants will be recruited from the research project office in Kabarole District to assist with both data collection and analysis/interpretation. It is always difficult to engage youth in providing information on delicate subjects such as social relationships and sexual health. This was no less the case in Uganda. Some youth may have been very uncomfortable sharing their thoughts on who they socialize with, and who their best friends and confidantes are. Efforts were made to rigorously train the research assistants about the nature of the research and the sensitivities it could entail, and include them in the data analysis to maximize a cultural understanding of the results. Further details are provided in the Appendix, part A.

Limitations regarding the methods themselves are addressed more fully in the manuscripts. In those chapters, we give specific details about the limitations that would impact the results found.

1.8 Ethical Considerations

Prior to beginning the fieldwork, the study was approved by the Ministry of Health in Uganda, and the Uganda National Council for Science and Technology in May, 2008. The application for University of Alberta ethics was also approved in April, 2008

In line with previous research involving school students in Uganda, verbal consent was sought by the District Education Officer (DEO) and by the Head Masters of the participating schools. Students were given an information sheet detailing the purpose of the study, the possible risks/benefits, and that their participation is completely voluntary (see Appendix D). Details of the information sheet were stated verbally by the principle researcher before distributing the questionnaires to the students.

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References

African Youth Alliance. (2006). HIV/AIDS Fact Sheet: Uganda. Retrieved from http://www.pathfind.org/site/PageServer?pagename=Programs_Uganda_pubs.

Agha, S., & Van Rossem, R. (2004). Impact of a school-based peer sexual health intervention on normative beliefs, risk perceptions, and sexual behaviour of Zambian adolescents. *Journal of Adolescent Health*, 34, 441-452.

Audrey, S., Holliday, J., Parry-Langdon, N., & Campbell, R. (2006). Meeting the challenges of implementing process evaluation within randomized controlled trials: the example of ASSIST (a stop smoking in schools trial). *Health Education Research*, 21(3), 366-377.

Bond, K. (2003). Building connections: understanding relationships and networks to improve adolescent sexual and reproductive health programs. Seattle: Program for Appropriate Technology in Health (PATH).

Buller, D. B., Morrill, C., Tarn D., Aickin, M., Sennott-Miller, L., Buller M. K., Larkey, L, Aladtorre, C., & Wentzel, T. M. (1999). Randomized trial testing the effect of peer education at increasing fruit and vegetable intake. *Journal of National Cancer Institute*, 91(17), 1491-1500.

Campbell, S. (2005). Using peer education projects to prevent HIV/AIDS in young people. *Nursing Standard,* 20(10), 50-55.

Caron, F., Godin, D., Otis, J., & Lambert, L. D. (2004). Evaluation of a theoretically based AIDS/STD peer education program on postponing sexual intercourse and on condom use among adolescents attending high school. *Health Education Research*, 19(2), 185-197.

Cartagena, R. G., Veugelers, P. J., Kipp, W., Magigav, K., Laing, L. M. (2006). Effectiveness of an HIV prevention program for secondary school students in Mongolia. *Journal of Adolescent Health*, 39, 925.e9-925.e16.

Feinberg, M. E., Riggs, N. R., & Greenberg, M. T. (2005). Social networks and community prevention coalitions. *Journal of Primary Prevention*, 26(4), 279-298.

Forster, S. J., & Furley, K. E. (1989). Public awareness survey on AIDS and condom use in Uganda. *AIDS*, 3, 147-54.

Hasan, M., Moore, L., & Chalder, M. (2005). Feasibility study for an evaluation of a schools-based, peer-led intervention to reduce pupil problem drinking: the teenage alcohol project. Retrieved from The Alcohol Education and Research Council: http://www.aerc.org.uk/librarySearch.html

Hawe, P., & Ghali, L. (2008). Use of social network analysis to map the social relationships of staff and teachers at school. *Health Education Research*, 23(1), 62-29.

Hawe, P., Webster, C., Shiell, A. (2004). A glossary of terms for navigating the field of social network analysis. *Journal of Epidemiology and Community Health*, 58, 971-975.

Kiapi-iwa, L., & Hart, G. J. (2004). The sexual and reproductive health of young people in Adjumani district, Uganda: qualitative study of the role of formal, informal, and traditional health providers. *AIDS Care*, 16(3), 339-347.

Kinsler, J., Sneed, C. D., Morisky, D. E., & Ang, A. (2004). Evaluation of a school-based intervention for HIV/AIDS prevention among Belizean adolscents. *Health Education Research*, 19(6), 730-738.

Knipscheer, C. P. M., & Antonucci, T. C. (1990). Social network research: substantive issues and methodological questions. Amsterdam: Swets and Zeitlinger.

Konde-Lule, J. K., Berkley, S., & Downing, R. (1989). The knowledge, attitudes, and practices concerning AIDS in Ugandans. *AIDS*, 3, 513-518.

Logie, D. (2004). Unfairness of social and economic structures affecting AIDS in Africa. *British Medical Journal*, 324, 1034.

Machal, J. Z. (2001). Unsafe sexual behaviours among schoolgirls in Mozambique: a matter of gender and class. *Reproductive Health Matters*, 9(17), 82-90.

National AIDS Documentation Centre. The official website of the Uganda AIDS Commission. Retrieved March 18, 2009 from http://www.aidsuganda.org/.

Neema, S., Ahmed, F. H., Kibombo, R., & Bankole, A. (2006). Adolescent sexual and reproductive health in Uganda: results from the 2004 national survey of adolescents. Occasional Report No.25. New York: Guttmacher Institute.

O'Connor, H. (1999). Adolescent sexual behaviour in Uganda. (Masters' thesis, University of Alberta).

Okonkwo, P. I., Fatusi, A. O., & Ilika, A. L. (2005) Perception of peers' behaviour regarding sexual health decision making among female undergraduates in Anambra State, Nigeria. *African Health Sciences*, 5(2), 107-113.

Ross, M. W.,& Williams, M. L. (2002). Effective targeted and community HIV/STD prevention programs. *The Journal of Sex Research*, 39(1), 58-62.

Uganda District Information Portal. Retrieved from www.kabarole.go.ug.

Uganda Ministry of Health, *The National Health Policy*, Kampala, Uganda: Ministry of Health, 2000.

Uganda Ministry of Education and Sports, *National Policy Guidelines on HIV/AIDS*, Kampala, Uganda: Ministry of Education and Sports, 2006

Valente, T. W., Fosados, R. (2006). Diffusion of innovations and network segmentation: the part played by people in promoting health. *Sexually Transmitted Diseases*, 33(7 Suppl), S23-S31.

Valente, T. W., & Davis, R. L. (1999). Accelerating the diffusion of innovations using opinion leaders. *The ANNALS of the American Academy of Political and Social Science*, 556, 55-67.

Visser, M. (2007). HIV/AIDS prevention through peer education and support in secondary schools in South Africa. *Journal of Social Aspects of HIV/AIDS*, 4(30), 678-694.

Wasserman, S., & Faust, K. (1994). Social network analysis: methods and applications. New York: Cambridge University Press.

Wiist, W. H., & Snider, S. (1991). Peer education in friendship cliques: prevention of adolescent smoking. *Health Education Research, 6(1),* 101-108.

Wolf, R. C., & Tawfik, L. A. (2000). Peer promotion programs and social networks in Ghana: methods for monitoring and evaluating AIDS prevention and reproductive health programs among adolescents and young adults. *Journal of Health Communication*, 5(Suppl), 61-80.

World Health Organization. (2004). Risk and protective factors affecting adolescent reproductive health in developing countries. Retrieved from http://www.who.int/child_adolescent_health/documents/sex_rep_health/en/index.html.

CHAPTER 2

LITERATURE REVIEW

2.1 The Peer Group Context of Health Behaviour

Health behaviour theorists have long attested to the importance of social influences in health decision making. For example, the prominent Social Cognitive Theory builds in a construct of outcome expectancies, of which social outcome expectancies, or the value of the anticipated reaction of those in one's environment, play a role. In essence, an individual is going to consider anticipated approving or disapproving responses, by his/her peers, to a particular health decision, and the perceived reaction will affect the decision that is made (Lusczynska and Schwarzer, 2007). The Theory of Planned Behaviour describes the social influence as subjective norms, which are individual's beliefs that significant others think that they should engage in a behaviour (Conner and Sparks, 2007). For example, an adolescent may decide to begin smoking if he thinks that his friends have favourable attitudes towards smoking behaviour. Other models have focused on more of a learning and observing approach, such as the Theory of Interpersonal Behaviour, which speaks more specifically about social group subcultures and norms and their facilitating effect on health behaviour decisions (Norman and Conner, 2007). Though these theories describe the effects of the social environment on an individual, at the very base level the individual is consciously making the decision of which health behaviour to engage in. Social Network Analysis (SNA) is a technique that can be used to develop a richer description of the social environment. In addition to identifying peer groups, SNA creates a structural map of the relationships in a given community, and these can be examined on several different levels, including the individual or sub-group level.

In adolescence, the peer group is an important context when attempting to understand and influence health behaviours. Peer influence can occur in several different ways, including modelling (Hundelby and Mercier, 1987) and direct peer persuasion (Graham, Marks, & Hansen, 1991). However, more recent research has acknowledged that simply studying peer influence may ignore other group-level aspects, leading to a greater number of studies which implement the use of SNA to determine network-level measures that enhance the conceptualization of peer influence. Research has focused on many types of troublesome adolescent behaviour, including alcohol consumption (Bot et al, 2005), smoking (Wiist and Snider, 1991; Abel, Plumridge and Graham, 2002; Ennett et al, 2008; Valente, Unger, and Johnson, 2005), substance abuse (Ennett et al, 2006), eating disorders (Hutchinson & Rapee, 2006), and risky sexual behaviour (Okonkwo, Fatusi, and Ilika, 2005). The mechanisms of peer influence in these studies are different but related, and are modified by friendship and group characteristics. For example, in their study about drinking behaviour, Bot et al (2005) found that the friendship dimensions that most affected the tendency to drink alcohol were relative differences in sociometric status and degree of reciprocity desired within the friendship[1]. In 1996, Ennett and Bauman concluded that simple peer influence is not a powerful determinant of adolescent substance abuse because of friendship selection characteristics, and recommended the use of SNA to provide a more critical examination. Later, Ennett et al (2008) reconfirmed that smoking by peers was a risk factor for individual smoking, as well as other friendship characteristics that were described using SNA[2]. These researchers (Ennett et al, 2006) have also used measures of social embeddedness and social status to describe substance abuse in adolescents[3]. In a different approach, Abel,

Plumridge, and Graham (2002) examined smoking behaviours within a youth community in terms of clustering the relationship profiles of similar adolescents to see if similar individual network composition affects health behaviour in the same way[4].

In terms of peer influence and social networks, risky sexual behaviours in youth have not been as widely studied as substance abuse, drinking, or smoking, but it stands to reason that the determinants of other risk behaviours may work similarly. In the Ugandan context, youth have admitted that there is a peer pressure aspect in the decision to engage in pre-marital sex (Amuyunzu-Nyamongo, Biddlecom, Ouedraogo, & Woog, 2005). A recent review by Kohler, Behrman, and Watkins (2007) highlighted the conclusions of others that the social environment has significant effects on individual's decisions regarding sexual behaviours. They strongly recommend that the community's social network must always be taken into consideration when developing any sort of health intervention. However, their population of study was the adult population, and given the intuitive sense that youth networks are different than adult networks, their conclusions may not be entirely generalizable. Okonkwo, Fatusi, and Ilika (2005) studied female undergraduates in Nigeria and conclude that there is indeed an aspect of social influence present in the decision to engage in sexual behaviour, but acknowledged that their approach needed a grander account of the social environment and looking at the social structure may be helpful. Sieving, Eisenberg, Pettingell, and Skay (2006) concur with these results after they examined the role of friend-related variables on sexual debut. A study by Dolcini et al (2008) describes promising preliminary findings of a friendship-based intervention program set to reduce the transmission of human immunodeficiency virus (HIV) and sexually transmitted infections (STIs). The researchers utilize the

existing social relationships to deliver a health intervention education program. They achieved favourable results, but their follow-up time is short (3 months) and no control group was used. These researchers also did not use formal SNA, leading to questions about whether or not all potential subgroups would be reached by this intervention. That said, their work represents the growing acceptance that relationships are very important when trying to change group and social norms.

In summary, the social environment plays an important role in health behaviour decisions for young people. Within that environment, there are many factors at play, including the various aspects of peer influence. Recent research has shown that peer influence should not be considered in isolation, rather it must be held in context of the greater social structure that involves relationship characteristics, subgroup characteristics, and network characteristics (these terms will be explained in detail later). Social network analysis is a tool to enable researchers to do just that.

2.2 Using Social Network Analysis

Social network analysis, the structural examination of a network of relationships, is a relatively recent phenomenon, growing in popularity over the past 2 or 3 decades (Berkman et al, 2000). SNA is used to understand and describe social relationships, and make inferences of how these relationships affect individual and group behaviour. A brief outline of the more common measures and definitions will be presented here, and there are several excellent reviews and textbooks that provide simple, clear descriptions of SNA. If more information is desired, readers are advised to refer to the online textbook of Hanneman and Riddle (2005) or the 1994 textbook by Wasserman and Faust.

In addition, Valente, Gallaher and Mouttapa (2004) give a succinct description of basic and intermediate SNA measures. For a basic glossary of SNA terms, refer to Hawe, Webster, and Shiell (2006).

Social networks have been linked to health research and health outcomes as a measure of social support; the greater the number of relationships present, the better the health outcomes (for a recent example of this type of work, see Magliano et al, 2006). Another common use of SNA is to identify patterns of disease transmission. However, there are many other uses of SNA in health research, such as investigating information transmission networks, examining the influence of social position on health behaviour, creating better partnerships through health organizational networks, and identifying individuals and relationships that will help maximally diffuse a health program message (Luke & Harris, 2007; Valente & Fosados, 2006).

2.3 SNA definitions

The most basic element in a network is the **actor**, or **node**, which is mostly commonly depicted, through social network analysis visualization software, as a small solid shape, such as a circle. This represents the individual person within the network, but in some cases, it may represent a single collective unit. To represent the relationship between actors or nodes, a **tie**, or a line drawn between two nodes, is used. Using a school-based example, if individual student is a node, a friend relationship could be an example of a tie. There are a number of attributes that can be used to describe each node or tie. For example, one may choose to describe the ties in terms of weight, such as a best-friendship versus a casual acquaintance, and draw a thicker line for the more

meaningful relationship. Attributes may also be qualitative in nature. For example, nodes may be characterized (and subsequently analyzed) by gender or location. There are a few types of networks available, but commonly a **one-mode** network is used, which involves the relational ties between a single set of **bounded** actors. In this sense, 'bounded' means that the boundaries of the network are clearly specified; for instance, the network consists of all of the students within a certain grade, and none from outside of that grade.

When using a one-mode network, data collection primarily involves the use of surveys. Subjects are asked to identify their relationships along any variety of characteristics chosen by the researchers. For instance, a researcher wishing to study close friendships may ask "Whom do you like as a friend?" A researcher who studies supportive relationships may ask "Whom do you go to for advice?" Strength of ties may be sought at this juncture, with the researcher requesting a valued response (i.e., "Rank your friends in terms of how close you are to them"). Depending on the size of the network, a community roster may be given for the subject to refer to, but if the network is too large, this may not be feasible. In addition, the researcher may choose to limit the number of responses given, though this will result in a less complete network. However, this may be required for logistical reasons.

Network data is usually entered into a matrix for use with network analysis software. Many network measures are accomplished through a variety of matrix algebraic processes. Network visualization, though not required to calculate network measures, is accomplished through a **sociogram,** or a graphic representation of nodes and ties. Different network layouts are available, and will depend on the network aspect that

the researcher wishes to highlight. For example, nodes can be grouped according to a certain attribute, such as gender, or according to the similarity of their connections.

There is a plethora of network measures that can be used to describe the structure of the community. Some of the more common ones include:

Subgroup: Individuals who are more closely connected, or tied, with each other than they are with other members of the network. There are many measures of subgroups, such as **cliques**, **factions**, and **components**. **Isolates** are individuals who are not connected to anyone else in the network, and **pendants** are those who are connected to only one other member.

Density: The number of observed ties compared to the total number of ties possible. This measure can be used on different levels, such as density of a subgroup or density of the total community.

Reach: The set of connections between actors. Reach follows along a **path** of ties, and considers nodes reachable if they are connected by an unbroken path of ties to a node of interest.

Centrality: Essentially, this is the degree to which a node is prominent, or central, in a network; however, there are many different measures to determine this that require different conceptualizations. For example, **degree centrality** is the number of ties a given node has, whereas **closeness centrality** measures the lengths of paths to all other nodes from the node of interest. **Betweenness centrality**, another common measure,

involves the extent to which a node is present in paths between other pairs of nodes.

2.4 SNA Use in Health Interventions

SNA has been linked with Diffusion of Innovations theory in terms of using SNA to identify natural group leaders and "use them as delivery vehicles. The messenger is as important as the message" (Valente and Fosados, 2006). The Diffusion of Innovations theory describes how new messages, ideas, and concepts are spread throughout a community (Rogers, 2003). Embedded within this theory are several concepts which specifically highlight the importance of people within this process, namely that people can modify innovations, and that diffusion occurs in personal networks (Valente and Fosados, 2006).

The identification of influential individuals using social network analysis is not a new idea, and it has been used with success in many studies, particularly in schools with campaigns to reduce adolescent smoking (Valente et al, 2003; Wiist & Snider, 1991). However, there are many different ways that the identification has been carried out. Occasionally, the nominations come from program staff or those familiar with the population members; for example, Kelly et al (1991) used the observations of bartenders in homosexual clubs to identify key popular individuals. A more sociometric approach may include a snowball technique where the process begins by asking one group member to identify the opinion leaders in the population, who then get successively interviewed until the desired number of leaders are achieved, such as used by Latkin (1998) in an injection drug user intervention. The main disadvantage of this technique is the strong

possibility of extended time needed to locate and interview all of the nominated individuals (Valente & Pumpuang, 2007). According to Valente & Pumpuang (2007), the most valid and reliable technique to identify opinion leaders is to obtain data for a total network. However, there are many ways of locating influence in a network. For example, Buller et al (1999) used network analysis to identify the subgroups first, and then find influential individuals within each subgroup. This is very similar to another successful study by Kelly et al (2006) in a young male Roma population in Bulgaria. Different approaches have also been made in matching opinion leaders with the audience that they are most likely to affect; i.e. the group members who nominated them (Valente & Davis, 1999). In this proposed scenario, the intervention team goes through three specific steps, starting with isolating the top 10% of individuals who received the most amount of nominations, to create group assignments before the program begins. Though this has been successful as a mathematical diffusion model, it only relies on the most popular individuals rather than looking at other means of influence. The use of different network measures to identify key players should be examined further. Borgatti (2003) has created an algorithm that goes through all possible combinations to find the sets of people that, as a group, have the highest reach in the network. This algorithm is complex and takes into account several variables that focus on the idea of overall group connectedness and reach, and has been assembled into a KeyPlayer software package (part of the UCInet 6 suite). One potential downside to this technique is that it relies on each of the identified individuals being willing to be part of the health intervention, and when alternatives are searched for, another completely different set is produced by the program. Another concern particular to the adolescent population is that because there is

a decreased focus on the most popular individuals, the importance of peer influence within the youth setting may be lessened.

An understanding of the pre-existing community structure is important in planning health interventions. Hawe and Ghali (2008) used SNA to identify key players within a school who would be useful in the initiation of a whole-school health promotion intervention. They also looked at other measures to describe their network. They believe that their results will "lead to more strategic choices for health promotion intervention agents than the traditional methods used up until now." In other words, program planners will be able to alter and better target their program based on the network density, presence of isolated subgroups, existence of gatekeepers, and so on. In her 2003 publication *"Building connections: Understanding relationships and networks to improve adolescent sexual and reproductive health programs",* Katherine Bond expands on several of these concepts and specifically writes about how SNA can improve health promotion interventions in the adolescent population. Her three main ideas are as follows:

1. The use of SNA can "help programs assess risk to improve program design, targeting, and selection." Programs may be able to use SNA to identify susceptible groups and individuals that may not be reached very easily.
2. Many successful youth programs lie on an interpersonal behaviour model theoretical framework, and SNA will help the program planners understand the placement and structure of the subgroups where the

interpersonal communication happens, and the position of influential individuals who most affect the interpersonal communication.

3. Using SNA may indirectly result in a social change that occurs through creating supportive linkages and mobilizing a community to be more aware of the social norms that affect them.

2.5 Peer Education

Peer education (PE) became quite popular in the 1990s as a way of implementing a health promotion intervention in an adolescent group (Backett-Milburn & Wilson, 2000). PE uses individuals directly from the target population and trains them to be informal or formal educators of their peers. The theoretical basis for PE draws from many health behaviour models, including Social Learning Theory (Bandura, 1977), which posits that people learn by observing the behaviour of others. The Theory of Reasoned Action states that people's individual perceptions of social norms can influence them to change their behaviour (Connor & Sparks, 2007). The Diffusion of Innovation theory (Rogers, 2003), as discussed previously, can serve as a model to explain how peer educators may act as behaviour modification agents by affecting the norms and information channels within their communities, as there is evidence that information and ideas are best transferred by people who are similar to those to whom the innovation is being introduced. Another theory that embraces the importance of peer influence is the Prototype-Willingness Model, which speaks specifically of adolescent tendency to create prototypical images of idealized behaviour based on perceived group norms, and act in accordance (Conner & Norman, 2007). PE draws on aspects of all of these theories as it

basically assumes that influential individuals chosen from a particular community can lead to change within that community, and that this change occurs through a variety of processes, most importantly interpersonal communication.

Many have specifically described several reasons why PE is an appropriate choice when designing a new health intervention for adolescents. Firstly, the peer educator has a certain level of credibility in the target population because he/she is embedded within of the target population (Caron et al, 2004). Secondly, the peer educator helps make the program culturally appropriate, because the individual has an intimate understanding of the norms and values within that community (Visser, 2007; Shuguang & Vande Ven, 2003). Thirdly, the peer educator is able to exert influence in a number of venues, particularly during informal interactions. Lastly, the peer educator can serve as an accessible role model for the behaviours they are helping to try to change (Campbell, 2005). However, though peer education has a theoretical basis, there is continued study into its mechanisms of action in order to comprehensively understand how it works and what factors are important to success and sustainability.

There are many examples of PE programs in youth; in particular, PE seems to be the approach of choice when creating programs around sexual health (Visser, 2007). The most common way of evaluating projects involves a follow-up test (or, a pre-test and post-test system) that measures changes in knowledge, attitudes, and practise, though outcomes may vary. For example, in a study in Mongolia, Cartagena et al (2006) included a self-efficacy measure in addition to standard testing. Other groups of measures include knowledge, attitudes, skills, and risk perception (Borgia et al, 2005); attitudes, perceived behavioural control, personal normative beliefs, anticipated regret,

and intentions (Caron et al, 2004); and normative beliefs and behavioural practise (Agha and Van Rossem, 2004). In each of the previous examples, positive changes in practise (behaviour) were the most difficult to demonstrate, ranging from statistically insignificant increases (Cartagena et al, 2006) to no increase (Agha & Van Rossem, 2004; Borgia et al, 2005). Borgia et al (2005) gives a possible explanation: "[…] the interval of time [..] may have been too brief to observe changes in behaviour." A brief follow-up period is a common criticism of PE evaluations. A recent study by Visser (2007) had a relatively longer follow-up time (18 months) and was able to demonstrate an effect on time of sexual activity onset when a peer-intervention group was compared to a control group. Because there is infrequent reporting of sustained behaviour change, PE continues to be researched.

Because the success of the program may be largely reliant on the peer educators, the recruitment and selection of peers should be a careful and exact process. This is not always the case. Currently, the commonly recommended selection criteria for peer educators appears not to be borne of rigorous research; rather, the selection criteria are intuitive and may be arbitrarily decided upon by the program implementing institution. PE guides are available for use, and a representative list of peer educator qualifications is displayed in Table 2.1 (page 33). A question arising from this approach is: "Who selects the peer educators?" As many of these programs are administered in schools, one practise is for teachers to choose the peer educators. Another common approach is to solicit volunteers. Both of these practices may be troublesome; the teachers may be far removed from the population and perceptions of what makes a youth influential (Wiist & Snider, 1991), and volunteers may be too different than those in the target population

(Valente & Pumpuang, 2007). For example, in peer education programs in Mongolia and Uganda, the teachers select students based on high academic achievement, stating that students will not respect the teachings of someone who does achieve high marks (Cartagena et al, 2006; Jones, *personal communication*, March 2009). Many programs also recommend directly involving the target community in the selection of peer educators, such as through nominations (Buller et al, 1999; Visser, 2007). This approach appeals to the notion that the most popular individuals within a group are the most influential. However, this may not be the case, as social network theory suggests that these individuals may also be highly constrained because they experience pressure to be responsive to group needs (Ennett et al, 2006).

An obvious application of SNA in the context of a PE program is to select the peer educators. Secondary benefits of this approach include a better understanding of the social networks that exist within the student population and the subgroups and divisions that may exist. Being able to harness natural flows of communication and influence can improve the long-term results of a PE program and perhaps improve impact outcomes.

Table #2.1: Qualities to look for in a peer educator*

An ideal peer educator:

- Has the ability to communicate clearly and persuasively with their peers
- Has good interpersonal skills
- Is accepted and respected by their peers
- Has a non-judgemental attitude
- Is highly motivated to work towards behavioural risk reduction
- Is self-confident and shows potential for leadership
- Has the time and energy to devote to the work

**Adapted from AIDSCAP "How to create an effective peer education project"*

References

Abel, G., Plumridge, L., & Graham, P. (2002). Peers, networks, or relationships: strategies for understanding social dynamics as determinants of smoking behaviour. *Drugs: Education, Prevention, and Policy*, 9 (4), 325-338.

Agha, S., & Van Rossem, R. (2004). Impact of a school-based peer sexual health intervention on normative beliefs, risk perceptions, and sexual behaviour of Zambian adolescents. *Journal of Adolescent Health*, 34, 441-452.

AIDS Control and Prevention (AIDSCAP). (n.d.). How to Create and Effective Peer Education Project. Retrieved from www.fhi.org.

Amuyunzu-Nyamongo, M., Biddlecom, A. E., Ouedraogo, C., & Woog, V. (2005). Qualitative evidence on adolescents' views of sexual and reproductive health in sub-saharan Africa. *Occasional Report, No. 16.* New York: Guttmacher Institute.

Backett-Milburn, K. & Wilson, S. (2000). Understanding peer education: insights from a process evaluation. *Health Education Research*, 15(1), 85-96.

Bandura, A., (1977). Social Learning Theory. New York: General Living Press.

Bauman, K. E., & Ennett, S. T. (1996). On the importance of peer influence for adolescent drug use: commonly neglected considerations. *Addiction*, 91(2), 185-198.

Berkman, L. F., Glass, T., Brissette, I., Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine*, 51(6), 843-857.

Bond, K. (2003). Building connections: understanding relationships and networks to improve adolescent sexual and reproductive health programs. Seattle: Program for Appropriate Technology in Health (PATH).

Borgatti, S. P., Everett, M. G., & Freeman, L.C. (2002). UCINet for windows: software for social network analysis. Harvard: Analytic Techonologies.

Borgatti, S. P. (2003). Identifying sets of key players in a network. In Proceedings of 1st International Conference on Integration of Knowledge Intensive Multi-Agent Systems , (pp. 127-131). IEEE press, Boston, MA.

Borgia, P., Marinacci, C., Schifano, P., & Perucci, C. A. (2005). Is peer education the best approach for HIV prevention in schools? Findings from a randomized controlled trial. *Journal of Adolescent Health*, 36, 508-516.

Bot, S. M., Engels, R. C. M. E., Knibbe, R. A., & Meeus, W. H. J. (2005). Friend's drinking behaviour and adolescent alcohol consumption: the moderating role of friendship characteristics. *Addictive Behaviours*, 20, 929-947.

Buller, D. B., Morrill, C., Tarn D., Aickin, M., Sennott-Miller, L., Buller M. K., Larkey, L, Aladtorre, C., & Wentzel, T. M. (1999). Randomized trial testing the effect of peer education at increasing fruit and vegetable intake. *Journal of National Cancer Institute*, 91(17), 1491-1500.

Campbell, S. (2005). Using peer education projects to prevent HIV/AIDS in young people. *Nursing Standard*, 20(10), 50-55.

Caron, F., Godin, D., Otis, J., & Lambert, L. D. (2004). Evaluation of a theoretically based AIDS/STD peer education program on postponing sexual intercourse and on condom use among adolescents attending high school. *Health Education Research*, 19(2), 185-197.

Cartagena, R. G., Veugelers, P. J., Kipp, W., Magigav, K., Laing, L. M. (2006). Effectiveness of an HIV prevention program for secondary school students in Mongolia. *Journal of Adolescent Health*, 39, 925.e9-925.e16.

Connor, M. & Sparks, P. (2007). Theory of planned behaviour and health behaviour. In M. Connor & P. Norman (Eds.) Predicting health behaviour. (2nd Edition). New York: Open University Press.

Dolcini, M. M., Harper, G. W., Boyer, C. B., Watson, S. E., Anderson, M, Pollack, L. M. & Chang, J. Y. (2008). Preliminary finding on a brief friendship-based HIV/STI intervention for urban African American youth: Project ORE. *Journal of Adolescent Health*, 42, 629-633.

Ennett, S. T., Bauman, K. E., Hussong, A., Faris, R., Foshee, V. A., & Cai, L. (2006). The peer context of adolescent substance use: findings from social network analysis. *Journal of Research on Adolescence*, 16(2), 159-186.

Ennett, S. T., Faris, R., Hipp, J., Foshee, V. A., Bauman, K. E., Hussong, A., & Cai, L. (2008). Peer smoking, other peer attributes, and adolescent cigarette smoking: a social network analysis. *Prevention Science*, 9, 88-98.

Graham, J. W., Marks, G., & Hansen, W. B. (1991). Social influence processes affecting adolescent substance use. *Journal of Applied Psychology*, 76, 291-298.

Hanneman, R. A.,& Riddle, M. (2005). Introduction to social network methods. Riverside, CA: University of California, Riverside. (published in digital form at http://faculty.ucr.edu/~hanneman/)

Hawe, P., Webster, C., & Shiell, A. (2004). A glossary of terms for navigating the field of social network analysis. *Journal of Epidemiology and Community Health*, 58, 971-975.

Hawe, P., & Ghali, L. (2008). Use of social network analysis to map the social relationships of staff and teachers at school. *Health Education Research*, 23(1), 62-29.

Hundleby, J. D., & Mercier, G. W. (1987). Family and friends as social environments and their relationship to young adolescents' use of alcohol, tobacco, and marijuana. *Journal of Marriage and the Family,* 49, 151-164.

Hutchinson, D. M.,& Rapee, R. M. (2007). Do friends share similar body image and eating problems? The role of social networks and peer influences in early adolescence. *Behaviour Research and Therapy*, 54, 1557-1577.

Kelly, J. A., Lawrence, J. S., Diaz, Y. E., Stevenson, L. Y., Hauth, A. C., Brasfield, T. L, Kalichman, S. C., Smith, J. E., & Andrew, M. E. (1991). HIV risk behaviour reduction following intervention with key opinion leaders of population: an experimental analysis. *American Journal of Public Health*, 81(2), 168-171.

Kelly, J. A., Amirkhanian, Y. A., Kabakchieva, E., Vassileva, S., Vassilev, B., McAuliffe, T. L., DiFranceisco, W. J., Antonova, R., Petrova, E., Khoursine, R. A., & Dimitrov, B. (2006). Prevention of HIV and sexually transmitted diseases in high risk social networks of young Roma (Gypsy) men in Bulgaria: randomized controlled trial. *British Medical Journal,* 333, 1098-1101.

Kohler, H-P., Behrman, J. R., & Watkins, S. C. (2007). Social networks and HIV/AIDS risk perceptions. *Demography*, 44(10), 1-33.

Latkin, C. (1998). Outreach in a natural setting: the use of peer leaders for HIV prevention among injecting drug users' networks. *Public Health Report,* 113(Suppl 1), 151-159.

Luke, D. A., & Harris, J. K. (2007). Network analysis in public health: history, methods, and applications. *Annual Review of Public Health,* 28, 69-93.

Luszczynska, A., & Schwarzer, R. (2007). Social Cognitive Theory. In M. Connor & P. Norman (Eds.) Predicting health behaviour. (2nd Edition). New York: Open University Press.

Magliano, L., Fiorillo, A., Malangone, C., De Rosa, C., & Maj, M. (2006). Social network in long-term diseases: a comparative study in relatives of persons with schizophrenia and physical illnesses versus a sample from the general population. *Social Science & Medicine,* 62, 1392-1402.

Norman, P., & Conner, M. (2007). Predicting and changing health behaviour: future directions. In M. Connor & P. Norman (Eds.) Predicting health behaviour. (2nd Edition). New York: Open University Press.

Okonkwo, P. I., Fatusi, A. O., & Ilika, A. L. (2005) Perception of peers' behaviour regarding sexual health decision making among female undergraduates in Anambra State, Nigeria. *African Health Sciences*, 5(2), 107-113.

Rogers, E. M. Diffusion of Innovations, 5th Ed. New York: Free Press, 2003.

Shuguang, W., & Van de Ven, P. (2003). Peer HIV/AIDS education with volunteer trishaw drivers in Yaan, People's Republic of China: process evaluation. *AIDS Education and Prevention,* 15(40), 334-345.

Sieving, R. E., Eisenberg, M. E., Pettingell, S., & Skay, C. (2006). Friends' influence on adolescents' first sexual intercourse. *Perspectives on Sexual and Reproductive Health*, 38(1), 13-19.

Valente, T. W., & Davis, R. L. (1999). Accelerating the diffusion of innovations using opinion leaders. *Annals of the American Academy of Political and Social Science*, 566, 55-67.

Valente, T.W., Hoffman, B. R., Ritt-Olson, A, Lichtman, K, Johnson, C. A. (2003). Effects of a social-network method for group assignment strategies on peer-led tobacco prevention programs in school. *American Journal of Public Health*, 93(11), 1837-1843.

Valente, T. W., Gallaher, P., & Mouttapa, M. (2004). Using social networks to understand and prevent substance use: a transdisciplinary perspective. *Substance Use & Misuse*, 39(10-12), 1685-1712.

Valente, T. W., Unger, J. B., & Johnson, C. A. (2005). Do popular students smoke? The association between popularity and smoking among middle school students. *Journal of Adolescent Health*, 37, 323-329.

Valente, T. W., & Pumpuang, P. (2007). Identifying opinion leaders to promote behaviour change. *Health Education & Behaviour*, 34(6), 881-896.

Visser, M. (2007). HIV/AIDS prevention through peer education and support in secondary schools in South Africa. *Journal of Social Aspects of HIV/AIDS*, 4(30), 678-694.

Wasserman, S., & Faust, K. (1994). Social network analysis: methods and applications. New York: Cambridge University Press.

Wiist, W. H., & Snider, S. (1991). Peer education in friendship cliques: prevention of adolescent smoking. *Health Education Research, 6(1),* 101-108.

Endnotes

[1]The main findings were that when a nominated friend was of a higher status (as voted by the youth participants), the respondent was more likely to choose to start drinking. In addition, these tendencies were modified by whether or not the friendship nomination was reciprocated.

[2]The authors examined the following characteristics: having friends, friendship quality (includes reciprocity and closeness), and betweenness centrality.

[3]Embeddedness was measured by degree of reciprocity, density, social position, and out-of-network friendship nomination. Status was measured by normalized in-degree, reach centrality, betweenness centrality, and Bonacich power.

[4]The authors identified the subgroups in the network and drew conclusions based on structural equivalence, which involves examining the pattern of relationships in terms of similar network measures.

CHAPTER 3

USING SOCIAL NETWORK ANALYSIS TO IDENTIFY POTENTIALLY EFFECTIVE PEER EDUCATORS

3.1 Introduction

Africa accounts for 70% of the world's HIV/AIDS burden, despite have only 10% of the world's population (Logie, 2004). Starting in 1986, the Ugandan government created a structured, multi-sectoral response to assisting its citizens in the fight against HIV/AIDS (National Aids Documentation Centre, 2009). Yet, an estimated 1.1 million people currently living in Uganda have HIV/AIDS (out of a population of 30 million), and incidence has increased by between 120,000 to 150,000 each year since 2004 (NADC, 2009; World Bank, 2008). Nearly 80% of those infected with HIV are between the ages of 15-45 years (NADC, 2009). Of particular concern is the adolescent population, whose knowledge and understanding of sexuality has the potential to determine sexual practices over the course of their lifetime (Machal, 2001). Uganda has a predominantly young population, with the age group of 10-19 making up 24% of the population (Uganda Ministry of Health, 2000). Other sexual and reproductive issues may exist, with the World Bank (2003) reporting that 21-29% of females drop out of school due to pregnancy, and in some cases are expelled from school if they become pregnant (Kiapi-iwa & Hart, 2004).

With the risks of HIV infection and unwanted pregnancy, adolescents in Uganda face a formidable double threat. Knowledge of condoms, STI's, and HIV/AIDS have all been measured in past surveys (African Youth Alliance, 2002), however, this knowledge does not seem to be utilized in practise, as the same surveys measure adolescents as making up over 50% of new HIV infections in 2001. There appears to be significant potential for the introduction of a peer education program in the country to reduce the burden of STIs (including HIV) and teen pregnancy.

3.2 Peer Education and Social Network Analysis

Health intervention programs in adolescents can take many forms, depending on the composition and culture of the community, the proposed venue(s), the resources available, and many other variables. Peer education is a specific type of approach that has resulted in a good deal of success in youth populations (Cartagena et al, 2006; Agha & Van Rossem, 2004; Visser, 2007). Peer education uses individuals directly from the target population and trains them to be informal or formal educators of their peers. Peer education draws on aspects of many health behaviour theories as it basically assumes that influential individuals chosen from a particular community can lead to change within that community, and that this change occurs through a variety of processes, most importantly interpersonal communication (Bond, 2003). Many have specifically described several reasons why peer education is an appropriate choice when designing a new health intervention for adolescents. Firstly, the peer educator has a certain level of credibility in the target population because he/she is embedded within of the target population (Caron et al, 2004). Secondly, the peer educator helps make the program culturally appropriate, because the individual has an intimate understanding of the norms and values within that community (Visser, 2007; Shuguang & Vande Ven, 2003). Thirdly, the peer educator is able to exert influence in a number of venues, particularly during informal interactions. Lastly, the peer educator can serve as an accessible role model for the behaviours they are helping to try to change (Campbell, 2005). However, though peer education has a theoretical basis, there is continued study into its mechanisms of action in order comprehensively understand how it works and what factors are important to success and sustainability.

Peer education theory relies heavily on peer educators themselves, and it thus can be assumed that peer educators ought to be selected very carefully. The commonly recommended selection criteria for peer educators appears not to be borne of rigorous research; rather, the selection criteria are intuitive and may be arbitrarily decided upon by the program-implementing institution. Many prominent peer education guides list recommendations for peer educator selection, and they frequently include the following characteristics: non-judgmental, good communicator, motivated, and well-liked by peers (AIDSCAP). A question arising from this approach is: "Who is responsible for selecting the peer educators?" As many of these programs are administered in schools, one practise is for teachers to choose the peer educators (Cartagena et al, 2006). Another common approach is to solicit volunteers (Valente & Pumpuang, 2007). Both of these practices may be troublesome; the teachers may be far removed from the population and perceptions of what makes a youth influential, and volunteers may be too different than the target population. Current examples of teacher chosen selection process occur in Mongolia and Uganda; the teachers select students based on high academic achievement, stating that students will not respect the teachings of someone who does not get good grades (Cartagena et al, 2006; Jones, *personal communication,* March 2009). Many programs also recommend directly involving the target community in the selection of peer educators, such as through nominations (Buller et al, 1999). This approach appeals to the notion that the most popular individuals within a group are the most influential. However, this may not be the case, as social network theory suggests that these individuals may also be highly constrained because they experience pressure to maintain their social status (Ennett et al, 2006). This would imply that "popular" individuals may

have a vested interest in maintaining existing norms and behaviours rather than initiating change. In addition, social network analysis often demonstrates the existence of several subgroups within a community, some of which may not be accessed if only the most popular or the smartest peers were chosen to be peer educators. Along with long-term evaluation of peer education programs, it seems as though rigorous examination of the peer educators themselves in terms of characteristics and selection would be fruitful to maximize the effectiveness of a peer education program.

Social Network Analysis (SNA) is a technique that will create a map of a community based on relationships. SNA assigns a value to these relationships (for example, the presence of a relationship can equal a one, and the absence of a relationship will equal a zero) for entry into a matrix. Matrix algebra and other complex mathematical operations can then be computed to give a plethora of different measures of the community, both in terms of the individuals, the subgroups, or everyone involved (the total network). SNA is an approach that marries certain aspects of mathematics and social science theories. SNA seeks to describe the underlying structure of communities and investigate the relationships that exist between the members of that community (Hanneman & Riddle, 2005). SNA is thus a relational approach and holds that the ties, or relationships, between individuals have important consequences in terms of communication, influence, behaviour, and roles. The analysis of social networks in terms of structure and characteristics is being used with increasing frequency in social science and health research because it acknowledges the importance of social relationships to health behaviour (Luke & Harris, 2007; Valente, Gallaher, & Mouttapa, 2004; Cohen & Lemay, 2007). In the context of adolescent health interventions, network analysis can

describe personal networks and interpersonal communication, and may identify group leaders can be largely responsible for diffusion of information (Bond, 2003). This type of information can allow program planners and researchers to utilize the natural flow of communication within groups to more effectively plan and implement health promotion and social change interventions. Specifically, an understanding of the relationships and structures within a community can help identify influential members that may help diffuse a message within the group (Valente & Fosados, 2006; Valente et al, 2007). Additionally, SNA can uncover the weak and vulnerable areas of a network that may cause fragmentation if they were disrupted (Borgatti, 2003). For example, a school community may have two subgroups of adolescent females, and the groups have little in common so they do not communicate. However, using SNA, one can identify the presence of a single female that communicates with members of each subgroup. This single female is considered to constitute a vulnerable area of the network, because if she left the school, the community would be considered 'fragmented' because the only connection between the subgroups was lost. Attention paid to these areas can strengthen the reach of a health intervention program, as the individuals within these weak areas are themselves very powerful knowledge brokers (Granovetter, 1973). As per our previous example, the single female that bridged the subgroups may have control over the flow of communication between the groups, since she is the only one who communicates with both. Broader SNA literature indicates that there may be several subgroups within a youth population. In many cases these sub-groups are connected through different individuals. Therefore it could be postulated that information planted in key individuals will reach the majority of youth in the larger group. However, this evidence also indicates

that there are sub-groups that may not be connected to others. In this case, sub-groups of students may be missed entirely in the chain of communication and influence unless specific members of that sub-group have been included in the peer education program.

We hypothesize that SNA will help us identify students within the schools that would best serve as peer educators. Peer influence is an important factor in youth health behaviour decision making (Sieving, Eisenberg, Pettingell, & Skay, 2006; Graham, Marks, & Hansen, 1991), and we will use SNA measures that are associated with peer influence. Being well situated within natural flows of communication is also very important when considering health program information dissemination (Valente & Davis, 1999), and SNA will help us identify those individuals who are in positions that will allow this to happen most effectively and efficiently. In addition, we will also try to identify the sub-groups within the schools, and use basic measures of network analysis to describe the networks. This type of work has been attempted in other research studies of health intervention planning and implementation with varying degrees of success (Kelly et al, 1991; Latkin, 1998; Buller et al, 1999; Valente & Davis, 1999; Kelly et al, 2009). However, most only looked for a single mode of influence, and our study will look at multiple modes of influence in different types of networks. The specific measures that we used are discussed further in detail below.

3.3 Research Objective

This study aimed to examine social networks amongst a sample of secondary school students in a medium sized town in western Uganda. The primary intent was to

inform the planning of a school based peer education program about sexual and reproductive health. The specific research questions asked were:

1. Who are the leaders that influence the transmission or adoption of innovations or norms? Identification of these individuals as peer educators has the potential of creating a more efficient peer education program.
2. Can the study of network and community structure inform other aspects of a peer education or health promotion program for youth?

3.4 Study Design

In April-June, 2008, a cross-sectional questionnaire was administered in two schools in the Kabarole district in western Uganda, which is about 300 kilometers from the capital city of Kampala. The schools were evaluated by basic social network analysis techniques to help inform a potential model for peer educator selection. The survey was created based on tools developed by Bond (2003) at the Program for Appropriate Technology in Health (Seattle, WA), which have been validated in several countries (such as Ghana and Thailand). The survey was modified for use in this population through consultation with our partners in Uganda, and content experts at Makerere University in Kampala. Pre-testing with local youth was performed to ensure understanding and further cultural appropriateness. The survey was conducted in English, as it is the official language of the country, though many local languages exist. All of the names supplied on the survey were assigned a numerical code and were entered into a matrix and analyzed using the UCInet 6 software program (a suite which also includes NetDraw, the network visualization program).

These schools were chosen because of their willingness to participate and their strong stated interest in a future peer education program for the prevention of STIs, including HIV. The schools are quite different: one is an urban day-school (Mpanga), while the other is a rural boarding school (Nyakasura). These basic differences allow for different day-to-day experiences for the students, as the students at Nyakasura interact with each other outside of class time, and at Mpanga, student interaction is unpredictable because they return to individual homes after class.

For SNA, boundary specification is important (Lauman, Marsden, & Prensky, 1980), and in both schools the intent was to study the entire Secondary 2 level (S2), as this is the most logical starting grade for a future peer education program. Students in S2 are usually between the ages of 15-17. It was felt that focusing on this age range would allow for future selection and training of peer educators, with the assumption those selected would remain with the program until they graduated, most likely 2-3 years later. 109 students were surveyed at Nyakasura school, and 284 were surveyed at Mpanga school. Unfortunately, due to incomplete record-keeping, it was difficult to determine the extent that these numbers represent the entire S2 level in each school, although best estimates agree on about two-thirds. It is important to note that the data collection took place at the level of the grade; however, some data analysis occurred at the level of the class, which each grade is partitioned into. The reasons for this are discussed in detail in the findings and discussion.

To collect data for SNA, each of the students were asked two questions: "In your grade, whom do you like as a friend?", and "In your grade, whom have you talked to about sexual health matters in the past three months?", and were permitted to nominate

up to seven individuals. The two networks identified by the two questions will herein be referred to as the Friendship network and the Sexual Health network, respectively.

3.5 Social Network Analysis Terms

Prior to a discussion about the specific network measures used, it is useful to define some of the terms used to describe the network. A network is made of individuals and their relationships, and we visually represent a network using a **sociogram**. A **node,** or **actor**, is an individual within a network, and is commonly represented by a symbol such as a circle or a square. The relationship symbol extending from them is typically drawn as a straight line and is called a **tie.** When there is a straight line placed between two nodes, this indicates that there is a relationship. The absence of a line indicates that there is no relationship. A single relationship is represented by a **dyad**, or a tie between two actors**.** The **geodesic** distance is the shortest path between actors. For instance, in a network where Student A nominates Student B, and Student B nominates Student C, the geodesic distance between Student A and Student B is one, and the geodesic distance between Student A and Student C is two. We could also define this by using **path**, with the path length between Student A and Student B is one, and the path length between Student A and C is two; however, 'path' is a more generic term and does not indicate that the length stated is the shortest or most direct possible. Data for SNA is typically collected using surveys, and consist of asking individuals questions about their relationship with a roster list of others within the same defined community, though there are many possible variations depending on the nature of the research and the type of information desired. For further information about SNA theory and definitions, readers

are advised to consult the online textbook or Hanneman and Riddle (2005) or the 1994 textbook of Wasserman and Faust.

There is a plethora of possible measures of a community network, but in order to create a parsimonious model here, the fewest measures that will allow for meaningful selection of peer educators will be calculated. These measures will occur at an individual, subgroup, and total network level. At the individual level, we decided to use two measures of centrality to identify peer educators: degree centrality and betweenness centrality. At the total network level, descriptive measures can provide information to program administrators that may be helpful in the overall understanding of the natural communication flow through the community. We will describe the total network in terms of density and reachability. We will then attempt to define subgroups using clique and Girvan-Newman analysis. Further details on all of these measures follow in the next section.

3.5.1 Individual Level Measures

3.5.1.1 Degree Centrality

Actors, or nodes, within a network are said to have a high degree centrality if they have many other connections with other actors. In a sense, degree centrality is equivalent to the notion of popularity, and the degree number is equal to the sum of all the ties they have with others. Individuals with a high degree centrality have a large number of nominations by others in the grade, and are generally considered to be more influential, particularly in an adolescent population. However, as stated previously, caution needs to be employed if these individuals were selected to be peer educators as there is evidence

which suggest that these individuals are more constrained behaviourally (Ennett et al, 2006), since they respond to the wishes of their community in order to maintain their status. Given this desire, they may be less inclined to initiate change, such as behaviour change. In addition, simply selecting people with the highest number of connections may not be helpful because they may overlap, or know the same people. For these reasons, additional measures of power and influence should be used. Degree centrality will identify some of the most influential members of a peer group, but this should not be the sole indicator relied on when choosing potential peer educators. Careful attention should be paid to the resulting sociogram, as actors with high degree centrality may be clustered and isolated from smaller subgroups.

3.5.1.2 Betweenness Centrality

Social status is often measured by a single indicator: betweenness centrality. Betweenness centrality measures the extent to which an adolescent indirectly links pairs or groups of adolescents who are not directly linked; thus, it is not the individual which is most important, but rather the relationship. Betweenness centrality is calculated by determining the shortest geodesic path between each pair of adolescents in the network and then determining the number of geodesics that include the actor of interest. An adolescent with a high betweenness centrality theoretically has a high social status as a result of being able to control flows of information or norms by either acting as a gatekeeper or as one who connects adolescents from different parts of a network. These individuals are important to approach by health intervention administrators as they can play a key role in a peer education program by virtue of their reach across the network.

These individuals are unfortunately harder to identify without SNA software, but it would be a worthwhile effort given their potential to broker an important message.

3.5.2 Subgroup Level Measures

3.5.2.1 Cliques and Cohesive Subgroups

A clique is a subset of a graph where all of the members have a direct relationship tie with each of the other members of the clique. For example, in a clique of Student A, B, C, and D, Student A would have a relationship with Student B, C, and D; Student B would have a relationship tie with Student A, C, and D, and so forth. Hence, a clique is a maximally connected subgroup. There are often several cohesive subgroups within a community, and they may each have a unique subculture that is defined by social norms and behaviours. For the purpose of a peer-directed health intervention program, it is important to identify these cliques and ensure that a peer educator is able to access them, because as a group, they may be more resistant to change. The formal notion of clique is quite restrictive and demanding (Hanneman & Riddle, 2005), and often it is necessary to loosen the notion of a subgroup. There are a few ways of accomplishing this, such as identifying n-cliques (allowing the "friend of a friend" on board), or k-cores (actors must be connected to "k" members of a group), or analyzing clique membership overlap.

Subgroups can also be thought of as a community-like structure, or a cluster of nodes that seem to have something in common because of the way they are grouped and tied. The Girvan-Newman algorithm is available on the NetDraw program, and is effective in finding community-like cohesive structures. Use of this algorithm will provide additional information about the existence of subgroups within the networks.

3.5.3. Network Level Measures

3.5.3.1 Density

Density is one of the most basic measures of cohesiveness in a network. The density of a network is defined as the observed number of ties divided by the total number of possible ties. Hence, the result is between 0 and 1, with a network density of 1 meaning that each node was tied to every other node. Density can also be defined for sub-groups (as formally defined) or sub-populations (based on attribute characteristics, such as gender). Knowledge of the density of a group can be useful in understanding how quickly messages may move through a community, or how engrained present social norms are. In addition, if peer leaders were chosen on the basis of prominent subgroup status (for example, high degree centrality), they are theoretically more influential in a densely connected group rather than a sparse, loosely connected group.

3.5.1.2 Reachability

Reachability refers to a property of connection in a total network. The resulting matrix will show the number 1 in the column of those who can be reached from any starting point in a network, no matter how convoluted the path. Those who are considered unreachable are typically isolates or in isolated subgroups, and will have zeros present in their matrix column. An actor is considered reachable if they are connected to another actor, or source of information, in some way.

3.6 Findings

3.6.1 Individual Level Measures - Centrality

3.6.1.1 Degree Centrality

This analysis identified individuals within each school who were rated as "popular" by their classmates. We found that there was a difference in the two networks (Friendship and Sexual Health) both in terms of who was popular and how many were popular. The lack of coincidence in the Friendship and Sexual Health networks indicates that students are more selective about who they turn to for sexual health information, and they do not necessarily go to the most popular students in the Friendship network for advice about sexual and reproductive health. In each of the schools, there were more "popular" students in the Friendship network, and they had higher popularity scores, which also adds evidence that a higher degree of selective advice solicitation is occurring.

Nyakasura School

Degree centrality is a measure of popularity, and is therefore generally considered to be a measure of influence. The result obtained is the number of times that a given actor was nominated by the other network members. nDegree is a normalized measure which takes into account the overall network centralization and allows us to compare networks. Within the school, for the question of "Whom do you like as a friend?" there were 23 individuals with a degree centrality of higher than 10. Conversely, when the question "Who have you talked to about sexual health matters?" there were only 14 individuals with a degree centrality higher than 10. The major results are viewed in Table 3.1 (Page 74).

Actor 17 retains the highest degree centrality in both of the network types. Additionally, Actor 39, 3, 15, 35, 41, and 8 have high degree centrality in both of the

networks. In terms of gender, four boys and three girls have high degree centrality in both of the networks.

Mpanga School

Prior to examining the degree centrality of Mpanga school students, it is fruitful to pursue evidence that suggests that the Mpanga school should not be looked at as a whole network, but as several networks with the class as the partitioning characteristic. Personal interview with the Mpanga Headmaster (2008) revealed that the level of interaction between the classes during the official school day is quite low and there are a very limited number of entire grade assemblies. The most important reason for this is space; Mpanga school does not have a facility that will house all of the students from a single grade at once. Additionally, unlike Nyakasura school, Mpanga school is a day school that does not have boarding facilities, and therefore the outside-of-school interaction is variable and unpredictable. For these reasons, a health intervention program based on peer education will likely be administered on an individual class basis. An appropriate place to start is viewing the sociogram of Mpanga school. These are Figure 3.1 and Figure 3.2 (Pages 83 & 84). Both of these sociograms utilize the 'Gower' layout, which groups nodes that have similar connections close to one another. From these illustrations, it seems evident that there is a natural grouping in the network on the basis of class. Another way to look at this is by using the 'Circle' layout, which places the nodes on the outside of a circle and the ties on the inside. The Friendship network is illustrated in circle layout in Figure 3.3 (Page 84), and the nodes are coloured and

grouped by class. Clearly, most of the node ties are directed towards other class members, though outside of class ties do occur.

Degree centralization is thus determined by class for the Mpanga data. The major results are shown in Table 3.2 (Page 75). In each class, the degree centrality is divided into whether the actor was mentioned in the "Whom do you like as a friend?" or "Who have you talked to about sexual health matters?" In each class, there is some overlap between the highest degree centralities in each group. However, in only 2 of the classes does the same actor have the highest degree centrality for each type of question (Class X and Class Z), and in several instances, the individuals who share the highest degree centrality in the Sexual Health network are not among the highest degree centrality individuals in the Friendship network.

3.6.1.2 Betweenness Centrality

This analysis identified the individuals who are situated strategically in information flow pathways. We found that in both of the schools, those with the highest scores tend to be found in the Sexual Health networks, indicating that the natural flows of communication about sensitive matters are more sharply defined and in the control of a small group.

Much like degree centrality is considered a measure of popularity, betweenness centrality is thought to be a measure of social status. As stated previously, individuals with a high betweenness centrality tend to form bridges between disconnected groups and/or individuals, and may serve as brokers or gatekeepers of information, which gives them a type of power. In common language, those with high betweenness centrality are the ones you have to "go through" to get access to information from different individuals

or groups. When examining information flows through a community, those with high betweenness centrality can help widen the spread of a message, whereas those with high degree centrality can help model a message. Occasionally, those with high degree centrality also have high betweenness centrality, but this is often not the case.

Nyakasura

The betweenness centrality measure for Nyakasura school yielded the opposite effect as the degree centrality measures. In this case, there were more people with higher betweenness centrality as nominated after the question "Who have you talked to about sexual health matters?" than "Whom do you like as a friend?" In addition, the net betweenness centrality values were higher in the Sexual Health network than the Friendship network, which may indicate that those who students seek for sensitive issue advice have the potential to be significant in their position as a gatekeeper. The major results are located in Table 3.3 (Page 76). Again, it is evident that there is some overlap between the two networks, but it is limited.

Mpanga School

The betweenness centrality scores are separated by class, and the six individuals with the highest normalized betweenness centralities are shown in Table 3.4 (Page 77). Similar to the degree centrality measures, it is clear that there is some overlap within the classes based on the two types of networks. In addition, the net betweenness values tend to be higher in the Sexual Health network. This was also observed in the data from Nyakasura school.

3.6.1.3 Comparison of Centrality Measures

Nyakasura School

Degree centrality and betweenness centrality are measures of different types of influence in a population, and the individuals with the highest of one type of centrality may not necessarily be highest in other type of centrality. Table 3.5 (Page 78)demonstrates the overlap of highest centrality measures for the two types of networks at Nyakasura School.

While there are certain actors who are higher in both types of centrality measures, there are several which are high in one measure and low in the other. This information can also be illustrated with sociograms. For example, in Figure 3.4 (Page 85), the actor symbols are manipulated to show the relative size of degree centrality in the Friendship network. In Figure 3.5 (Page 85), the same network is shown with the symbol size indicating the value of betweenness centrality. The sociograms for the Sexual Health network demonstrate similar results.

For each of the network types, it is evident that higher degree centrality is shared among several individuals. As a result, when viewed on a sociogram that weights the nodes by that particular attribute, the nodes are a similar size and it is difficult to distinguish the most influential individuals. For betweenness centrality, the differences are more obvious; individuals with the highest betweenness centrality scores are separated by a greater margin than those with the highest degree centrality scores. It now becomes visually clear on the graph that actors with high betweenness centrality have a high potential reach and link up actors who are not otherwise closely connected.

Mpanga School

The Mpanga School students demonstrate a similar story; actors who are high in one type of centrality are not necessarily high in other. For example illustration, Figure 3.6 and Figure 3.7 (Page 86) show the degree centrality and betweenness centrality maps, respectively, for Mpanga School Class X Friendship network. An important thing to notice about the sociograms is that they are a potent, easy to understand visual tool to highlight who controls different types of influence within a given community.

3.6.1.4 Combined Network Centrality Measures

This analysis resulted in the identification of individuals who are prominent in each of the networks, simultaneously. We found that the highest centrality scores calculated in separate networks were retained in the results of this particular analysis. However, those who were moderately high in the two separate networks show a greater prominence now, as their results were amplified. This helped to highlight those who have status and influence across different two different social situations.

UCInet allows the summation of networks to create a combined dataset of Friendship and Sexual Health nominations. We performed this operation and calculated the degree and betweenness centrality for each school. The results are given in Tables 3.6 (Page 79) and 3.7 (Page 80), for Nyakasura and Mpanga, respectively. As with the individual network centrality analyses, some overlap between the highest centrality scores exist, but it is limited. Individuals with high centrality scores in either of the individual networks are maintained as important actors in the combined networks, and

those who were important actors in both the Friendship and Sexual Health networks have their score amplified. An example is Actor 90 in Mpanga Class X, who obtained the fifth highest betweenness centrality score of in the Friendship network, but was not in the highest six identified in the Sexual Health network (90 was seventh highest). When measures were taken from the combined network, Actor 90's result as the individual with the highest betweenness centrality indicates their relatively strong status in both networks.

3.6.2 Network Level Measures

In this section, we briefly describe two total network measures for each of the schools: density and reachability. This will give general information about the nature of the social networks within the schools. We found that there was a large difference in density between Nyakasura and Mpanga school; however, when we looked at Mpanga's density by class, the results are similar to Nyakasura total networks. In each of the schools, the Friendship network was more dense than the Sexual Health network, confirming that students are more selective about who they approach for sensitive issue advice or information. With the reachability measure, we found that all of the Nyakasura students and the great majority of the Mpanga students are connected to the network, which indicates a high level of connectedness in each of the communities.

3.6.2.1 Density

The overall density values for Nyakasura school are much higher than in Mpanga School; 0.0702 and 0.0520 for the Friendship network and Sexual Health network,

respectively, versus 0.0165 and 0.0140 at Mpanga school. This difference is undoubtedly due to the class segregation occurring at Mpanga, which makes the total network appear sparse and disconnected with six different major subgroups. Indeed, the densities rise to a range of 0.0731 to 0.1119 for the Friendship network and 0.0573 to 0.0923 for the Sexual Health network when the density is examined in each individual Mpanga class.

3.6.2.2 Reachability

For the Nyakasura Friendship network, this measure indicates that all of the studied nodes are reachable, that is, each node has a path of any length that connects them with every other node. Similarly, the Sexual Health network also contains fully reachable nodes.

For Mpanga overall Sexual Health network, there are 4 actors that are not reachable: 538, 646, 834, and 527. For the Friendship network, there is only one actor that is unreachable: actor 277. These individuals would be displayed as isolates (nodes without any connections) on a sociogram. When reachability analysis is performed on a per class basis, the number of 'unreachable' individuals increases, suggesting that there are some issues with our arbitrary division of Mpanga data on class lines.

3.6.3 Subgroup Level Measures

In this section, we attempted several analytic measures to identify clique and clique-like structures. None of these techniques yielded workable results, but the use of the Girvan-Newman algorithm allowed us to discover community-like structures. The most

important observation is that there is evidence of gender segregation into communities, with females tending to be grouped with other females, and vice versa.

3.6.3.1 Clique Analysis

As defined above, a clique is a group that is maximally connected; that is, every node in the clique has a direct tie with every other actor in the clique. This is a strict definition that is often not easily operationalized in practice, most commonly because of very large numbers of small cliques identified and high amounts of node overlap. When we performed standard clique analysis, many small cliques were discovered. We attempted to uncover true subgroups looking at the hierarchical clustering of clique overlap, but the groups were not often well defined[1]. We also used other cohesive group identification techniques, such as n-clique analysis (where each individual is connected to other group members with a tie of 'n' path-length or less), n-clan analysis (where each individual is no further than 'n' steps from other group members when the connections are through other group members), and k-plex analysis (where each group member must have 'n-k' ties to other members). Each of these types of analysis yielded unmanageable results. For example, with Mpanga class X, n-clique analysis gave 800 2-cliques when the minimum group membership was set to five, and increasing the minimum group membership to ten resulted in 404 2-cliques. In the same class, the n-clan approach yielded a slightly more manageable number of n-clans (70), but there were 26 levels of overlap (that is, some individuals were members in 26 different n-clans). The k-plex technique also gave unmanageable results. As a result, we had to focus on a different

approach to defining groups within the different networks. We chose Girvan-Newman analysis.

3.6.3.2 Girvan-Newman Analysis

The NetDraw program can use the Girvan-Newman algorithm to determine communities within a network. In short, the algorithm calculates the number of geodesic paths between nodes and determines the highest betweenness scores, which are then individually removed and recalculations are performed until a high Q-value is achieved. At this Q-value, the nodes are grouped as having more dense connections with others in their subgroup community than all other network members. The Q-value is between 0.0 and 1.0, with a Q-value of 0.0 indicating that the probability of nodes belonging to different communities is no greater than chance. When clear sub-groups exist, the Q-value is usually between 0.2 to 0.7 (Fortunato, Latora, & Marchiori, 2004).

Because the clique analysis resulted in overlap between groups, and the relaxed measures of clique analysis did not give workable results, Girvan-Newman analysis was used to define subgroups within the networks. The Q-results are in Table 3.8 (Page 81). Note that the Q-result for the Nyakasura Friendship network is 0.000 and the seven subgroups identified are individual nodes, indicating that the Friendship network can be considered one large community. Likewise, the Q-value for the Mpanga Class P Friendship network is very low at 0.055. The Q-results for all other networks are greater than 0.18. Figure 3.8 (Page 87) shows a representative sociogram after Girvan-Newman analysis for Nyakasura Sexual Health network. The different colours respond with each

of the subgroups identified with this procedure. Because we have used shape to define our nodes by gender (circles are male, squares are female), we can see that the subgroups identified are more gender specific for the Sexual Health network than the Friendship network. Girvan Newman analysis showed us that there is an isolated community (consisting of three and two members, respectively) in each of Mpanga Class P and Class M for the Sexual Health network.

3.7 Discussion

We used Social Network Analysis to examine two different types of networks in two different types of schools in hopes that the results could inform health program peer educator selection. Generally, peer educators are chosen either by their external characteristics, such as friendliness and persuasiveness, or by nominations by interested parties. SNA allows for a selection approach that is based on individuals embedded within a network structure. Though this paper focuses on peer selection, we do not mean to suggest that a possible approach is to simply plant a seed of information into well-placed individuals, and hope that dissemination occurs naturally. Rather, this peer selection is merely one of the initial steps in a rigorously designed, comprehensive peer education health intervention for youth, which involves formal education processes and strong encouragement/development of informal communication.

The network level measures were intended to be descriptive and give insight into general aspects of cohesion in the networks. The important observation is that the Friendship network is more dense than the Sexual Health network in both of the schools, indicating that individuals may be more selective when approaching a peer about sensitive information; students do not talk to all of their friends about these matters,

confirming other work that shows that networks based on 'liking' someone are more dense than those based on 'advice' (Hawe & Ghali, 2008). A less dense network such as this may suggest that there is limited free and comfortable speech around sexual and reproductive health matters because it occurs with fewer individuals. Health intervention staff could monitor the density of this network and use a longitudinal increase in density as a measure of success in creating channels of communication within the community, as recent research suggests that the increase in interpersonal communication around sensitive topics can help prevent risky behaviour (Pick, Givandan, Sirkin, & Ortega, 2007; Real & Rimal, 2007). The reachability data confirms that it is theoretically possible to reach all or the great majority of students with a health intervention. If this was not the case, health program planners might need to develop a strategy to specifically reach the isolated groups or isolated students.

The two questions asked about relationships yielded two different networks (one related to general friendship and the other to more intimate advice), with different individuals occupying roles of influence in each, though there was some overlap. Therefore, if program planners are hoping to use individuals selected by nomination, they must be careful of the exact question(s) that they ask. At Nyakasura School and Mpanga school, the individuals with the highest degree centrality and betweenness centrality were different based on the type of question asked. Individuals that are considered friends may not necessarily be the individual that one approaches about his/her questions about sexual health matters, though the reasons behind this are unknown and are an area of further research. Asking for nominations of individuals approached regularly for sexual health information identifies the actors who are trusted in this regard, and this awareness can

prompt program planners to select these actors to provide them with correct information, especially if myths and rumors were spread, which can occur in youth populations around these types of issues (Bastien et al, 2008; McManus & Dhar, 2008). However, the influence of these actors is not known, as many studies of peer influence speak only of the influence within friendships (Sieving, Eisenberg, Pettingell, & Skay, 2006; Bot, Engels, Knibbe, & Meenus, 2005, are recent examples of this type of work). Therefore, it may be naïve to base peer selection only on an advice network, and a friendship network should be consulted to help identify social norm leaders.

Those with high centrality scores at Mpanga and Nyakasura schools have been identified in their respective networks. How then, shall the process of selecting peer educators occur? We have discussed the importance of influence and communication control, in the network terms of degree and betweenness centrality, but what are the best measures to consider, and from which network? As demonstrated, the two networks each give a different picture, with different individuals identified with types of importance, though some overlap occurs. Degree centrality in the Friendship network identifies popular students, who are assumed to have a high amount of influence in their circle of contacts, and likely beyond into non-direct acquaintances. Degree centrality in the Sexual Health network identifies students who are presently trusted sources of information and/or advice about sensitive issues. Ideally, a health promotion program would want to capitalize on both of these naturally occurring situations. In the same way, both measures of betweenness centrality could be exploited to give guidance to the peer educator selection process. Betweenness centrality is an important measure to consider when trying to maximize the coverage of information spread, as these individuals serve

as a connection between groups and can ensure that messages are moved within the greater community. Clearly, information from each of the networks is needed to make decisions about educator selection. Selecting peer educators strictly based on degree centrality can lead to the problem of poor coverage. Occasionally, those with high degree centrality are common members in a large subgroup, and their influence may not extend past the subgroup. Selecting only those with high betweenness centrality scores may not allow health programmers to capitalize on a peer influence and modeling effect.

When both of the networks (Friendship and Sexual Health) were combined, in their respective schools, new centrality measures were calculated. We believe that these new measures will adequately identify those who are overall most important in terms of influence and communication control. Based on this information, we can hypothetically create peer educator groups for each school. We want to access the individuals who have high degree centrality to address social norm influence, and utilize the individuals who are already well situated to spread a message about sexual and reproductive health. Therefore, we propose selecting those with the highest degree centrality and the highest betweenness centrality, from the combined networks, in equal proportion (i.e. if ten peer educators were required, five with high degree centrality and five with high betweenness centrality would be selected). As there is overlap, preference must be specified. Because full coverage is desired, we will place emphasis on high betweenness centrality to maximize information spread. Therefore, half of the required peer educators will be selected from degree centrality scores *first*, and the remaining selected from betweenness centrality scores selected *second*. We will thus 'go farther down the list' in betweenness centrality. Once these individuals are identified, they should be drawn into the network

map and visually inspected for possible redundancy. Valente and Fosados (2006) have suggested that 10% of network members should be opinion leaders, and for illustration purposes, we will follow these guidelines, though in practise, consideration would be given to available resources. The choices for peer educators are displayed in Table 3.9 (Page 81). Our data was coded to allow this visualization in a complete sociogram that illustrates both the Friendship and Sexual Health data in one image. Nyakasura school is demonstrated in Figure 3.9 (Page 88), and a representative sociogram from Mpanga (Class Z)[2] is Figure 3.10 (Page 89). One can observe the sociogram to confirm that the chosen individuals appear capable of achieving high network coverage. In addition, when comparing the proposed peer educators against the centrality data for the individual network analysis, we found that many of those with the highest scores in each category were selected. In most cases, at least three of the highest four actors were chosen. The exceptions were Mpanga Class Z Sexual Health (two of the four highest betweenness centrality) and Mpanga Class M Sexual Health (two of the four highest betweenness centrality). Another technique that can be used include to confirm that the proposed educators are potentially effective is calculating the 'reach steps' (such as the two-step reach as described by Hawe and Ghali, 2008) between all of the nodes and the peer educators, to examine the distance that one must overcome to access a peer educator, or vice versa. This particular analysis was not done in this study.

Subgroup analysis was performed because of evidence that suggests that cohesive subgroups often contain their own group norms and cultures (Scott, 2000; Hutchinson & Rapee, 2007), but with these populations the analysis proved troublesome, as the clique and clique-like measures gave results that were difficult to work with. This may be

because the networks are overall quite cohesive, as demonstrated by the well connected sociograms, and the reachability and density measures. We suggest further study into this phenomenon in resource-poor settings, as subgroup analysis may not always be necessary due to inherent characteristics of the economic, social, and cultural environment. However, when researchers have to limit the number of responses, which often is the case, it becomes more difficult to identify true cliques (Knoke & Yang, 2007). Theoretically, subgroup identification is important; it can allow researchers and programs planners to see if there are isolated groups present and how to best reach them. Our use of the Girvan Newman algorithm allowed us to view cohesive groups in a different way, by seeing if they are similar enough in their connections to be considered a sub-community. To confirm that the proposed peer educators would be appropriate choices, we evaluated their position within the sub-groups identified by Girvan-Newman analysis. From the results in Table 3.10 (Page 82), it is evident that the great majority of the subgroups have either a potential peer educator as a direct member, or as an immediate peripheral (one step away). The only two instances where this is not the case involves a completely isolated subgroup of two-actors in Mpanga Class M (Sexual Health network) and a three-actor isolated subgroup in Mpanga Class P (Sexual Health network). However, this may be an artefact of class division or poor record keeping.

Another aspect that our Girvan-Newman analysis allowed us to confirm is that close friendships, which might be characterized by willingness to talk about sexual and reproductive matters, are largely gender specific; that is, females speak with females, and males with males (Kirke, 2009; Gifford-Smith, Dodge, Dishion, & McCord, 2005). We can apply this to the peer selection by ensuring that there is a proportionally

representative gender balance in the educators selected. Table 3.9 (Page 81) also gives the gender of the proposed peer educators, and there is initially some cause for concern, as in two instances the gender profile of the proposed educators is different than the gender distribution of the school or class (specifically, Mpanga Class X and Mpanga Class N). When examined further, it is evident that there are individuals of the lacking gender with slightly decreased centrality scores than the proposed Peer Educators. They may be virtually equivalent to some that are selected. Therefore, the possibility exists for the program planners to have to use a small amount of discretion to ensure that there is appropriate gender distribution.

3.8 Limitations

The most significant limitation of the social network analysis study was artificial boundary creation in Mpanga school. After the data collection and data entry, we discovered that there was strong evidence that network maps should be created in each class, rather than an entire grade. However, in practise this needs to be done before the survey is administered. In our case, we proceeded with re-defining our boundaries post-data collection in order to create a model of peer selection. In-depth consultation with Mpanga school staff with regards to precise student interaction revealed that there was limited interaction between S2 classes during the day, and there is no facility on the premises that can house all of the S2 students at once. Initially, the Mpanga headmaster thought that perhaps a peer education program utilizing peer leaders could be a grade-wide venture, but our data suggests that natural opinion and communication leaders could be best identified on a classroom basis. In contrast, Nyakasura is a boarding school and

the students have constant interaction opportunities outside of class time, as well as having large assembly accommodations. The network map did not demonstrate clear class boundaries (Nyakasura has three classes: X, Y, & Z), so a peer education program could be administered as a grade-wide endeavour.

Boundary specification issues also highlights the problems encountered with record-keeping in the two schools. Both of the schools suffered from inaccurate and out-dated class rosters, with missing students and students assigned to multiple classes. We thus had to rely on previous-semester information and had to spend much time tracking down students who were not listed on the roster. In some cases, the students names were completely foreign to the teachers, and in other cases, the students were in other grades. In addition, some students used nicknames or only first names when nominating their network members, which required additional legwork to sort out. In the end, very few complete surveys had to be discarded, and some of them could only have a portion of their surveys used in the analysis.

Boundary specification almost always requires a trade-off, as one must decide where a network must end (Lauman, Marsden, & Prensky, 1983). In both of these schools, grades and classrooms are not completely segregated and the network of relationship will extend beyond the artificial borders. However, for this project, the proposed peer education program will be administered by grade, so it made sense to create the boundary where it was. Additionally, limiting the number of responses by each student will not allow for the most true representation of the network, but it needs to be done for logistical reasons. The arguments for analysing Mpanga school on a class basis, rather than an entire grade, have already been presented; however, because we artificially

created the class boundary after asking about friendships within the grade by survey, we do have some isolates and pendants that may not be present if we changed our boundaries. This is confirmed by the reachability data, with the presence of 'unreachable' individuals appearing in the class networks even though they were considered reachable in the entire network. Therefore, if SNA was used as a peer selection tool in practise in this population, data would have to be gathered with a new boundary specification, as previously stated.

School attendance also proved to be an issue. The presence of large numbers of out-of-school youth is a serious and persistent problem in Uganda (Neema, Ahmaed, Kibombo, & Bankole, 2006). Specific to our study, this created an incomplete network with increased numbers of pendants (students with only one tie). We have the information about who nominated the missing students, but do not have the corresponding information about who they (the missing students) would have nominated. This casts a shadow on the density and centrality measures, though it is unreasonable to expect that all students will always be present for survey. However, stability testing in a well-defined network has been measured, and suggests that even when sampling levels are low (50%), degree centrality is reliable (Costenbader & Valente, 2003), but betweenness centrality is less stable. Brewer and Webster (1999) also found that degree centrality remains stable when there is missing data (in terms of forgetting of friends), as well as minimal effects on betweenness centrality. Borgatt, Carley, and Krackhardt (2006) found that most measures of centrality were quite consistent under various causes of imperfect data, as long as the causes were not extensive.

It remains to be seen what type of response the chosen actors will give when approached with the opportunity to become a peer educator. Since this type of analysis only looked at community structures, there is no information on characteristics, willingness, capability, etc. Therefore, a strategy of further selection should be developed if there is not adequate buy-in from those identified in this analysis. In addition, another limitation in this study is the concept that adolescent networks may not be stable over time due to developmental and social structural factors, such as classroom assignment change (Cillessen, 2007), and centrality measures and subgroup memberships may be constantly in flux. An assessment of the amount of change within the network may be helpful information, which is now possible with newer software, such as SIENA (Snijders, 2007). Different measures of centrality are being developed, particularly with the increased interest in creating a measure that is specific for information flow (Borgatti, 2005). Therefore, program planners wishing to use SNA in the advancement of their health interventions would be wise to keep abreast of developments in the field of centrality measures.

Generalizability is always a concern, and we cannot state with confidence that our study results are applicable to other youth situations. SNA has not been performed to any great extent in secondary schools in resource poor settings, and more should be learned about network characteristics that may define these types of populations. For instance, we had difficulty identifying cohesive subgroups through standard methods; perhaps this part of the investigation is not a productive use of time and resources due to inherent characteristics arising from cultural and economic differences. Continued study into the

social networks of youth within resource poor settings is warranted to see if common themes arise.

3.9 Overall Conclusion

In summary, we have proposed a relatively simple model for peer educator selection. First, survey data is obtained that asks students about both their friendship and their advice network. The networks that result from these two questions can be combined to create a network that takes into consideration both the naturally existing modes of peer influence (with regards to friendship and sexual health information) and naturally occurring paths of communication (again, with regards to friendship and sexual health information). When degree centrality and betweenness centrality are calculated on this combined network, the individuals who are most important remain highlighted, and can quickly be selected to create a team of peer educators that have both influence and reach. Using these two key centrality measures in combination appears to be the appropriate approach for an adolescent population; the use of only one measure may be limited or inadequate.

In conclusion, we were able to successfully identify two different networks within two different secondary schools in western Uganda. Both of these schools are interested in running a peer education program for sexual and reproductive health. Network analysis performed prior to program implementation demonstrated that valuable information can be gained about the social structure about the school, and this information can be used to guide the peer educator selection process.

Table 3.1: Degree Centrality in Nyakasura School

Nyakasura: Friendship			Nyakasura: Sexual Health		
Actor	**Degree**	**nDegree**	**Actor**	**Degree**	**nDegree**
17	17	16.038	17	16	15.094
39	15	14.151	35	12	11.321
3	15	14.151	68	11	10.377
98	13	12.264	39	11	10.377
4	13	12.264	105	11	10.377
15	13	12.264	15	10	9.434
67	13	12.264	3	10	9.434
35	13	12.264	60	10	9.434
48	13	12.264	59	10	9.434
25	12	11.321	116	10	9.434
120	11	10.377	50	10	9.434
23	11	10.377	8	10	9.434
47	11	10.377	5	10	9.434
41	11	10.377	41	10	9.434
14	11	10.377			
81	10	9.434			
20	10	9.434			
92	10	9.434			
38	10	9.434			
26	10	9.434			
31	10	9.434			
8	10	9.434			
127	10	9.434			

Table 3.2: Degree Centrality by Class at Mpanga School

Mpanga Class X: Friendship Network		**Mpanga Class X: Sexual Health Network**		**Mpanga Class M: Friendship Network**		**Mpanga Class M: Sexual Health Network**	
Actor	**nDegree**	**Actor**	**nDegree**	**Actor**	**nDegree**	**Actor**	**nDegree**
73	22.222	73, 78, 90	16.667	607, 621	15.152	614, 617, 653	17.021
82	19.444	18, 65	15.278	614, 617, 625,	13.636	630, 658	14.894
90, 46	16.667	6, 14, 82	13.889	654, 658		664	12.766
44, 79	15.278	72, 79, 22	12.5	630, 638, 643	12.121	605, 609, 647,	10.638
78, 421, 9,	13.889					625	
18, 21							
Mpanga Class Z: Friendship Network		**Mpanga Class Z: Sexual Health Network**		**Mpanga Class P: Friendship Network**		**Mpanga Class P: Sexual Health Network**	
260	18.75	260	19.481	722	21.429	740	22.642
339	15	335	14.286	740, 705, 771	19.643	722	20.755
426	13.75	320, 267	11.688	739, 750	17.857	738	16.981
329, 318, 320,	12.5	254, 272, 287,	10.39	755, 769, 770	16.071	707, 750, 770,	15.094
322, 267, 278,		301, 314, 318,				771	
288, 302		319, 324, 325,				739	13.208
		329, 336, 339				756, 757	11.321
Mpanga Class Y: Friendship Network		**Mpanga Class Y: Sexual Health Network**		**Mpanga Class N: Friendship Network**		**Mpanga Class N: Sexual Health Network**	
503, 530, 549	20.588	533	35.585	803, 808, 815	21.739	850	18.868
533	19.118	562	24.615	810, 813, 836	19.565	803, 806, 815,	16.981
505	17.647	561	20	801, 802, 840	17.391	855, 862, 864	
507, 531, 536,	16.176	530, 531, 501	16.923			808, 840, 848	15.094
562		520, 529, 539,	15.385				
554, 529, 516	14.706	542, 550					

Table 3.3: Betweenness Centrality at Nyakasura School

Nyakasura: Friendship		**Nyakasura: Sexual Health**	
Actor	**nBetweenness**	**Actor**	**nBetweenness**
17	7.299	116	10.658
39	5.995	17	10.302
3	5.969	3	9.124
25	5.517	35	8.278
14	4.662	59	7.437
48	4.339	8	6.981
67	4.353	39	6.742
38	4.087	41	6.391
		15	5.56
		20	5.349
		24	5.243
		45	5.164

Table 3.4: Betweenness Centrality by Class at Mpanga School

Mpanga Class X: Friendship Network		**Mpanga Class X: Sexual Health Network**		**Mpanga Class M: Friendship Network**		**Mpanga Class M: Sexual Health Network**	
Actor	**nBetweenness**	**Actor**	**nBetweenness**	**Actor**	**nBetweenness**	**Actor**	**nBetweenness**
73	11.027	65	15.844	638	14.362	614	38.28
44	9.979	73	11.634	614	13.977	617	16.454
26	6.509	44	10.885	658	12.453	653	15.514
21	5.857	51	9.589	621	11.858	630	14.732
90	5.73	18	9.028	607	11.371	605	12.353
75	5.619	6	7.703	669	10.246	658	10.888
Mpanga Class Z: Friendship Network		**Mpanga Class Z: Sexual Health Network**		**Mpanga Class P: Friendship Network**		**Mpanga Class P: Sexual Health Network**	
260	10.904	336	17.338	750	15.96	722	19.959
329	8.977	260	16.735	722	14.838	738	19.693
288	7.635	267	14.744	770	13.642	740	17.28
331	7.356	329	13.957	714	10.719	770	12.768
339	6.815	335	12.966	727	9.886	739	12.287
267	6.675	287	9.189	705	9.544	771	10.84
Mpanga Class Y: Friendship Network		**Mpanga Class Y: Sexual Health Network**		**Mpanga Class N: Friendship Network**		**Mpanga Class N: Sexual Health Network**	
533	16.32	533	25.364	813	16.361	803	12.677
503	10.605	562	10.153	830	12.246	813	9.62
507	9.54	565	7.458	801	8.486	862	8.897
501	7.16	520	7.281	808	7.932	810	7.101
549	6.697	539	6.165	803	7.242	840	6.676
565	6.293	501	5.748	832	7.1	850	6.486

Table 3.5: Centrality Measures at Nyakasura School

Friendship Network				
Actor	**nDegree**	**Rank**	**nBetweenness**	**Rank**
17	16.038	1	7.299	1
39	14.151	2	5.995	2
3	14.151	3	5.969	3
98	12.264	4	2.73	18
4	12.264	4	2.566	23
15	12.264	4	3.963	9
67	12.264	4	4.353	7
35	12.264	4	3.786	10
48	12.264	4	4.339	6
25	11.321	10	5.517	4
14	10.377	11	4.662	5
38	9.434	16	4.087	8
Sexual Health Network				
17	15.094	1	10.302	2
35	11.321	2	8.278	4
68	10.377	3	2.913	32
39	10.377	3	6.743	7
105	10.377	3	1.883	43
15	9.434	6	5.56	9
3	9.434	6	9.124	3
60	9.434	6	3.353	25
59	9.434	6	7.437	5
116	9.434	6	10.658	1
50	9.434	6	4.9	14
8	9.434	6	6.981	6
5	9.434	6	4.789	15
41	9.434	6	6.391	8
20	8.491	15	5.349	10
24	8.491	15	5.243	11
45	6.604	29	5.164	12

Table 3.6: Combined Network Centrality at Nyakasura School - Highest Values

Actor	nDegree	Actor	nBetweenness
17	20	17	10.563
8	15	25	5.426
39	14.167	3	5.337
3, 45, 41	13.333	41	4.663
20, 25, 68, 32	12.500	14	4.657
		50	4.317
		45	4.205
		116	4.014

Table 3.7: Combined Network Centrality at Mpanga School – Highest Values

Mpanga Class X:				**Mpanga Class M:**			
Actor	**nDegree**	**Actor**	**nBetweenness**	**Actor**	**nDegree**	**Actor**	**nBetweenness**
73	25	90	7.696	738, 739, 740, 750	27.586	750	15.434
82	22.368	73	7.639	722	24.138	739	12.396
90	21.053	65	6.62	705, 707, 770	20.69	770	11.473
65	19.737	44	6.136			722	11.412
6, 78	18.421	21	5.371			707	10.547
14, 18, 51, 75	17.105	6	5.135			738	9.396
Mpanga Class Z:				**Mpanga Class P:**			
260	23.457	260	13.525	533	36.62	533	20.365
329, 339	17.284	329	9.673	562	28.169	562	7.71
336	16.049	336	9.057	503, 530, 534	22.535	565	8.192
267, 299, 318, 320	13.58	333	6.055	505, 561	19.718	553	4.581
322, 324		339	5.248			507	4.49
		297	5.052			535	4.341
Mpanga Class Y:				**Mpanga Class N:**			
607	16.667	654	10.81	808, 815	25.926	862	11.639
617, 621, 654, 658	15.152	614	10.662	803, 810, 862	24.074	830	8.956
605, 614, 615	13.363	615	10.612	804, 850	22.222	813	8.271
625		658	9.681			810	7.014
		621	9.96			850	6.907
		669	8.739			844	6.206

Table 3.8: Q-values for Girvan-Newman Analysis

School	Network	Class	Number of Groups	Q-Value
Nyakasura	Friendship		7	0.000
	Sexual Health		2	0.369
Mpanga	Friendship	X	3	0.182
	Sexual Health	X	4	0.510
	Friendship	Z	5	0.537
	Sexual Health	Z	6	0.555
	Friendship	Y	3	0.429
	Sexual Health	Y	5	0.299
	Friendship	M	4	0.441
	Sexual Health	M	7	0.540
	Friendship	P	2	0.055
	Sexual Health	P	7	0.482
	Friendship	N	4	0.369
	Sexual Health	N	5	0.355

Table 3.9: Proposed Peer Educators Selected

School	Class	Students Selected	Gender Selected	Gender Surveyed (On Record*)
Nyakasura	-	17, 8, 39, 3, 15, 35 25, 41, 14, 50 45, 116	8 males, 4 females	84 males, 24 females (119 males, 32 females)
Mpanga	X	73, 82, 90, 65, 44, 21, 6, 75 or 12	2 (4) males, 6 females	25 males, 32 females (41 males, 50 females)
Mpanga	Z	260, 329, 339, 336, 333, 297, 267	3 males, 4 females	26 males, 29 females (46 males, 45 females)
Mpanga	Y	533, 562, 530 or 534, 503, 565, 553, 507, 535	3(4) males, 4 females	27 males, 23 females (38 males, 33 females)
Mpanga	M	607, 621 or 617, 654, 614, 615, 658, 669	4(5) males, 3 females	24 males, 23 females (30 males, 38 females)
Mpanga	P	738 or 740, 750, 739, 770, 722, 707, 705	3 males, 4(5) females	10 males, 23 females (31 males, 39 females)
Mpanga	N	808 or 815, 803, 862, 830, 813, 810, 850	5 (6) males, 2 females	25 males, 16 females (41 males, 29 females)

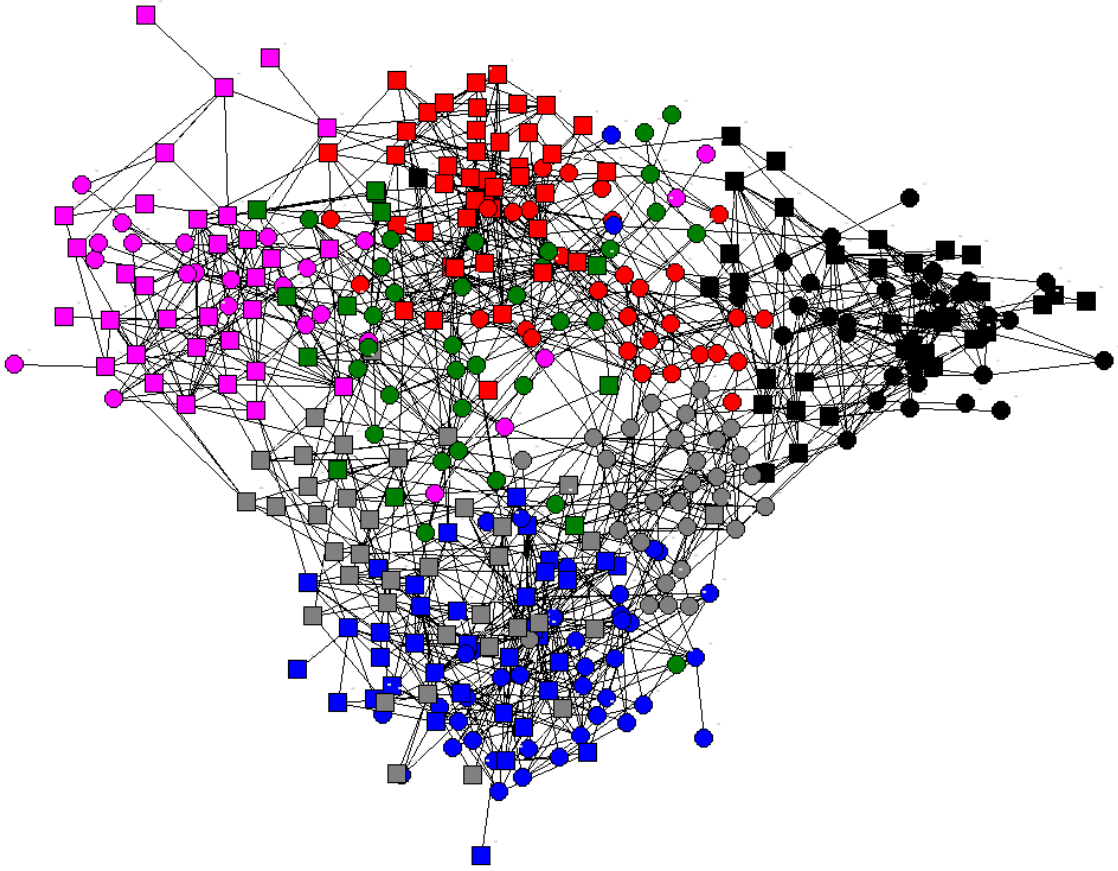
*Records have suspected deficiencies

Table 3.10: Potential Peer Educator Reach in Girvan-Newman Communities

School	Network	Class	Number of Groups	Groups with Potential PEs as Member	Groups within 1 step of Potential PEs
Nyakasura	Friendship		N/A*	-	-
	Sexual Health		2	2	-
Mpanga	Friendship	X	3	2	1
	Sexual Health	X	4	3	1
	Friendship	Z	5	4	1
	Sexual Health	Z	6	3	3
	Friendship	Y	3	3	-
	Sexual Health	Y	5	3	1
	Friendship	M	4	2	1
	Sexual Health	M	7	4	2
	Friendship	P	N/A*	-	-
	Sexual Health	P	7	3	3
	Friendship	N	4	3	1
	Sexual Health	N	5	3	1

*Q-value indicates that no sub-groups are present

Figure 3.1: Mpanga Friendship Network Sociogram, Gower



Legend:
Shape: Circle = Males; Square = Females
Colour: Red = Class X
Blue = Class Z
Purple = Class Y
Black = Class M
Grey = Class P
Green = Class N

Figure 3.2: Mpanga Sexual Health Network Sociogram, Gower

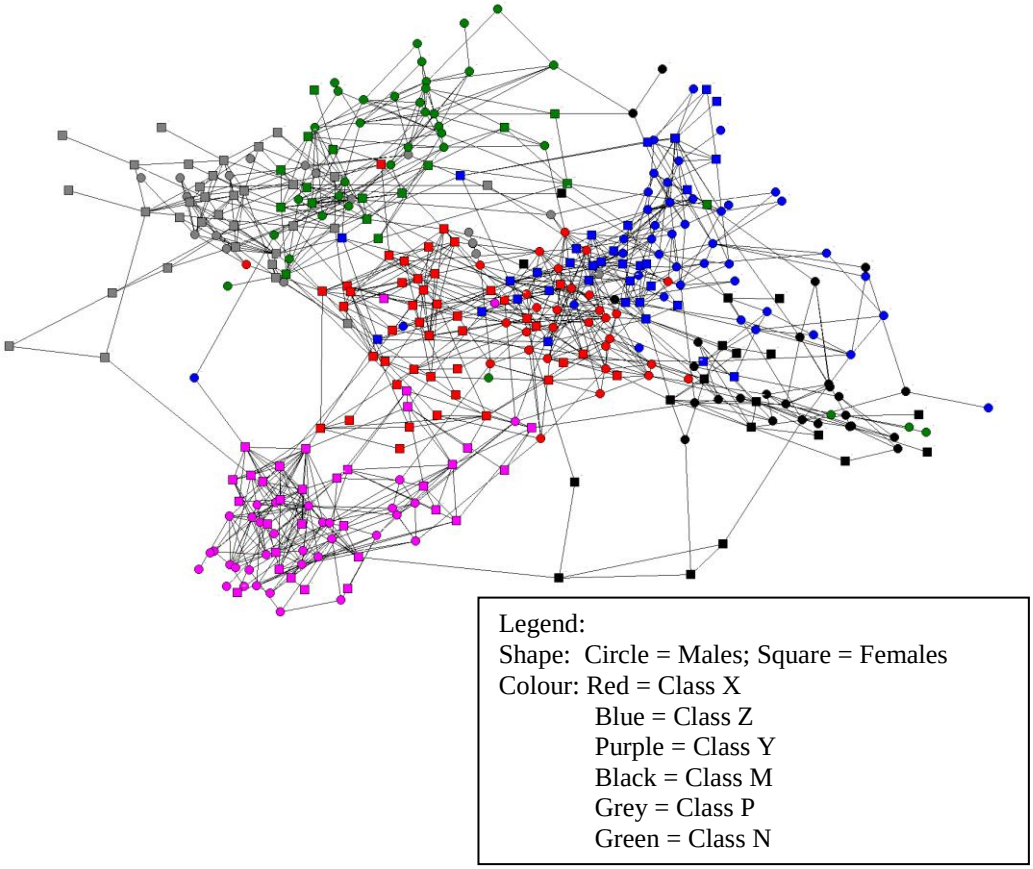


Figure 3.3: Mpanga Friendship Network Sociogram, Circle

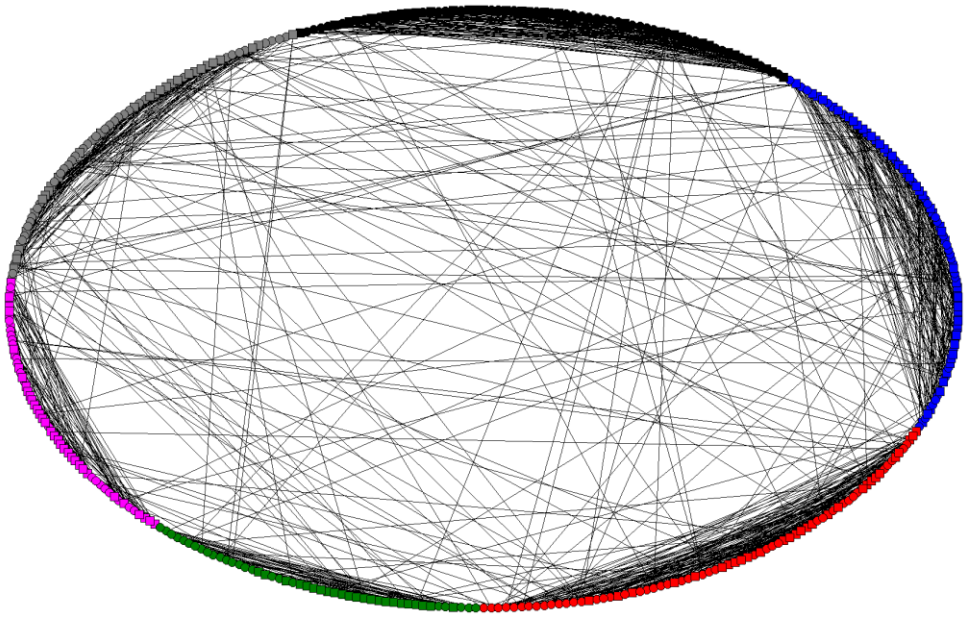


Figure 3.4: Degree Centrality for Friendship Network at Nyakasura

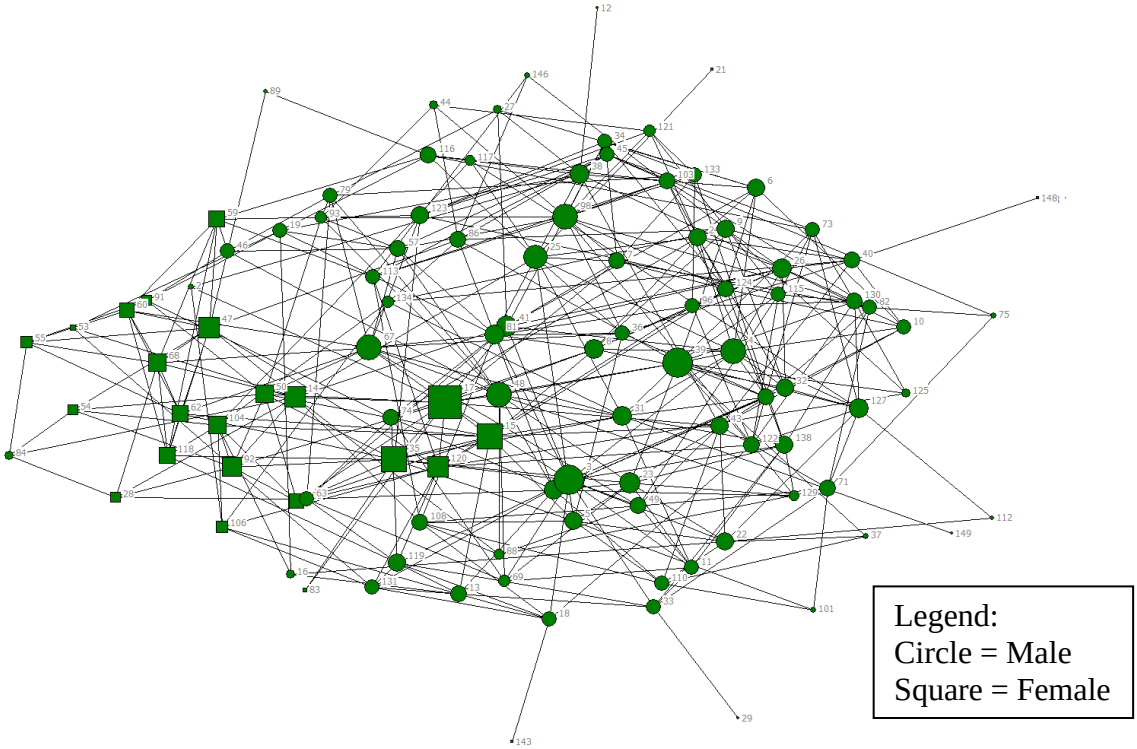


Figure 3.5: Betweenness Centrality for Friendship Network at Nyakasura

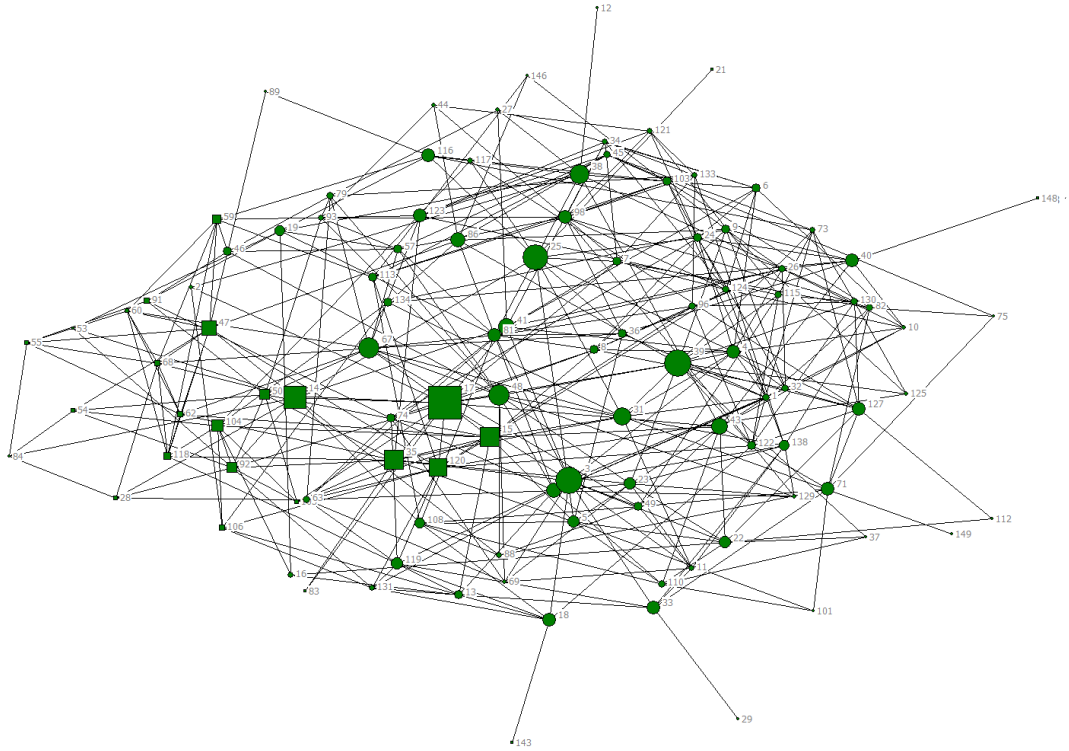
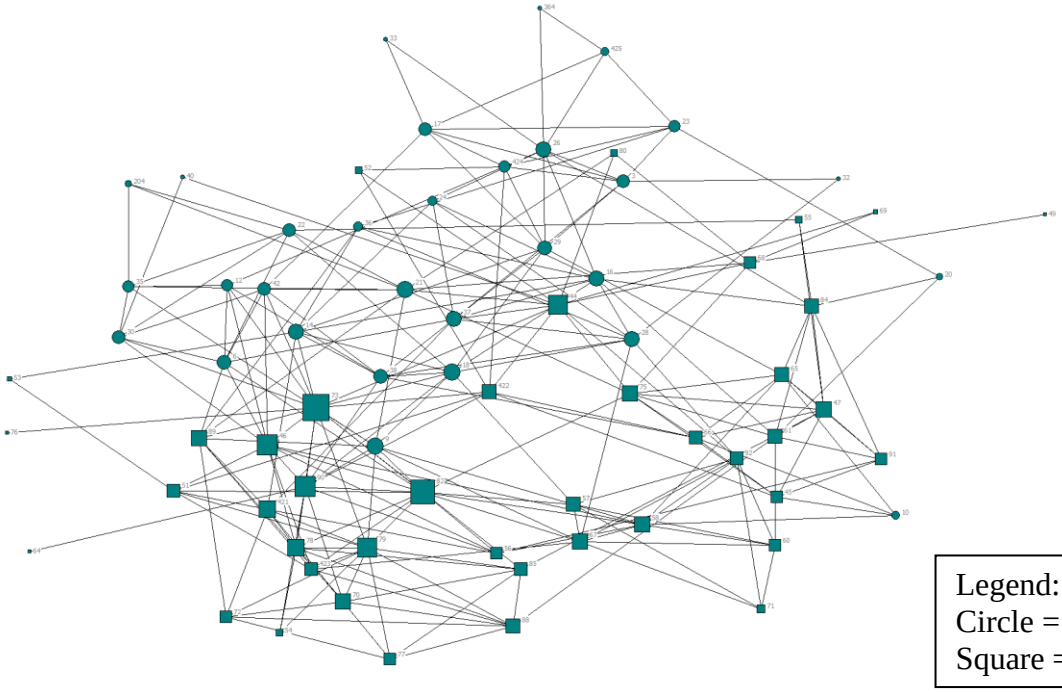


Figure 3.6: Degree Centrality for Friendship at Mpanga Class X



Legend:
Circle = Male
Square = Female

Figure 3.7: Betweenness Centrality for Friendship at Mpanga Class X

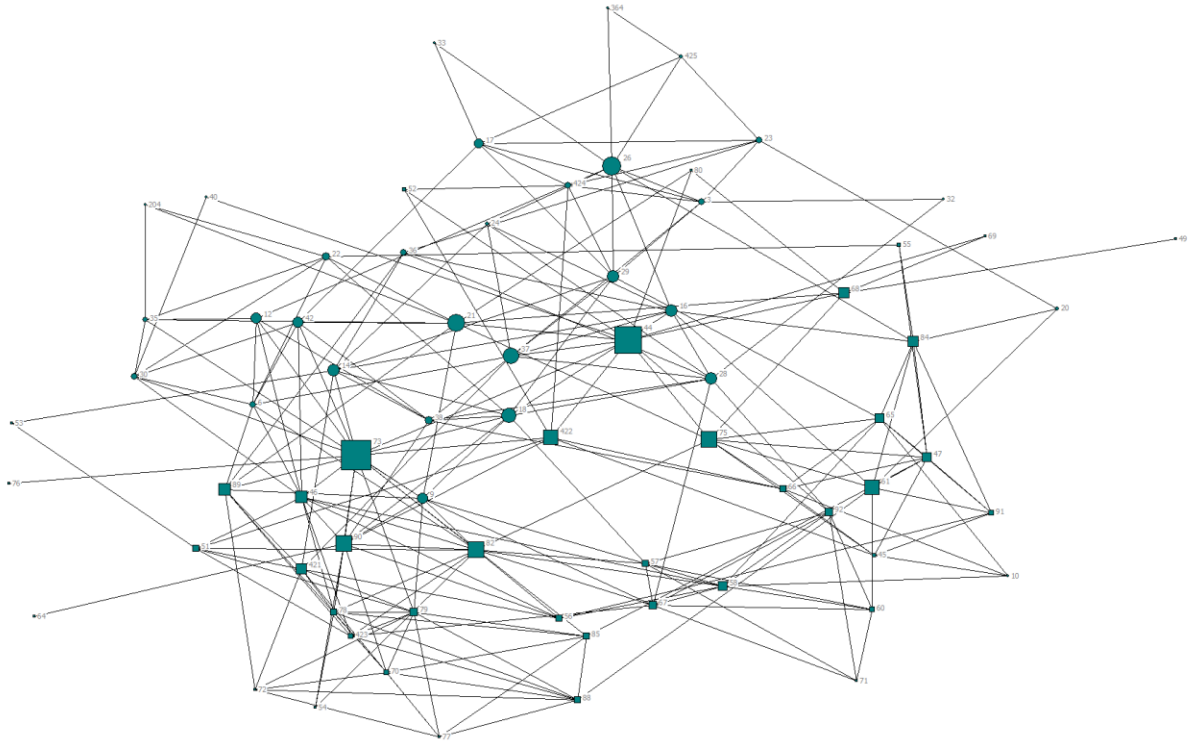


Figure 3.8: Nyakasura Sexual Health Network, Girvan-Newman Analysis

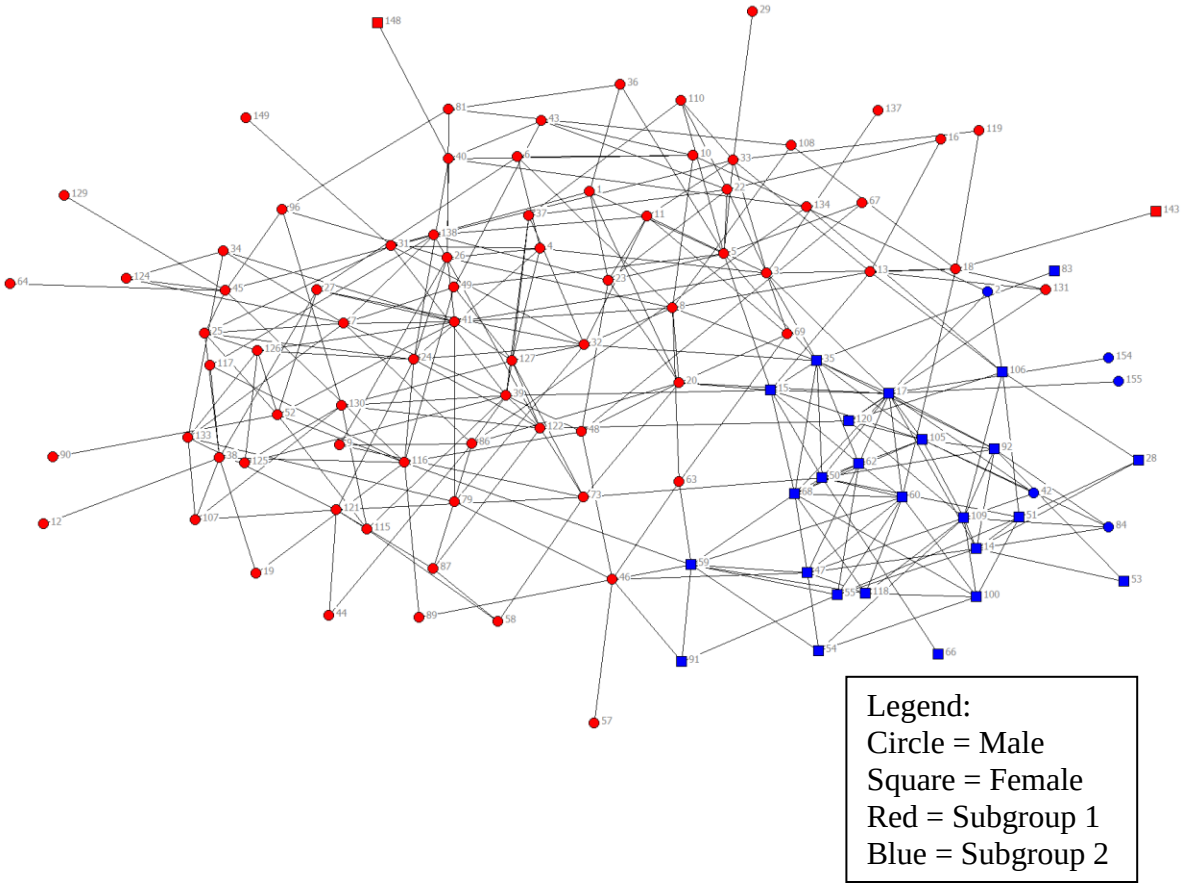
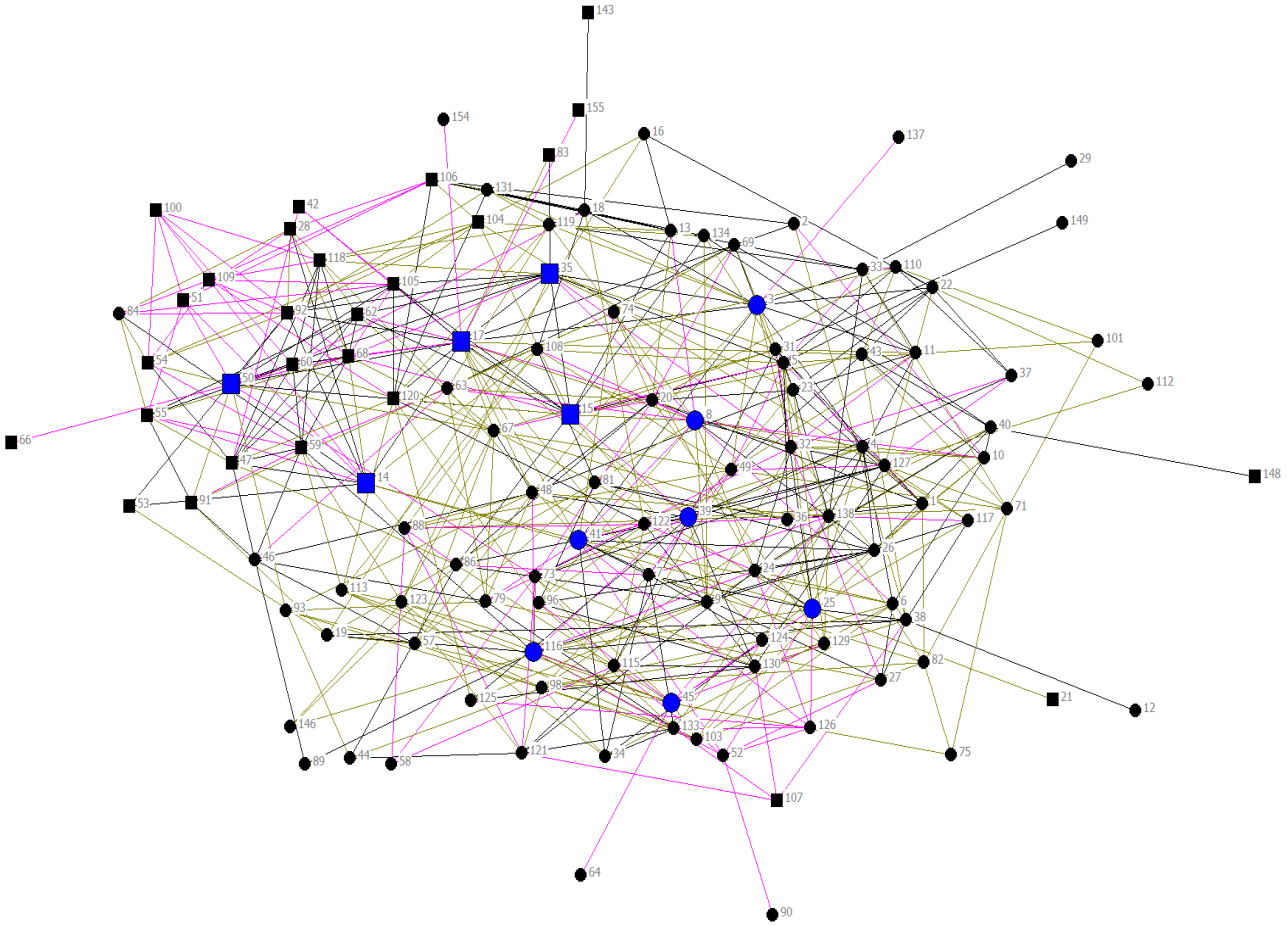


Figure 3.9: Peer Educator Network Placement at Nyakasura



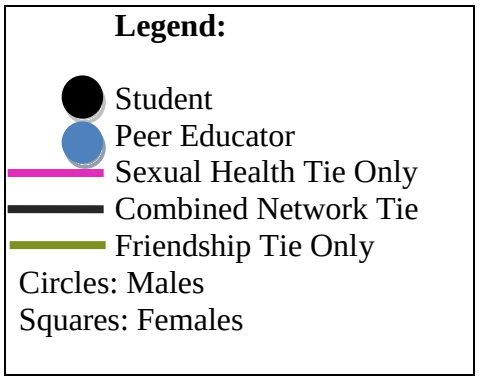
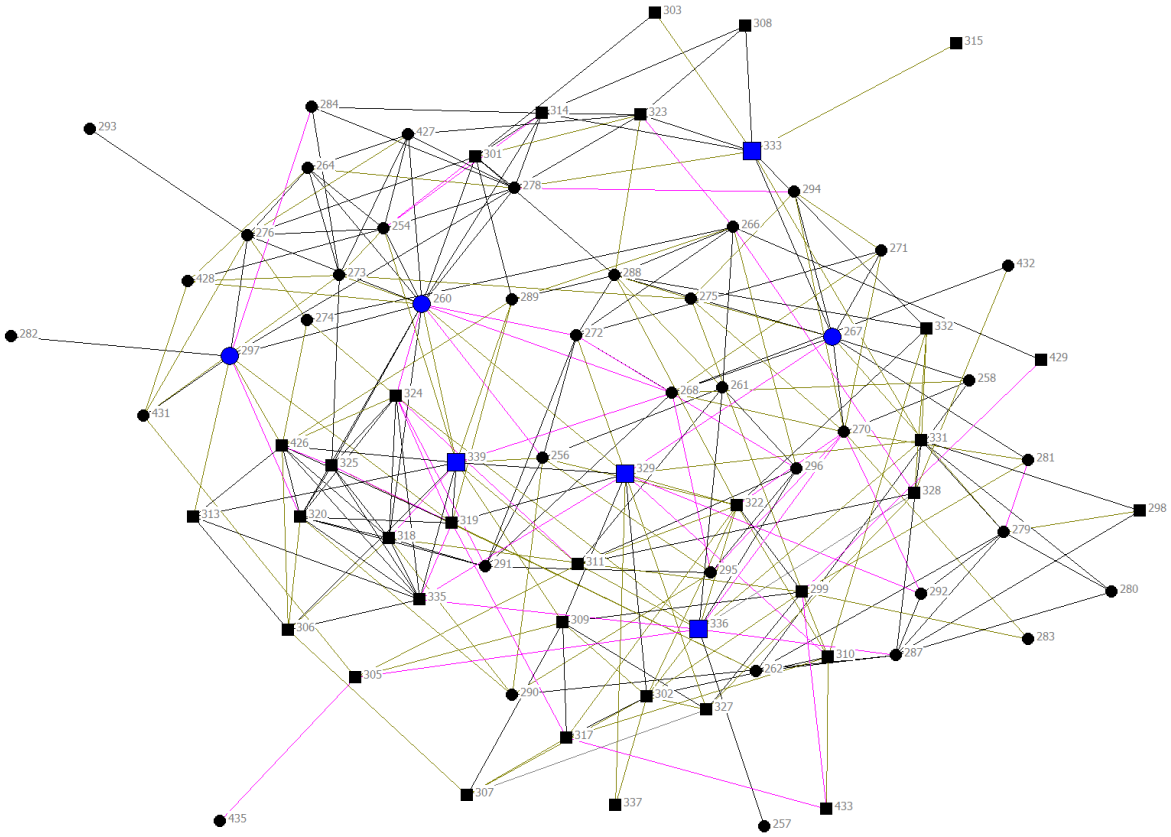


Figure 3.10: Peer Educator Network Placement – Mpanga Class Z



Legend:

Student
Peer Educator
Sexual Health Tie Only
Combined Network Tie
Friendship Tie Only
Circles: Males
Squares: Females

References

Agha, S., & Van Rossem, R. (2004). Impact of a school-based peer sexual health intervention on normative beliefs, risk perceptions, and sexual behaviour of Zambian adolescents. *Journal of Adolescent Health*, 34, 441-452.

African Youth Alliance. (2002). HIV/AIDS Fact Sheet: Uganda. Retrieved from http://www.pathfind.org/site/PageServer?pagename=Programs_Uganda_pubs.

AIDS Control and Prevention (AIDSCAP). (n.d.). How to Create and Effective Peer Education Project. Retrieved from www.fhi.org.

Bastien, S., Sango, W., Mnyika, K. S., Masatu, M. C., & Klepp, K. I. (2008). Changes in exposure to information, communication knowledge about AIDS among school children in Northern Tanzania, 1992-2005. *AIDS Care*, 20(3), 382-387.

Bond, K. (2003). Building connections: understanding relationships and networks to improve adolescent sexual and reproductive health programs. Seattle: Program for Appropriate Technology in Health (PATH).

Borgatt, S. P., Carley, K. M., & Krackhardt, D. (2006). On the robustness of centrality measures under conditions of imperfect data. *Social Networks*, 28, 124-136.

Borgatti, S. P., Everett, M. G., & Freeman, L.C. (2002). UCINet for windows: software for social network analysis. Harvard: Analytic Techonologies.

Borgatti, S. P. (2005). Centrality and network flow. *Social Networks*, 27, 55-71.

Bot, S. M., Engels, R. C. M. E., Knibbe, R. A., & Meeus, W. H. J. (2005). Friend's drinking behaviour and adolescent alcohol consumption: the moderating role of friendship characteristics. *Addictive Behaviours*, 20, 929-947.

Brewer. D. D., & Webster, C. M. (1999). Forgetting of friends and its effects on measuring friendship networks. *Social Networks*, 21, 361-373.

Buller, D. B., Morrill, C., Tarn D., Aickin, M., Sennott-Miller, L., Buller M. K., Larkey, L, Aladtorre, C., & Wentzel, T. M. (1999). Randomized trial testing the effect of peer education at increasing fruit and vegetable intake. *Journal of National Cancer Institute*, 91(17), 1491-1500.

Campbell, S. (2005). Using peer education projects to prevent HIV/AIDS in young people. *Nursing Standard*, 20(10), 50-55.

Caron, F., Godin, D., Otis, J., & Lambert, L. D. (2004). Evaluation of a theoretically based AIDS/STD peer education program on postponing sexual intercourse and on condom use among adolescents attending high school. *Health Education Research*, 19(2), 185-197.

Cartagena, R. G., Veugelers, P. J., Kipp, W., Magigav, K., Laing, L. M. (2006). Effectiveness of an HIV prevention program for secondary school students in Mongolia. *Journal of Adolescent Health*, 39, 925.e9-925.e16.

Cillessen, A. H. N. (2007). New perspectives on social networks in the study of peer relations. In P.C. Rodkin & L.D. Hanish (Eds). Social network analysis and children's peer relationships. New directions for child and adolescent development, No. 118. San Francisco: Jossey-Bass.

Cohen, S., & Lemay, E. (2007). Why would social networks be linked to affect and health practices? *Health Psychology*, 26, 410-417.

Costenbader, E., & Valente, T. W. (2003). The stability of centrality measures when networks are sampled. *Social Networks*, 25, 283-307.

Ennett, S. T., Bauman, K. E., Hussong, A., Faris, R., Foshee, V. A., & Cai, L. (2006). The peer context of adolescent substance use: findings from social network analysis. *Journal of Research on Adolescence*, 16(2), 159-186.

Fortunado, S., Latora, V., Marchiori, M. (2004). Method to find community structures based on information centrality. *Physical Review E*, 70, 056104.

Graham, J. W., Marks, G., & Hansen, W. B. (1991). Social influence processes affecting adolescent substance use. *Journal of Applied Psychology*, 76, 291-298.

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology*, 78(6), 1360-1380.

Gifford-Smith, M., Dodge, K., Dishion, T.J., McCord, J. (2005). Peer influence in children and adolescents: crossing the bridge from developmental to intervention science. *Journal of Abnormal Child Psychology*, 33(3), 255-265.

Hanneman, R. A., Riddle, M. (2005). Introduction to social network methods. Riverside, CA: University of California, Riverside. (published in digital form at http://faculty.ucr.edu/~hanneman/)

Hawe, P., & Ghali, L. (2008). Use of social network analysis to map the social relationships of staff and teachers at school. *Health Education Research*, 23(1), 62-29.

Hutchinson, D. M.,& Rapee, R. M. (2007). Do friends share similar body image and eating problems? The role of social networks and peer influences in early adolescence. *Behaviour Research and Therapy*, 54, 1557-1577.

Kelly, J. A., Lawrence, J. S., Diaz, Y. E., Stevenson, L. Y., Hauth, A. C., Brasfield, T. L, Kalichman, S. C., Smith, J. E., & Andrew, M. E. (1991). HIV risk behaviour reduction following intervention with key opinion leaders of population: an experimental analysis. *American Journal of Public Health*, 81(2), 168-171.

Kirke, D. M. (2009). Gender clustering in friendship networks: some sociological implications. *Methodological Innovations Online*, 4, 23-36.

Knoke, D., & Yang, S. (2007). Social Network Analysis. (2nd Edition). Thousand Oaks, CA: SAGE Publications.

Latkin, C. (1998). Outreach in a natural setting: the use of peer leaders for HIV prevention among injecting drug users' networks. *Public Health Report*, 113(Suppl 1), 151-159.

Laumann, E. O., Marsden, P. V., Prensky, D. (1980). The boundary specification problem in network analysis. Methods in Social Network Analysis Conference, April 13-16, 1980. University of California.

Logie, D. (2004). Unfairness of social and economic structures affecting AIDS in Africa. *British Medical Journal*, 324, 1034.

Luke, D. A., & Harris, J. K. (2007). Network analysis in public health: history, methods, and applications. *Annual Review of Public Health*, 28, 69-93.

Machal, J. Z. (2001). Unsafe sexual behaviours among schoolgirls in Mozambique: a matter of gender and class. *Reproductive Health Matters*, 9(17), 82-90.

McManus, A., & Dhar, L. (2008). Study of knowledge, perception, and attitude of adolescent girls towards STIs/HIV, safer sex and sex education: a cross sectional survey of urban adolescent school girls in South Delhi, India. *BMC Women's Health*, 8(12), doi: 10.1186/1472-6874-8-12.

National AIDS Documentation Centre. The official website of the Uganda AIDS Commission. Retrieved March 18, 2009 from http://www.aidsuganda.org/.

Neema, S., Ahmed, F. H., Kibombo, R., & Bankole, A. (2006). Adolescent sexual and reproductive health in Uganda: results from the 2004 national survey of adolescents. *Occasional Report No.25*. New York: Guttmacher Institute.

Pick, S., Givaudan, M., Sirkin, J., & Ortega, I. (2007). Communication as a protective factor: evaluation of a life skills HIV/AIDS prevention program for Mexican elementary-school students. *AIDS Education and Prevention*, 19(5), 408-421.

Real, K., & Rimal, R. N. (2007). Friends talk to friends about drinking: exploring the role of peer communication in the theory of normative social behaviour. *Health Communication*, 22(2), 169-180.

Rogers, E. M. Diffusion of Innovations, 5th Ed. New York: Free Press, 2003.

Scott, J. (2000). Social Network Analysis: A Handbook, 2nd Ed. London:Sage.

Shuguang, W., & Van de Ven, P. (2003). Peer HIV/AIDS education with volunteer trishaw drivers in Yaan, People's Republic of China: process evaluation. *AIDS Education and Prevention*, 15(40), 334-345.

Sieving, R. E., Eisenberg, M. E., Pettingell, S., & Skay, C. (2006). Friends' influence on adolescents' first sexual intercourse. *Perspectives on Sexual and Reproductive Health*, 38(1), 13-19.

Snijders, T. A. B., Steglich, C. E. G., Schweinberger, M., & Huisman, M. (2007). Manual for SIENA version 3. Groningen: University of Groningen. Oxford: University of Oxford, Department of Statistics.

Uganda Ministry of Health, *The National Health Policy*, Kampala, Uganda: Ministry of Health, 2000.

Valente, T. W., & Davis, R. L. (1999). Accelerating the diffusion of innovations using opinion leaders. *Annals of the American Academy of Political and Social Science*, 566, 55-67.

Valente, T.W., Hoffman, B. R., Ritt-Olson, A, Lichtman, K, Johnson, C. A. (2003). Effects of a social-network method for group assignment strategies on peer-led tobacco prevention programs in school. *American Journal of Public Health*, 93(11), 1837-1843.

Valente, T. W., Gallaher, P., & Mouttapa, M. (2004). Using social networks to understand and prevent substance use: a transdisciplinary perspective. *Substance Use & Misuse*, 39(10-12), 1685-1712.

Valente, T. W., Fosados, R. (2006). Diffusion of innovations and network segmentation: the part played by people in promoting health. *Sexually Transmitted Diseases*, 33(7 Suppl), S23-S31.

Visser, M. (2007). HIV/AIDS prevention through peer education and support in secondary schools in South Africa. *Journal of Social Aspects of HIV/AIDS*, 4(30), 678-694.

Wasserman, S., & Faust, K. (1994). Social network analysis: methods and applications. New York: Cambridge University Press.

Endnotes

[1]Results of the hierarchical clustering for clique overlap are found in the appendices of this thesis.

[2]The sociograms from the other Mpanga classes are found in the appendices of this thesis.

CHAPTER 4

FRIENDSHIPS WITHIN TWO SECONDARY SCHOOLS IN FORT PORTAL, UGANDA: IMPLICATIONS FOR PEER EDUCATION

4.1 Introduction

Without a doubt, relationships influence health behaviour and health decisions. In no place is this seen more strongly than in the adolescent population. At this developmental stage, individuals are becoming more aware of the inclination to position themselves within a greater social context (Brown, 1990). Peer pressure, social behaviour norms, and health behaviour norms all impose perceived constraints upon an individual (Eisenberg, Neumark-Sztainer, Story & Perry, 2005; Sieving, Eisenberg, Pettingell & Skay, 2006; Nyanzi, Pool, & Kinsman, 2001). These concepts can be described in terms of the relationships that exist within a community, and investigations about the types of relationships that occur, the level of support, and the perceived norms can allow health intervention program planners to better understand the local social influences. The majority of youth programs that have been shown to be effective are based on interpersonal behaviour models, in which behaviour is viewed as a dynamic interaction between the individual and his or her environment (Bond, 2003). The social environment has an overriding importance in youth health intervention programs.

Peer education is a method that has shown tremendous promise in adolescent health interventions, particularly when addressing sexual and reproductive health behavior change (Visser, 2007; Cartagena et al, 2006; Merakou & Kourea-Kremastinou, 2006). Peer education centres on individuals chosen directly from the target population and trains them to be informal or formal educators of their peers. Visser (2007) has succinctly outlined the major lines of thought as to why peer education has such potential for effectiveness, including more meaningful communication because of common language and experience, increased opportunity for positive behaviour modeling, and

heightened youth participation and empowerment as a result of witnessed involvement. Uganda, a small country in Sub-Saharan Africa, is struggling with high rates of HIV/AIDS, though official, multi-sectoral attempts to reduce infection rates have been in place for more than two decades. Though there is a national primary-school level sexual education program (the Presidential Initiative on AIDS Strategy for Communication to youth implemented in all primary schools in 2004, as detailed by Neema, Ahmaed, Kibombo, & Bankole, 2006), efforts to create more effective and sustainable programs for youth are warranted.

4.2 Context

Africa accounts for 70% of the world's HIV/AIDS burden, despite have only 10% of the world's population (Logie, 2004). Starting in 1986, the Ugandan government created a structured, multi-sectoral response for assisting its citizens in the fight against HIV/AIDS (National Aids Documentation Centre, 2009). Yet, an estimated 1.1 million people currently living in Uganda have HIV/AIDS (out of a population of 30 million), and incidence has increased by between 120,000 to 150,000 each year for the past five years (NADC, 2009; World Bank, 2008). Nearly 80% of those infected with HIV are between the ages of 15-45 years (NADC, 2009). Of particular concern is the adolescent population, whose knowledge and understanding of sexuality has the potential to determine sexual practices over the course of their lifetime (Machal, 2001). Uganda has a predominantly young population, with the age group of 10-19 making up 23.3% of the population, and young people 10-24 comprising 33.5% of the population (Uganda Ministry of Health, 2000). Other sexual and reproductive issues may exist, with the

World Bank (2003) reporting the 21-29% of females drop out of school due to pregnancy, and in some cases are expelled from school if they become pregnant (Kiapi-iwa & Hart, 2004).

With the risks of HIV infection and unwanted pregnancy, adolescents in Uganda face a formidable double threat. Knowledge of condoms, STI's, and HIV/AIDS have all been measured in past surveys (African Youth Alliance, 2002), however, this knowledge does not seem to be widely practiced, as the same surveys measure adolescents as making up over 50% of new HIV infections in 2001. There is evidence that there is a high rate of sexual activity in adolescents in Uganda (Twa-Twa, 1997; Shuey, Babishangire, Omiat, & Bagarukayo, 1999; Konde-Lule et al, 1997). The 2004 National Survey of Adolescents indicates that this rate is about 30% for adolescents aged 12-19 (Neema, Ahmaed, Kibombo, & Bankole, 2006).

There appears to be significant potential for the introduction of a peer education program in the country to reduce the burden of STIs (including HIV) and teen pregnancy. Previous studies of school-based education programs in Uganda have had the following recommendations: increase the interpersonal communication of information amongst students and between students and teachers (Shuey, Babishangire, Omiat, & Bagarukayo, 1999) and use participatory techniques and peer education to increase social interaction and model appropriate behaviours (Kinsman et al, 2001). Though the programs that prompted these recommendations were not peer-based, their recommendations can be achieved through a peer education program because it inherently increases interpersonal communication and utilizes positive role modeling, among other important aspects. A recent study, in nearby Tanzania, also strongly recommended that effort should be aimed

at increasing sexual health discussion within adolescents friendship networks for the purpose of a broader exposure to AIDS and related information (Bastein, Sango, Mnyika, Masatu, & Klepp, 2008). Other research has shown that increased communication about sensitive topics can have a positive effect on perceived norms and help prevent risky behaviour (Pick, Givandan, Sirkin, & Ortega, 2007; Real & Rimal, 2007).

4.3 Study Purpose and Design

A greater understanding of relationship context and setting before a health intervention is implemented can be very informative for program planners. The study purpose is to look at the supportive relationships in youth, and develop a solid base of understanding of the how, the what, and to what extent adolescents communicate in their relationships, and how comfortable they are doing so. A more thorough understanding of what adolescents communicate about and how easily they talk about it can focus the dialogue and content of an intervention (Neema, Ahmaed, Kibombo, & Bankole, 2006). In addition, if increased communication is one of the goals of the peer education program, a baseline level can be established (for process and impact evaluation).

This cross-sectional study utilized parts of a questionnaire developed by the Program for Appropriate Technology in Health, located in Seattle, Washington. The instrument is composed of questions that have been collected from a variety of surveys and validated in different countries, and has been adapted from *Building Connections: Understanding relationships and networks to improve adolescent sexual and reproductive health programs* (Bond, 2003). This resource has informed several peer program evaluations. In order to make these resources specific to Ugandan youth, the

general question framework was adapted in close collaboration with our Ugandan research partners. The questions underwent thorough evaluation for content validity from experts before being pre-tested with a small sample of Ugandan youth. In this type of analysis, respondents nominate three specific people who are friends with the respondent and answer a series of questions about their relationship with them. Most of the responses require the respondent to circle a categorical response, such as 'yes' or 'no'. Since there is a need for youth STI/HIV prevention programming, the communication questions centre around relevant topics. For example, students indicated their level of agreement with statements such as *"In the past 3 months, I've talked with him/her about my questions about contraception"*, and *"My friend helps me when I need information about sex."* Each of these statements and questions were considered separately about each of their nominated friends, so each statement yielded three answers.

The questionnaire was administered to Secondary 2 (S2) level students in two schools in the Kabarole District of western Uganda. These students are approximately 15-17 years of age. The schools are quite different; Nyakasura school is a rural mixed-gender boarding institution, having a student population of about 135 S2 students. Mpanga is an urban mixed day-school, where the approximately 400 S2 live in or around the town of Fort Portal. The fundamental differences in levels of 'outside-of-school' influences may have an impact on the results of this study. In both of these schools, the Headmasters have expressed firm willingness to participate in a future health intervention based on a peer education model, and agreed to facilitate the collection of data. Uganda has six levels of secondary education, and according to the Headmasters of the schools, a peer education program for sexual and reproductive health would likely begin at the S2

level. Therefore, this preliminary study targeted the youth most likely to be involved in a future peer education program.

In each respective school, the survey was administered to each of the present S2 students simultaneously. However, due to available facilities and other site-specific logistics, this occurred differently. At Mpanga, the lack of a large meeting place meant that survey administration occurred in six individual classrooms with approximately 40-60 students in each room. One research assistant (per classroom) invigilated this process. At Nyakasura, all of the S2 students met in a large chapel, and three research assistants were present.

The students were not required to give the full names of their nominated friends, merely the initials. They were, however, required to give their own full names, which on completion of the survey were promptly assigned a numerical code to ensure confidentiality and facilitate data entry. The data was analyzed to give descriptive results, using STATA 9 statistical software.

4.4 Results

In total, 109 students at Nyakasura and 284 students at Mpanga completed the survey. Surveys were not used if they were less than 70% complete, resulting in 89 surveys from Nyakasura and 256 from Mpanga. The study was designed to include all of the students in the S2 grade; unfortunately, we are unable to determine the degree of completeness of the population, as neither of the schools possessed current grade rosters. In general, the existence of out-of-school youth is a major problem in Uganda, as many students either never attend school, drop out of school, or attend sporadically (Neema,

Ahmaed, Kibombo, & Bankole, 2006). Therefore, school records are constantly in flux and it is difficult to obtain exact numbers of those attending. However, when compared to the most recent term student list, it appears as though approximately two-thirds of the usual student population were surveyed.

The survey was divided into sections[1]: characteristics, connection, support and exchange, information and communication, and norms/perceived behaviours. For the characteristics section, the students are asked to describe whether the friend is 'very close' or 'close'. This is followed by questions that assess connection, such as the level of understanding and enjoyment with the nominated friend. To examine support and exchange, questions are asked about specific types of emotional and material support, such as the provision of money when in need, or supplying support in times of sadness. Next, there is a section about information and communication, where students are asked about recent (within the past three months) communication about various sexual and reproductive health topics. Finally, the students are asked about their perceptions around their friends' behaviour. The results for the overall student population, the males and females, and each school can be found in Table 4.1 (Page 111). The discussion of results will be arranged according to gender and school.

Gender:

Some difference can be noted between gender, in particular the questions *'My friend helps me when I need information about sex'* (females had fewer 'always' responses and greater 'never' responses*), 'I am able to talk to him/her about boyfriends/girlfriends'* (females had fewer 'agree' responses). There were also differences in perceptual questions around whether they think that their friend has a

romantic relationship, has sexual relations, or uses contraception. This may imply that females are less comfortable talking about sex and relationships than males. There is a clear distinction by gender in the gender of friends. The responses to the question '*What is your friend's gender?*', in which the majority of males chose males (75.9% vs. 24.1%), and females chose females (75.7% vs. 24.3%), which agrees with a recent country-wide survey (Neema, Ahmaed, Kibombo, & Bankole, 2006).

Types of communication and support:

Generally, students are more likely to feel enjoyment with their friends and experience fulfillment of emotional needs. The students are less likely to experience fulfillment of material needs, such as money or health resources. Recent communication around sexual and reproductive matters has occurred in approximately half of friendships, other than specific communication about STIs, which occurs in over 70% in most types of friendships, perhaps reflecting the prominence of HIV in the country and the government's concerted effort to combat transmission of the illness (Neema, Ahmaed, Kibombo, & Bankole, 2006). This agrees with the findings of the 2004 National Survey of Adolescents, although it is important to note that while there is high levels of communication and awareness, inaccuracies in prevention methods are common (Neema, Ahmaed, Kibombo, & Bankole, 2006). Communication about contraception remains quite low, occurring in less than 37% of friendships overall. In short, the students are most likely to talk about STIs, are moderately likely to talk about other sexual issues, and least likely to talk about contraception. This seems to follow a continuum of 'least personal' to 'most personal' type of issue.

School Differences:

Each school is relatively similar in levels of support within friend relationships. The major school differences occur in communication about sexual and reproductive issues, and perceptions about sexual activity. At Nyakasura and Mpanga, the students are equally likely to communicate about *'what is right and wrong about sex'* and *'what he/she thinks about young people having sex'* and *'preventing sexually transmitted infections'*. However, the students are less likely to talk about *'my questions on sex'* (occurs in 41.7% of friendships at Nyakasura and 52.4% of friendships at Mpanga) and contraception (occurs in 25.6% of friendships at Nyakasura and 40.2% of friendships at Mpanga). With regards to perceptions about sexual activity, Nyakasura school students believed that 23.4% of their friends have had sexual relations, 18.2% of their friends use contraception, 3.7% of their friends have had sex with a prostitute, and 8.1% of their friends have received money or gifts for sex. The corresponding proportions at Mpanga are much higher at 32.1%, 28.9%, 9.4%. and 23.2%, respectively (Table 4.1).

Very close vs. close friends:

One of the initial survey questions asked the students to describe their nominated friends as 'very close' or 'close', and all of the students nominated at least one 'very close' friend. In Table 4.2 (Page 112), we list the results when considering the responses given for 'very close' friendships vs. the responses for 'close' friendships. Again, the male and female responses were separated out of deference to widely reported gender differences in friendships, and there were a few interesting results. Firstly and expectedly, the questions around support and connection received more responses that indicated strong support when a 'very close' friend was considered, across each gender.

For example, the question *'My friend helps me when I have a personal problem'* received an 'always' response from males 55.7% of the time with their 'very close' friends, and 37.7% with their 'close' friends. This was almost exactly mirrored in the female population with 56.8% 'always' from their 'very close' friends and 34.5% from their 'close' friends. A similar pattern holds for questions about 'very close' friends helping the respondent feel better in sad times, giving financial assistance when needed, or providing general enjoyment and understanding. However, changes begin to emerge when information is sought about communication around sexual and reproductive health issues. With these responses, males exhibit a similar willingness to talk about these matters with both their 'very close' and 'close' friends. Females, on the other hand, maintain more of a selectiveness and talk primarily with their 'very close' friends as opposed to their 'close' friends; the exception to this being communication specifically about the transmission of sexually transmitted infections, which is universally quite high in all instances, as previously stated. There was a gender difference noted in the 2006 National Survey of Adolescents, where about 40% of males aged 12-19 talked with their friends about sex-related matters, but only about 25% of females talked with their friends (Neema, Ahmaed, Kibombo, & Bankole, 2006), which provides clues into basic gender differences in communication levels. Other research has shown that females have a more positive attitude about communication about sensitive topics, but males exhibited more communication behaviours about these topics (Pick, Givaudan, Sirkin, & Ortega, 2007).

Intriguing results are noted when looking closely at Table 4.2 (Page 112) with regards to perceived sexual behaviours. For both males and females, they more often

believe that their 'close' friends are engaged in various sexual activities than their 'very close' friends. For the statement *'I think that my friend has had sexual relations'* males said 'yes' 35.1% of the time for their 'close' friends, and 31.2% for their 'very close' friends. Females responded with 36.5% and 21.2%, respectively. For the statement *'I think that my friend has had sex with a prostitute'*, males said 'yes' 11.4% of the time for their 'close' friends, and 5.8% for their 'very close' friends. Females responded with 9.0% and 6.2%, respectively. For the statement *'I think that my friend has received money or gifts for sex'*, males said 'yes' 19.6% of the time for their 'close' friends, and 15.4% for their 'very close' friends. Females responded with 27.4% and 19.9%, respectively. The 2004 National Survey of Adolescents shows that roughly 30% of adolescents aged 12-19 have had sexual relations, though there is a trend of increasing activity as age increases (Neema, Ahmaed, Kibombo, & Bankole, 2006). Perceptions regarding sexual activity are often inaccurate, with sexual perceived activity rates falsely elevated (Martens et al, 2006), but little is known about this in the Ugandan context. It seems as though the perceptions for the 'very close' friends may be closer to reality for males. Perceptions of sexual activity amongst their peers are an important consideration since studies have shown that youth make health behaviour decisions based on perceived norms rather than the actual case (Selvan, Ross, Kapadia, Mathai, & Hira, 2001; Buhi & Goodson, 2007).

Male Friends vs. Female Friends

Intuitively, we suspected that there may be a difference noticed when comparing nominees of different gender (i.e. males that nominate female friends vs. male friends). The results for this are in Table 4.3 (Page 113). Indeed, there are some differences in

same-gender friendship compared with opposite-gender friendships, with more personal support and enjoyment being provided by same-gendered friendships. With regards to other types of resources, more males are able to provide monetary assistance when needed to both male and female respondents. Females tend to talk to their male friends more about sexual matters, with more responses that indicate support given for *'My friend helps me when I need information about sex'* (34.4% for male friends vs. 29.0% for female friends) and *'In the past 3 months, I've talked with him/her about my questions on sex'* (53.5% for males friends vs. 46.9% for female friends). However, female students gave slightly more 'yes' responses for their female friends to the statement '*In the past 3 months, I've talked with him/her about what is right and wrong about sex'* (59.1% for female friends vs. 53.8% for male friends). Male friends were reported more often to be in a romantic relationship by both genders; however, each gender reported that they think that a greater proportion of their opposite gender friends have *'had sexual relations'.* A large discrepancy occurs in perceptions about contraception use, with males reporting that they think that 28.7% of their male friends and 34.7% of their female friends use contraception, while females report that they think that 26.2% of their male friends but only 16.2% of their female friends use contraception. Interestingly, this pattern reverses when asked about their perceptions about their friends receiving money or gifts for sex; males believe that 15.9% of their male friends have received presents, while females believe that 26.4% of their male friends receive presents.

The students were asked to describe the characteristics that they like about their friends; see Table 4.4 (Page 114). Overall, males value qualities around being knowledgeable, helpful, and playful/fun, though when considering opposite gender

friendships, attractiveness was the most valued characteristic (listed 20.8% of the time, compared to playful/fun at 19.8% and caring/loving at 14.2%). As well, in their 'very close' friendships, males highly valued trustworthiness as a characteristic. Females were most likely to value helpfulness, being knowledgeable, and being good/respectful in their friendships, although similar to males, they placed a higher emphasis on attractiveness in their opposite gender friendship, though this characteristic lagged behind the leading quality of being knowledgeable (14% vs. 20%). These characteristics may be helpful when considering the types of individuals who should administer a health promotion program.

4.5 Discussion

Some of the questions in the survey were sensitive, and efforts were made to ensure confidentiality, such as physically separating the students and closely invigilating the survey, and not requiring the full names of the friends nominated. However, despite our efforts, we cannot be sure that all of the students trusted that the results would remain confidential and felt free to give honest answers. In addition, though the questions were pre-tested for comprehension, we cannot be sure that they were all understood. Reliability testing was performed with a small subset of the students two weeks later, and good correlation was achieved, with each student nominating the same three friends and characterizing them in a similar matter as the first survey. However, friendships in adolescents are typically quite dynamic, and this must be taken into consideration.

Our research confirms that there are supportive relationships in Ugandan youth within schools. Each student reported at least one 'very close' friend, and the majority of

these friendships are characterized by exchanges that provide for several types of emotional and material needs. Friendships that are same-gender are generally more supportive, and thus peer education planners should ensure that the local gender proportions are covered in peer educator selection.

Of note to health intervention planners is the responses to the statement *'My friend helps me when I need information about sex'*. In terms of questions about support and exchange, this received the lowest percentage of positive responses, indicating that friends are not generally a source of information about sex. Still, various topics about sex are spoken about in friendships. Most frequently it is talk about STIs. Other topics related to sex were less frequently reported, with the proportions closer to half. It remains to be seen if the communication contains correct and true information about sexual and reproductive health, and there is evidence to suggest that similar to many youth environments, misconceptions abound (Neema, Ahmaed, Kibombo, & Bankole, 2006; Bastien et al, 2008; McManus & Dhar, 2008). The relatively low proportions of youth talking with their friends about sex may indicate that the youth themselves do not trust the quality of information provided by friends. Therefore, it is crucial that efforts to increase interpersonal communication about these matters must be accompanied by increased access to factual information. There is a large amount of room for improvement in communication about sexual and reproductive health matters, particularly in regards to contraception. This is the subject that is least discussed amongst friends. Perhaps it is related to the need to identify themselves as sexually active in order to get information on contraception. The presence of relatively high amounts of STI related conversation demonstrates that the students are not adverse about

communicating about sensitive matters, so an opportunity to capitalize on this communication exists. Recent research demonstrates that increased communication is vital when trying to change social norms and reducing risky behaviour (Pick, Givaudan, Sirkin, & Ortega, 2007). In addition to developing more realistic ideas about risk perception, increased interpersonal communication will help counter misconceptions and increase knowledge (Bastien et al, 2008).

Perceptions about risk behaviours are often greater determinants of decision making than the actual rate of risk behaviour (Buhi & Goodson, 2007), and the fact that there are discrepancies in perceptions several of the subgroups, particularly the 'very close' vs. the 'close' friendships, indicates that there are inaccuracies in youth perceptions and they may make decisions based on these myths (Abraham & Sheeran, 2007; Norman & Conner, 2007). Discrepancies in perceptions also occurred in the males vs. the females in terms of contraception use and receiving money or gifts for sex.

In conclusion, as a result of our investigation into friendships of youth, we have been able to discuss several items of use to peer education program planning, such as identifying gender balances and respected characteristics in peer educator selection. Of note is the gap in communication about sexual and reproductive health, which could be strategically utilized to have a positive impact on social norms and risk-taking behaviour. The fact that youth are comfortable talking with their peers about STIs provides an important point of entry for health promotion programs.

Table 4.1: Overall Results by School and Gender, by Frequency (Percent)

Question	Response	Overall		Nyakasura		Mpanga		Males		Females	
How close are you to your friend?	Close	622	(61.9%)	158	(58.3%)	464	(63.2%)	323	(58.1%)	299	(66.6%)
	Very Close	383	(38.1%)	113	(41.7%)	270	(36.8%)	233	(41.9%)	150	(33.4%)
What is your friend's gender?	Male	529	(53.1%)	170	(60.5%)	359	(50.2%)	422	(75.9%)	107	(24.3%)
	Female	467	(46.9%)	111	(39.5%)	356	(49.8%)	134	(24.1%)	333	(75.7%)
How much do you feel that your friend understands you?	Very much	686	(66.9%)	196	(69.0%)	490	(66.0%)	393	(68.0%)	293	(65.4%)
	A little	288	(28.1%)	79	(27.8%)	209	(28.2%)	151	(26.1%)	137	(30.6%)
	Not at all	52	(5.1%)	9	(3.2%)	43	(5.8%)	34	(5.9%)	18	(4.0%)
How much do you feel that you have enjoyment with your friend?	Very much	714	(70.4%)	208	(74.0%)	506	(69.0%)	400	(69.6%)	314	(71.5%)
	A little	243	(24.0%)	57	(20.3%)	186	(25.4%)	133	(23.1%)	110	(25.1%)
	Not at all	57	(5.6%)	16	(5.7%)	41	(5.6%)	42	(7.3%)	15	(3.4%)
My friend helps me when I have a personal problem	Always	509	(48.6%)	144	(50.5%)	365	(47.9%)	279	(47.9%)	230	(49.5%)
	A little	443	(42.3%)	125	(43.9%)	318	(41.7%)	245	(42.1%)	198	(42.6%)
	Never	95	(9.1%)	16	(5.6%)	79	(10.4%)	58	(10.0%)	37	(8.0%)
My friend helps me when I need money	Always	384	(36.9%)	129	(45.3%)	255	(33.7%)	201	(34.6%)	183	(39.7%)
	Sometimes	490	(47.0%)	124	(43.5%)	366	(48.3%)	282	(48.5%)	208	(45.1%)
	Never	168	(16.1%)	32	(11.2%)	136	(18.0%)	98	(16.9%)	70	(15.2%)
My friend helps me when I have a health problem	Always	469	(45.0%)	134	(47.5%)	335	(44.1%)	247	(42.5%)	222	(48.2%)
	Sometimes	394	(37.8%)	111	(39.4%)	283	(37.2%)	223	(38.4%)	171	(37.1%)
	Never	179	(17.2%)	37	(13.1%)	142	(18.7%)	111	(19.1%)	68	(14.8%)
My friend helps me when I need information about sex	Always	341	(33.6%)	82	(29.3%)	259	(35.3%)	207	(36.2%)	134	(30.3%)
	Sometimes	293	(28.9%)	78	(27.9%)	215	(29.3%)	173	(30.2%)	120	(27.1%)
	Never	380	(37.5%)	120	(42.9%)	260	(35.4%)	192	(33.6%)	188	(42.5%)
In the past 3 months, I've talked with him/her about what is right and wrong about sex	Yes	651	(62.0%)	173	(60.3%)	478	(62.6%)	377	(64.2%)	274	(59.2%)
	No	399	(38.0%)	114	(39.7%)	285	(37.4%)	210	(35.8%)	189	(40.8%)
In the past 3 months, I've talked with him/her about what he/she things about young people having sex	Yes	527	(50.6%)	152	(52.8%)	375	(49.7%)	281	(48.2%)	246	(53.6%)
	No	515	(49.4%)	136	(47.2%)	379	(50.3%)	302	(51.8%)	213	(46.4%)
In the past 3 months, I've talked with him/her about my questions on sex	Yes	513	(49.4%)	120	(41.7%)	393	(52.4%)	296	(50.7%)	217	(47.8%)
	No	525	(50.6%)	168	(58.3%)	357	(47.6%)	288	(49.3%)	237	(52.2%)
In the past 3 months, I've talked with him/her about contraception	Yes	379	(36.2%)	73	(25.6%)	306	(40.2%)	205	(35.0%)	174	(37.8%)
	No	667	(63.8%)	212	(74.4%)	455	(59.8%)	381	(65.0%)	286	(62.2%)
In the past 3 months, I've talked with him/her about preventing sexually transmitted infections	Yes	767	(72.6%)	210	(72.2%)	557	(72.7%)	422	(71.3%)	345	(74.2%)
	No	290	(27.4%)	81	(27.8%)	209	(27.3%)	170	(28.7%)	120	(25.8%)
I think that my friend has a boyfriend/girlfriend	Yes	468	(45.2%)	111	(40.5%)	357	(46.9%)	275	(48.2%)	193	(41.6%)
	No	567	(54.8%)	163	(59.5%)	404	(53.1%)	296	(51.8%)	271	(58.4%)
I think that my friend has had sexual relations	Yes	306	(29.8%)	64	(23.4%)	242	(32.1%)	184	(32.9%)	122	(26.2%)
	No	720	(70.2%)	209	(76.6%)	511	(67.9%)	376	(67.1%)	344	(73.8%)
I think that my friend uses contraception	Yes	264	(26.2%)	46	(18.2%)	218	(28.9%)	171	(30.8%)	93	(20.6%)
	No	743	(73.8%)	207	(81.8%)	536	(71.1%)	385	(69.2%)	358	(79.4%)
I think that my friend has had sex with a prostitute	Yes	80	(7.9%)	10	(3.7%)	70	(9.4%)	49	(8.9%)	31	(6.8%)
	No	930	(92.1%)	259	(96.3%)	671	(90.6%)	504	(91.1%)	426	(93.2%)
I think that my friend has received money or gifts for sex	Yes	198	(19.2%)	22	(8.1%)	176	(23.2%)	97	(17.1%)	101	(21.8%)
	No	833	(80.8%)	250	(91.9%)	583	(76.8%)	471	(82.9%)	362	(78.2%)

Table 4.2: Results of Close Vs. Very Close Friend, by Frequency (Percent)

Question	Response	Overall About Close Friend	Overall About Very Close Friend	Male About Close Friend	Male About Very Close Friend	Female About Close Friend	Female About Very Close Friend
What is your friend's gender?	Male	186 (51.8%)	317 (53.9%)	152 (69.4%)	248 (81.3%)	34 (24.3%)	69 (24.4%)
	Female	173 (48.2%)	271 (46.1%)	67 (30.6%)	57 (18.7%)	106 (75.7%)	214 (75.6%)
How much do you feel that your friend understands you?	Very much	185 (51.1%)	471 (77.6%)	125 (55.8%)	250 (79.1%)	60 (43.5%)	221 (75.9%)
	A little	151 (41.7%)	114 (18.8%)	83 (37.1%)	51 (16.1%)	68 (49.3%)	63 (21.6%)
	Not at all	26 (7.2%)	22 (3.6%)	16 (7.1%)	15 (4.7%)	10 (7.2%)	7 (2.4%)
How much do you feel that you have enjoyment with your friend?	Very much	202 (56.1%)	474 (79.1%)	134 (58.8%)	243 (78.1%)	68 (51.5%)	231 (80.2%)
	A little	128 (35.6%)	102 (17.0%)	72 (31.6%)	52 (16.7%)	56 (42.4%)	50 (17.4%)
	Not at all	30 (8.3%)	23 (3.8%)	22 (9.6%)	16 (5.1%)	8 (6.1%)	7 (2.4%)
My friend helps me when I have a personal problem	Always	135 (36.4%)	345 (56.2%)	84 (37.7%)	177 (55.7%)	51 (34.5%)	168 (56.8%)
	A little	190 (51.2%)	228 (37.1%)	111 (49.8%)	117 (36.8%)	79 (53.4%)	111 (37.5%)
	Never	46 (12.4%)	41 (6.7%)	28 (12.6%)	24 (7.5%)	18 (12.2%)	17 (5.7%)
My friend helps me when I need money	Always	105 (28.6%)	255 (41.4%)	60 (26.9%)	124 (38.8%)	45 (31.3%)	131 (44.3%)
	Sometimes	182 (49.6%)	281 (45.6%)	111 (49.8%)	156 (48.8%)	71 (49.3%)	125 (42.2%)
	Never	80 (21.8%)	80 (13.0%)	52 (23.3%)	40 (12.5%)	28 (19.4%)	40 (13.5%)
My friend helps me when I have a health problem	Always	136 (36.9%)	307 (50.2%)	76 (34.2%)	154 (48.4%)	60 (40.8%)	153 (52.2%)
	Sometimes	151 (40.9%)	215 (35.2%)	92 (41.4%)	112 (35.2%)	59 (40.1%)	103 (35.2%)
	Never	82 (22.2%)	89 (14.6%)	54 (24.3%)	52 (16.4%)	28 (19.0%)	37 (12.6%)
My friend helps me when I need information about sex	Always	126 (34.8%)	204 (34.3%)	85 (38.6%)	115 (36.7%)	41 (28.9%)	89 (31.7%)
	Sometimes	103 (28.5%)	173 (29.1%)	64 (29.1%)	98 (31.3%)	39 (27.5%)	75 (26.7%)
	Never	133 (36.7%)	217 (36.5%)	71 (32.3%)	100 (31.9%)	62 (43.7%)	117 (41.6%)
In the past 3 months, I've talked with him/her about what is right and wrong about sex	Yes	215 (57.0%)	406 (66.6%)	141 (61.8%)	211 (66.6%)	74 (49.7%)	195 (66.6%)
	No	162 (43.0%)	204 (33.4%)	87 (38.2%)	106 (33.4%)	75 (50.3%)	98 (33.4%)
In the past 3 months, I've talked with him/her about what he/she things about young people having sex	Yes	173 (46.6%)	330 (54.1%)	104 (46.2%)	163 (51.3%)	69 (47.3%)	167 (57.2%)
	No	198 (53.4%)	280 (45.9%)	121 (53.8%)	155 (48.7%)	77 (52.7%)	125 (42.8%)
In the past 3 months, I've talked with him/her about my questions on sex	Yes	173 (46.5%)	318 (52.7%)	113 (50.0%)	170 (53.8%)	60 (41.1%)	148 (51.6%)
	No	199 (53.5%)	285 (47.3%)	113 (50.0%)	146 (46.2%)	86 (58.9%)	139 (48.4%)
In the past 3 months, I've talked with him/her about contraception	Yes	134 (35.4%)	225 (37.1%)	82 (35.7%)	112 (35.4%)	52 (35.1%)	113 (38.8%)
	No	244 (64.6%)	382 (62.9%)	148 (64.3%)	204 (64.6%)	96 (64.9%)	178 (61.2%)
In the past 3 months, I've talked with him/her about preventing sexually transmitted infections	Yes	271 (71.5%)	453 (73.5%)	159 (69.1%)	233 (72.8%)	112 (75.2%)	220 (74.3%)
	No	108 (28.5%)	163 (26.5%)	71 (30.9%)	87 (27.2%)	37 (24.8%)	76 (25.7%)
I think that my friend has a boyfriend/girlfriend	Yes	185 (49.5%)	256 (42.6%)	113 (49.8%)	142 (46.7%)	72 (49.0%)	114 (38.4%)
	No	189 (50.5%)	345 (57.4%)	114 (50.2%)	162 (53.3%)	75 (51.0%)	183 (61.6%)
I think that my friend has had sexual relations	Yes	131 (35.7%)	157 (26.3%)	77 (35.2%)	94 (31.2%)	54 (36.5%)	63 (21.2%)
	No	236 (64.3%)	441 (73.7%)	142 (64.8%)	207 (68.8%)	94 (63.5%)	234 (78.8%)
I think that my friend uses contraception	Yes	113 (30.7%)	137 (23.5%)	79 (35.3%)	83 (28.0%)	34 (23.6%)	54 (18.9%)
	No	255 (69.3%)	445 (76.5%)	145 (64.7%)	213 (72.0%)	110 (76.4%)	232 (81.1%)
I think that my friend has had sex with a prostitute	Yes	38 (10.5%)	35 (6.0%)	25 (11.4%)	17 (5.8%)	13 (9.0%)	18 (6.2%)
	No	325 (89.5%)	551 (94.0%)	194 (88.6%)	277 (94.2%)	131 (91.0%)	274 (93.8%)
I think that my friend has received money or gifts for sex	Yes	84 (22.7%)	106 (17.6%)	44 (19.6%)	47 (15.4%)	40 (27.4%)	59 (19.9%)
	No	286 (77.3%)	495 (82.4%)	180 (80.4%)	258 (84.6%)	106 (72.6%)	237 (80.1%)

Table 4.3: Results by Gender of Friend Nominated, by Frequency (Percent)

Question	Response	Males by Males		Females by Males		Males by Females		Females by Females	
How close are you to your friend?	Close	248	(62.0%	57	(46.0%)	69	(67.0%)	214	(66.9%)
	Very Close	152	(38.0%	67	(54.0%)	34	(33.0%)	106	(33.1%)
How much do you feel that your friend understands you?	Very much	296	(71.5%)	83	(62.9%)	65	(63.1%)	213	(66.4%)
	A little	101	(24.4%)	37	(28.0%)	34	(33.0%)	94	(29.3%)
	Not at all	17	(4.1%)	12	(9.1%)	4	(3.9%)	14	(4.4%)
How much do you feel that you have enjoyment with your friend?	Very much	311	(75.5%)	78	(60.0%)	69	(65.7%)	227	(72.8%)
	A little	88	(21.4%)	31	(23.8%)	32	(30.5%)	74	(23.7%)
	Not at all	13	(3.2%)	21	(16.2%)	4	(3.8%)	11	(3.5%)
My friend helps me when I have a personal problem	Always	208	(50.7%)	57	(43.2%)	48	(45.7%)	164	(49.5%)
	A little	171	(41.7%)	56	(42.4%)	44	(41.9%)	145	(43.8%)
	Never	31	(7.6%)	19	(14.4%)	13	(12.4%)	22	(6.6%)
My friend helps me when I need money	Always	161	(38.8%)	33	(25.6%)	45	(42.1%)	128	(39.3%)
	Sometimes	202	(48.7%)	63	(48.8%)	41	(38.3%)	150	(46.0%)
	Never	52	(12.5%)	33	(25.6%)	21	(19.6%)	48	(14.7%)
My friend helps me when I have a health problem	Always	184	(44.7%)	50	(38.5%)	41	(38.3%)	166	(50.9%)
	Sometimes	165	(40.0%)	40	(30.8%)	45	(42.1%)	116	(35.6%)
	Never	63	(15.3%)	40	(30.8%)	21	(19.6%)	44	(13.5%)
My friend helps me when I need information about sex	Always	147	(36.1%)	50	(39.4%)	34	(34.3%)	91	(29.0%)
	Sometimes	126	(31.0%)	31	(24.4%)	20	(20.2%)	92	(29.3%)
	Never	134	(32.9%)	46	(36.2%)	45	(45.5%)	131	(41.7%)
In the past 3 months, I've talked with him/her about what is right and wrong about sex	Yes	272	(65.7%)	73	(55.7%)	56	(53.8%)	195	(59.1%)
	No	142	(34.3%)	58	(44.3%)	48	(46.2%)	135	(40.9%)
In the past 3 months, I've talked with him/her about what he/she things about young people having sex	Yes	198	(48.1%)	64	(49.6%)	56	(54.9%)	172	(52.4%)
	No	214	(51.9%)	65	(50.4%)	46	(45.1%)	156	(47.6%)
In the past 3 months, I've talked with him/her about my questions on sex	Yes	213	(51.7%)	57	(43.8%)	54	(53.5%)	152	(46.9%)
	No	199	(48.3%)	73	(56.2%)	47	(46.5%)	172	(53.1%)
In the past 3 months, I've talked with him/her about contraception	Yes	145	(35.1%)	43	(32.8%)	40	(38.8%)	119	(36.3%)
	No	268	(64.9%)	88	(67.2%)	63	(61.2%)	209	(63.7%)
In the past 3 months, I've talked with him/her about preventing sexually transmitted infections	Yes	304	(72.9%)	90	(67.7%)	78	(74.3%)	240	(72.7%)
	No	113	(27.1%)	43	(32.3%)	27	(25.7%)	90	(27.3%)
I think that my friend has a boyfriend/girlfriend	Yes	200	(49.8%)	54	(41.5%)	49	(45.8%)	132	(40.1%)
	No	202	(50.2%)	76	(58.5%)	58	(54.2%)	197	(59.9%)
I think that my friend has had sexual relations	Yes	125	(32.1%)	44	(34.4%	34	(31.8%)	74	(22.3%)
	No	265	(67.9%)	84	(65.6%)	73	(68.2%)	258	(77.7%)
I think that my friend uses contraception	Yes	112	(28.7%)	43	(34.7%)	27	(26.2%)	52	(16.2%)
	No	278	(71.3%)	81	(65.3%)	76	(73.8%)	269	(83.8%)
I think that my friend has had sex with a prostitute	Yes	26	(6.7%)	11	(8.9%)	7	(6.6%)	21	(6.5%)
	No	361	(93.3%)	113	(91.1%)	99	(93.4%)	303	(93.5%)
I think that my friend has received money or gifts for sex	Yes	63	(15.9%)	24	(18.3%)	28	(26.4%)	66	(20.0%)
	No	333	(84.1%)	107	(81.7%)	78	(73.6%)	264	(80.0%)

Table 4.4: Characteristics Most Appreciated by Respondents

	Males						**Females**					
Characteristics	Nyakasura	Mpanga	About their Male Friends	About their Female Friends	About their Very Close Friends	About their Close Friends	Nyakasura	Mpanga	About their Male Friends	About their Female Friends	About their Very Close Friends	About their Close Friends
Attractive	7 (3.8%)	35 (13.1%)	16 (4.9%)	22 (20.8%)	16 (6.5%)	23 (12.8%)	1 (1.5%)	33 (9.1%)	14 (14%)	19 (6.3%)	28 (10.1%)	6 (4.7%)
Caring/Loving	21 (11%)	20 (7.5%)	25 (7.7%)	15 (14.2%)	24 (9.72%)	16 (8.9%)	9 (13.6%)	19 (5.2%)	6 (6%)	20 (6.7%)	19 (6.9%)	9 (7%)
Friendly	3 (1.6%)	5 (1.9%)	8 (2.5%)	0 (0%)	6 (2.43%)	2 (1.1%)	2 (3.0%)	4 (1.1%)	1 (1%)	4 (1.3%)	1 (0.3%)	5 (3.9%)
Good/Respectful	18 (9.7%)	20 (7.5%)	25 (7.7%)	11 (10.4%)	22 (8.91%)	15 (8.3%)	9 (13.6%)	56 (15.5%)	14 (14%)	49 (16.3%)	41 (14.8%)	19 (14.7%)
Helpful	33 (18%)	35 (13.1%)	58 (17.9%)	8 (7.6%)	41 (16.6%)	23 (12.8%)	17 (25.8%)	74 (20.5%)	16 (16%)	65 (21.7%)	60 (21.7%)	24 (18.6%)
Related/Family	1 (0.5%)	1 (0.4%)	2 (0.6%)	0 (0%)	0 (0%)	2 (1.1%)	0 (0%)	6 (1.7%)	0 (0%)	5 (1.7%)	2 (0.7%)	4 (3.1%)
Fun/Playful	36 (19%)	71 (26.5%)	77 (23.8%)	21 (19.8%)	53 (21.5%)	43 (23.9%)	5 (7.6%)	49 (13.6%)	14 (14%)	37 (12.3%)	36 (13%)	15 (11.6%)
Religious	3 (1.6%)	4 (1.5%)	6 (1.8%)	1 (0.9%)	4 (1.6%)	3 (1.7%)	1 (1.5%)	8 (2.2%)	5 (5%)	3 (1%)	5 (1.8%)	3 (2.3%)
Knowledgeable	32 (17%)	42 (15.7%)	59 (18.2%)	11 (10.4%)	34 (13.8%)	34 (18.9%)	7 (10.6%)	70 (19.4%)	20 (20%)	54 (18%)	49 (17.8%)	26 (20.2%)
Trustworthy	25 (13%)	29 (10.8%)	39 (12%)	14 (13.2%)	41 (16.6%)	13 (7.2%)	15 (22.7%)	36 (10%)	10 (10%)	38 (12.7%)	30 (10.9%)	17 (13.2%)
Other	7 (3.8%)	6 (2.2%)	9 (2.8%)	3 (2.8%)	6 (2.43%)	6 (3.3%)	0 (0%)	6 (1.7%)	0 (0%)	6 (2%)	5 (1.8%)	1 (0.8%)

References

Abraham, C., & Sheeran, P. (2007). Health Belief Model. In M. Connor & P. Norman (Eds.) Predicting health behaviour. (2nd Edition). New York: Open University Press.

African Youth Alliance. (2002). HIV/AIDS Fact Sheet: Uganda. Retrieved from http://www.pathfind.org/site/PageServer?pagename=Programs_Uganda_pubs.

Bastien, S., Sango, W., Mnyika, K. S., Masatu, M. C., & Klepp, K. I. (2008). Changes in exposure to information, communication knowledge about AIDS among school children in Northern Tanzania, 1992-2005. *AIDS Care*, 20(3), 382-387.

Bond, K. (2003). Building connections: understanding relationships and networks to improve adolescent sexual and reproductive health programs. Seattle: Program for Appropriate Technology in Health (PATH).

Brown, B. B. (1990). Peer groups and peer culture. In S.S. Feldman & G.R. Elliot (Eds.), At the threshold: the developing adolescent. Cambridge, MA: Harvard University Press.

Buhi, E. R., & Goodson, P. (2007). Predictors of adolescent sexual behaviour and intention: a theory guided systematic review. *Journal of Adolescent Health*, 40, 4-21.

Buller, D. B., Morrill, C., Tarn D., Aickin, M., Sennott-Miller, L., Buller M. K., Larkey, L, Aladtorre, C., & Wentzel, T. M. (1999). Randomized trial testing the effect of peer education at increasing fruit and vegetable intake. *Journal of National Cancer Institute*, 91(17), 1491-1500.

Cartagena, R. G., Veugelers, P. J., Kipp, W., Magigav, K., & Laing, L. M. (2006). Effectiveness of an HIV prevention program for secondary school students in Mongolia. *Journal of Adolescent Health*, 39, 925.e9-925.e16.

Eisenberg, M. E., Neumark-Sztainer, D., Story, M., & Perry, C. (2005). The role of social norms and friends' influences on unhealthy weight-control behaviours among adolescent girls. *Social Science & Medicine*, 60, 1165-1173.

Kibombo, R., Neema, S., & Ahmed, F. H. (2007). Perceptions of risk to HIV infection among adolescents in Uganda: are they related to sexual behaviour? *African Journal of Reproductive Health*, 11(3), 168-181.

Kinsman, J., Nakiyingi, J., Kamali, A., Carpenter, L., Quigley, M., Pool, R., & Whitworth, J. (2001). Evaluation of a comprehensive school-based AIDS education programme in rural Masaka, Uganda. *Health Education Research*, 16(1), 85-100.

Konde-Lule, J. K., Wawer, M. J., Sewankambo, N. K., Serwadda, D., Kelly, R., Li, C., Gray, R., H., & Kigongo, D. (1997). Adolescents, sexual behaviour and HIV-1 in rural Rakai district, Uganda. *AIDS*, 11, 791-799.

Logie, D. (2004). Unfairness of social and economic structures affecting AIDS in Africa. *British Medical Journal*, 324, 1034.

Machal, J. Z. (2001). Unsafe sexual behaviours among schoolgirls in Mozambique: a matter of gender and class. *Reproductive Health Matters*, 9(17), 82-90.

Martens, M. P., Page, J. C., Mowry, E. S., Damann, K. M., Taylor, K. K., Cimini, M. D. (2006). Differences between actual and perceived student norms: an examination of alcohol use, drug use, and sexual behaviour. *Journal of American College Health*, 54(5), 295-300.

Merakou, K., & Kourea-Kremastinou, J. (2006). Peer education in HIV prevention: an evaluation in schools. *European Journal of Public Health,* 16(2), 128-132.

National AIDS Documentation Centre. The official website of the Uganda AIDS Commission. Retrieved March 18, 2009 from http://www.aidsuganda.org/.

Neema, S., Ahmed, F. H., Kibombo, R., & Bankole, A. (2006). Adolescent sexual and reproductive health in Uganda: results from the 2004 national survey of adolescents. *Occasional Report No.25*. New York: Guttmacher Institute.

Nyanzi, S., Pool, R., Kinsman, J. (2001). The negotiation of sexual relationships among school pupils in south-western Uganda. *AIDS Care*, 13(10), 83-98.

Pick, S., Givaudan, M., Sirkin, J., & Ortega, I. (2007). Communication as a protective factor: evaluation of a life skills HIV/AIDS prevention program for Mexican elementary-school students. *AIDS Education and Prevention*, 19(5), 408-421.

Real, K., & Rimal, R. N. (2007). Friends talk to friends about drinking: exploring the role of peer communication in the theory of normative social behaviour. *Health Communication*, 22(2), 169-180.

Selvan, M. S., Ross, M. W., Kapadia, A. S., Mathai, R., & Hira, S. (2001). Study of perceived norms, beliefs and intended sexual behaviour among higher secondary school students in India. *AIDS Care*, 13(6), 779-788.

Shuey, D., A., Babishangir, B., B., Omiat, S., & Bagarukayo, H. (1999). Increased sexual abstinence among in-school adolescents as a result of school health education in Soroti district, Uganda. *Health Education Research*, 14(3), 411-419.

Sieving, R. E., Eisenberg, M. E., Pettingell, S., & Skay, C. (2006). Friends' influence on adolescents' first sexual intercourse. *Perspectives on Sexual and Reproductive Health,* 38(1), 13-19.

STATA 9 Data Analysis and Statistical Software. College Station, Texas: StataCorp LP.

Twa-Twa, J. M. (1997). The role of the environment in the sexual activity of school students in Tororo and Pallisa districts of Uganda. *Health Transition Review*, Suppl 7, 67-81.

Uganda Ministry of Health, *The National Health Policy.* Kampala, Uganda: Ministry of Health, 2000.

Visser, M. (2007). HIV/AIDS prevention through peer education and support in secondary schools in South Africa. *Journal of Social Aspects of HIV/AIDS*, 4(30), 678-694.

Ybarra, M. L., Emenyonu, N., Nansera, D., Kiwanuka, J., & Bangsberg, D. R. (2008). Health information seeking among Mbararan adolescent: results from the Ugandan Media and You survey. *Health Education Research*, 23(2), 249-258.

Endnotes

[1]The survey was divided into seven sections, but only five are considered for this manuscript. Complete survey results can be found in the Appendices of this thesis.

CHAPTER FIVE

RECOMMENDATIONS AND FUTURE DIRECTIONS

5.1 Introduction

The present study was developed in the context of informing the initial stages of a peer-education based health intervention for adolescents in Uganda. The preceding chapters have highlighted the current need in the country for HIV/STI prevention programming, and have identified social network analysis as a unique analytical tool for gaining insight into the youth population in hopes of creating a more effective program. In close association, investigation into the context of peer relationships has also produced valuable information that will be useful to program planners, and anyone who is interested in a rich characterization of youth friendships.

As outlined in Chapter 1, the research objectives are:

Objective #1: Who are the leaders who influence the transmission or adoption of innovations or norms? Identification of these individuals as peer educators has the potential of creating a more efficient peer education program. Secondarily, knowledge about the network and community structure may inform other aspects of a peer education or health promotion program for youth.

Objective #2: What are the supportive relationships that exist amongst youth? How do young people feel about communicating with their friends? What are the behaviours taking place in relationships? The characterization of friendships and supportive relationships in an adolescent school population will help provide insight into communication patterns and possibly behavioural choices.

How well are these objectives met? In Chapter 3, we used two measures of centrality to identify influential peers in two different networks. The particular combination has not been used, as far as we know, to select peer educators, especially

given that we used two different types of networks (Friendship and Sexual Health) that were subsequently combined. Modelling, by way of sociograms, visually confirms that these individuals have both influence and reach, and their utilization as peer educators will aid diffusion of the message, and has the potential of resulting in sustainable behavioural change (by virtue of the influence factor). In Chapter 4, we examined youth friendships, and identified patterns of support and communication. For different types of support, youth turn to their very close friends. For communication about sexual and reproductive health matters, youth are equally likely to talk to their very close or close friends. In addition, the rate of communication about sensitive matters is not high, except in the case of STI prevention.

5.2 Recommendations

1. Trials should be performed that demonstrate the efficacy of using peers educators selected by social network analysis vs. peer educators selected by different types of means. We hypothesize that a greater diffusion of information and sustainable behavioural change is more likely to occur in the network-selected peer educator group because natural modes of influence and channels of communication will be utilized. In our study, we are able to visually verify that our suggested peer educators are well situated in information pathways, but we are unable to demonstrate how this will work in real life. We demonstrated that this type of analysis is feasible when an institution has access to basic social network analysis software and a computer; however, we realize that in resource-poor settings, this may not always be the case. For this study, we used UCInet 6, which is an inexpensive ($40USD), simple to use technology, though

some training in basic data entry and analysis would be beneficial. As with any type of analysis, access formal professional consultation and support would be valuable for any problems that arise. When a network is small, social network analysis can be done by hand, and influential, strategically connected individuals can be intuitively identified. Unfortunately, it is very difficult to perform centrality and subgroup algorithms without computer software.

When planning a study, we believe that particular attention should be paid to the following two points:

a) Boundary specification should be approached with great care, and a vision of how peer education will be delivered should be in place to aid this process.

b) There are different types of networks within a community. From the very beginning, consideration must be made in the type of network sought. We have looked at a combination of two different networks, and we believe that this will successfully identify effective peer educators.

2. When choosing peer educators for a program, attention must be paid to gender proportions within the community, as we demonstrated that there is communication selection by gender.

3. Research into network stability needs to be performed, particularly because a peer education system may extend through multiple years of secondary school. The Headmasters at Nyakasura and Mpanga indicated that they would prefer that peer educators remain the same throughout S2-S6, as to minimize training time and allow these individuals to develop a certain expertise. Longitudinal analysis would tell us if the chosen individuals maintained their high centrality measures throughout their school

career. Interestingly, it would also allow us to see if their high centrality measures were dependant only on their relationships at the time of the survey, or if they were inherent in the individual. If that was the case, a more careful exploration of their other characteristics may add to the body of knowledge regarding the identification of key opinion leaders.

4. Peer education programs can use levels of sexual and reproductive health communication in their process and impact evaluation, when studied longitudinally. We have demonstrated that these measures can be defined in a youth population, and, in this particular setting, there is room for growth in the level of communication in relationships. In addition, one can see if there are network changes associated with interventions. It may be that a very important value of SNA is not just selecting peer educators, but tracking the progress of a peer education program.

5.3 Unexpected Findings

Social Network Analysis

The lack of easily identifiable subgroups was surprising. Attempts at various measures, including clique, n-clique, n-clan, and k-plex gave unmanageable results, indicating that there is a high level of connection within the schools. The use of the Girvan-Newman algorithm allowed us to identify community-like structures, but it was not without problems, such as identifying single nodes as entire communities. However, Girvan-Newman was very useful for two reasons: firstly, it highlighted the presence of small isolated groups of three or fewer members, which was not possible with the clique or clique-type analyses; and, secondly, it clearly showed us that there are strong gender-

based ties in both the Friendship and Sexual Health networks, though these were stronger in the Sexual Health network. This strengthens the recommendation that peer educators are proportionally represented by gender. As for the presence of small isolated groups, these disappeared when the entire Mpanga school network was examined, suggesting that these individuals were misclassified into the wrong grade. This was discussed further in chapter three.

Adolescent Friendships

A discrepant perception between very close and close friends with regards to sexual activities was an unexpected finding. Various health behaviour theories state that perceptions have an impact on decision-making, and investigation into perceptions and norms is useful when trying to understand health behaviours and individual motivations. Our collection of network data alongside survey data will allow us to look at these perceptions structurally and investigate whether network measures are correlated with perceptions, by assigning various attributes to the student nodes. This, however, is beyond the scope of this particular publication.

5.4 Final Conclusion

We satisfactorily addressed our research objectives, but the work is still preliminary and much can be built on this foundation. We can conclude that a close examination of networks and relationships in youth populations is a fruitful venture for those who hope to create effective and targeted health programming. The Personal Network Survey (results discussed in Chapter 4) established that youth are willing to talk about certain sensitive matters, such as STIs, which suggests that they are open to

communicating about other issues that may affect their health. The Total Network Survey (results discussed in Chapter 3) verified that it is feasible to identify those who are critical in the lines of communication and influence. Taken together, both sets of data demonstrate that there is selective and/or limited communication about sexual and reproductive health within youth relationships in the Kabarole District in Uganda. There is space to create a grander interpersonal discourse on these matters, and the possibility to utilize the most effective route to do so.

APPENDICES

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A.1 Data Collection, Pretesting, and Research Assistant Training

Selection of Research Assistants

Mpanga Secondary School has approximately 400 students in the S2 grade but only had facilities to handle about 75 students at a time. The faculty members at this school strongly desired all students to be done at the same time and were reluctant to use very much in school time, which created the need to hire at least 5 research assistants because the surveys would be administered in 6 different classrooms. Nyakasura school has approximately 130 students in the S2 grade, with available facility to seat all of the students at the same time.

After discussion with senior staff at the research project office, a formal interview and hiring process was deemed unnecessary due to the relative simplicity of the survey administration and absence of follow-up or probing questions. Rather, research assistants were selected from recently graduated (from S6) who had occasionally assisted with research projects through the district health offices. 2 males and 3 females were selected and they were between the ages of 19 and 22. One of the females was formally employed as a research assistant and the other individuals were self employed as they attempted to support themselves through higher education.

Training Days

A training manual was created based on our previous professional experience with training similar aged individuals in Canada. Advice was also sought from the local researchers and professionals about possible training needs specific to individuals from developing countries. The final manual is 11 pages in length and includes information and training activities, and is found at the end of this section.

One and a half days were assigned for training. The first day began with introductions, followed by a thorough review of the survey questions. At this juncture, feedback was sought about the questions for understanding, since the difference in age between the S2 students and the research assistants is not substantial. Survey administration was then outlined in detail, after which the research assistants received time to individually create their presentation for the students. The researchers then recited their presentation to the others present as though they were saying it to the students. Feedback was given from the principle researcher and the other research assistants. After a break for lunch, the research assistants practiced their presentation on a selection of students for pre-testing. Each research assistant was assigned 2 students to which they had to instruct how to use the surveys. The pre-test students then completed the surveys. As this was part of the official pre-testing, after the students finished the surveys, an in-depth discussion was held about the understanding of each of the questions on each of the surveys.

The changes made after the pre-testing session are as follows:

1. For the Personal Network Survey
    a. 2 questions are added as number 3 and 4 about how many friends either do not go to school or are in a different class to help the study subjects understand that the survey is asking about total number of friends.
    b. Additional lines are added to allow students to give a more complete response to written questions “where did you meet ___?” and “what characteristics do you like about ____?”

c. "____ is able to make me feel better when I am upset" is changed to "_____is able to make me feel better when I am in bad moods" to reflect common local language

d. The term "cheers me up" is changed to "makes me laugh" for the same reason as 'c'.

e. The statement "I would like to be him/her" is changed to "I would like to be like him/her" as there was confusion of the meaning of the first statement.

f. Another question is added (#29) about perceived disapproval of sex before marriage to try to measure the influence of the friends on the subjects.

g. Another question is added about receiving money or gifts for sex as the pre-test students indicated that this would be a relevant question with regards to sexual behaviours.

2. For the Total Network Analysis

a. This survey was generally well understood. The only change made was using the word "class" rather than "grade" to refer to all of the students at the same level. The word "grade" in reference to a complete student group is not widely used.

b. A place to for the students to write their full name was added as question number one.

The pre-test students were thanked for their time, and the researcher debriefed the research assistants about both the changes in content of the surveys and their impressions about the first training day.

The second training session was a half day event that involved starting with a review of the research and its purpose. Questions were invited from the research assistants of which there were none. One change was suggested to the Personal Network Survey, and this was to change the word "contraception" to "family planning methods", despite efforts by the researcher to ensure that this term was understood by the pre-test students. Since the surveys were already duplicated in bulk, it was agreed that each of the research assistants would specifically clarify this point while they were giving their presentation and instructions. After this, each of the research assistants performed their planned talk, after which they received feedback from the group.

Data Collection

For Mpanga Secondary School, there were 5 hired research assistants and the head researcher present to survey 6 classrooms of students simultaneously. If all of the students were present, there would have been approximately 75 per classroom; however the classrooms were on average 2/3 full. The survey process took about one hour, from survey introduction, administration, and completion. All 6 data collections took between 45 and 70 minutes. A group debrief with the research assistants revealed that their task was more difficult than expected because it was hard to gain the complete attention of the students and some of the students asked inappropriate questions, likely for the purpose of humour. The female research assistants took longer than the male assistants, perhaps because it was more difficult for them to achieve a settled and quiet classroom due to

traditional gender roles and closeness in age of research assistant and participant. The researcher also experienced difficulty quieting her classroom and had to be quite persistent through inappropriate questions and comments before the students were prepared to listen to instruction.

For Nyakasura Secondary School, there were 3 hired research assistants and the head researcher present to survey all of the S2 students in one large chapel. The research assistants divided roles in their presentation and were all available to assist the other during the data collection.

Reflections

It was initially worrisome that there was not going to be a formal interview process, but reassurances were received as to the relative differences in experience of the researcher and the project office staff. The first meeting with the research assistants created some concern as one of the research assistants appeared to be underconfident and had difficulty understanding instruction. After completion of the first training day and individual private feedback, he showed remarkable improvement by the second training day; however, concerned still existed. During the data collection at the Mpanga Secondary School, it was clear that there needed to be an emphasis on the students completing the survey independently, for as soon as they received the survey they tried to work on and review it with their classmates, and it was difficult to persuade them to halt this type of activity as the classroom became very noisy once the surveys were handed out. When the researchers were questioned about their experiences, it difficult to ascertain the amount of distance that was maintained between students or how much effort was devoted to this activity; however, each research assistant maintained that they

had a degree of success when asking students to not share information with one another. The clear message obtained was that this aspect was the most challenging. Other difficulties encountered included solicitation for sponsorship from the head researcher by way of the research assistant. This interfered with the completion of the surveys and the concentration of the respondents.

There were distinct differences in the data collection between the two schools, primarily that there was more than one research assistant present and the entire grade was done simultaneously in the same space. The ratio of student to researcher was preserved; however, having more than one research assistant in the room helped maintain order, as did their previous data collection experience and the lesson learned that the maintenance of order needed to be addressed promptly. It is also possible that there was a true difference between the schools that resulted in a higher degree of apparent order. Limited observation of the students in recreation and the classroom showed that there might be behavioural differences between the schools, which might be explained by their structural differences (boarding vs. day) or different teaching policies.

In retrospect, the head researcher should have included more specific training for presentation styles and classroom management/teaching skills, as the research assistants communicated their frustrations at the difficulty of the task. They did not express that they felt that their training could be more in depth. Additionally, the head researcher was likely not an appropriate person to directly perform the data collection, which was the case at Mpanga Secondary School. The additional issues that stalled the settling efforts were directly related to the researcher's gender and race, as there were interruptions to ask for sponsorship, favours, and relationships.

Focus groups prior to completion of the surveys would be useful in making the tools more culturally specific. This was evident when the students and research assistants suggested "receiving money or gifts for sex" was a relevant question to ask in regards to perceived norms and behaviours.

In order to further characterize the experience of the research assistants, individual interviews could be held to gain detailed information about their classroom time. This would also inform investigation into the validity of the research results. Unfortunately, time did not allow this to occur. Another benefit from such interviews would be to inform other training efforts of research assistants that are selected from the local population.

A.2

Research Assistant Training Manual

Amanda Nischuk's Thesis Research: Social Network Analysis of Secondary Students in Fort Portal, Uganda

Schedules for Training Days

Monday, May 19th

0900 – Introductions and give manual
0930 – Go through manual
1000 – Time to create Individual Scripts
1100 – Practise survey administration on other RAs
1200 – Get feedback on survey administration
1300 – Lunch time
1400 – Practise survey administration on students for pre-test
1500 – Ask students about their experience with the survey
1600 – Debrief the training day and ask questions

Survey Administration day, Tuesday, May 27th

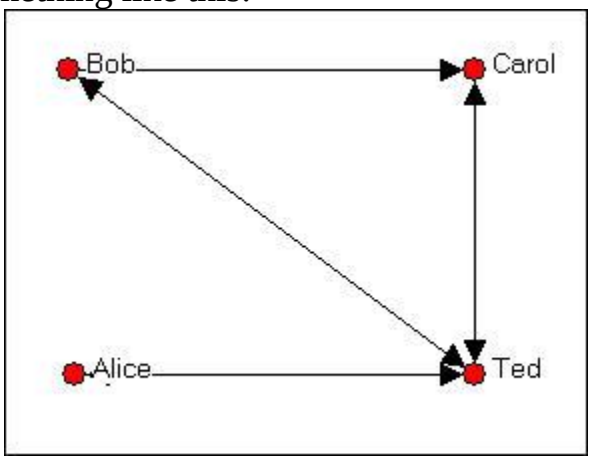
0930 – Meet at District Health Office and obtain survey package
1000 – Review any changes in survey resulting from pre-test
1030 – Practise introduction and survey administration
1200 – Get feedback on performance
1230 – Lunchtime
1345 – Travel to Mpanga School and get classroom assignments
1430 – Begin survey administration in individual classrooms
1600 – Give all materials back to Amanda Nischuk

Introduction to Social Network Analysis

What is Social Network Analysis?

There are a number of factors that affect health choices. One of the ones that I am interested in is peer relationships. For example, if I was studying the why young people choose to smoke cigarettes, I could look at whether or not their friends were smokers because I feel that this may impact their decision to smoke. Also, if the people that they spent time with had a positive attitude towards smoking, I think that the individual would be more likely to choose to smoke. These types of factors are present because of **social relationships**. Because we know that the types of social relationships that adolescents have can affect their behaviours and decisions, researchers have developed certain techniques to examine social relationships. One of these techniques is called **Social Network Analysis**. By doing Social Network Analysis, we can find out very important information that will allow health program planners to plan better health promotion programs. For example, a planner of an HIV/AIDS prevention program can use the information from my study to help plan a better program.

Social Network Analysis will create a map for us to look at. The map may look something like this:



In this map, each circle represents a **person**, and the lines with arrows represent whether or not these individuals communicate with one another. We can also make this map more meaningful by also asking specific **questions** about the lines between each person. For example, we can ask how often they communicate, if they also do activities together, if they help each other out with personal problems, etc. Using written surveys collects this type of information. You will help me distribute and collect these surveys.

Types of Surveys

There are two types of surveys that we will use. I have titled them 1)**Personal Network Survey,** and 2)**Total Network Analysis**. These will be completed separately because they each need a different explanation. These surveys ask questions about friendships within the S2 grade at the school. It is important for you to stress that the questions are only about other S2 students, not any students from other grades.

You will give the **Personal Network Survey** first. This survey may take up to 45 minutes for the students to complete.

After the students have completed the first survey and handed it in to you, you will introduce the second survey (**Total Network Analysis**). This survey may take up to 15 minutes to complete.

Administration of Surveys –
YOUR DUTIES AS A RESEARCH ASSISTANT

You are each responsible for a complete classroom of secondary students. There will be approximately 75 students in each class. There should be a teacher present to help you make sure that everyone is quiet and ready to listen to you. It might be hard to get everyone's attention, so you have to make sure that you speak **very clearly and loudly**. We need to make sure that the students understand you.

You will do the following:

1. Briefly introduce yourself and the research project. For instance, you will say something like: "*Hello, my name is _____. I am here assisting Amanda Nischuk, who is a researcher from the University of Alberta in Canada. She is doing research with S2 students. The type of research that she is doing is about relationships and communication with your friends. The purpose of this research is to find out information that can help plan health promotion programs, such as an intervention to help educate youth about the prevention of HIV/AIDS."*

2. Explain that there are 2 activities today, both are written surveys. Tell them that they will be doing each separately, so after they are done the first one they must remain quiet and attentive until everyone is ready to hear about the next activity. Here is the suggested speech "*We will be doing 2 activities today. There are 2 different types of surveys. Because they are different, I will talk about them separately. So, after you are finished with the first one, please remember to stay seated and quiet. Once everyone is finished, we will begin the second survey"*

3. It is extremely important to talk about confidentiality. I have gotten ethics approval from both the University of Alberta and the School of Public Health at Makerere University because I have assured them that I will maintain student confidentiality. So, you must cover the following information:
    a. Each student must place their name on each survey, but the <u>only</u> person who will see this name is me, Amanda Nischuk

b. Once the surveys are handed in, each student name will be converted to a number code, and only I will have the key to that code

c. The teachers and administrators of this school will not have access to this key, so they will not be told of your individual answers

Here is your suggested speech: "*It is important for me to tell you about confidentiality. In order to make sure that you feel comfortable answering all of these questions, Amanda Nischuk has made sure that all of your answers will remain confidential, or secret. She will achieve this by creating a numerical code that will be assigned to each of your names after you hand in the survey. This way, no one but her can identify your survey. Not even the teachers or administrators of this school will know the key to the numerical code."*

4. Another important detail is that completing this survey is a voluntary task. If any of the questions make anyone uncomfortable, they do not have to answer. You could say something like this: "*As you are completing the surveys, if any of the questions make you feel uncomfortable, you do not have to answer them.*

5. It will now be time for the first survey to be administered. This is the **Personal Network Survey.** You must give the following instructions to the students:
   a. This survey may take up to 45 minutes to complete.
   b. Write their name CLEARLY on the first page of the survey. The students are going to be asked questions about their 3 closest friends. Write their chosen closest friends initials very clearly in the spaces provided. Demonstrate how to remember which friend corresponds to each column, so they do not accidentally give the wrong information about their friends.
   c. Go through all of the questions and answer each of them about their 3 friends.
   d. When the students are finished, fold their paper in half with the written portion on the inside so no one can see what they have written. You will pass an envelope down each row, place the completed surveys inside.
   e. Once everyone is finished and you have collected all of the surveys, you will explain the second survey.

6. It will now be time for the second survey to be administered. This is the **Total Network Analysis**. You must give the following instructions:
    a. This survey is much shorter and will only take a few minutes to complete.
    b. Each student will be asked for the names of up to 7 individuals IN S2 GRADE for 2 questions. It is very important to write their full names, very clearly
    c. When they students are finished, fold the survey in half with the written portion on the inside so no one can see what they have written. I will pass an envelope down each row, place the completed surveys inside

Training Activities

1. **Write your introduction of yourself and this research project as how you will say it to the classroom full of students:**

2. **Write out what you will say to the students about the activities that they will do:**

3. **Write out how you will explain confidentiality to the students:**

4. **Write out how you will tell the students that their participation is voluntary:**

5. **Write out how you will instruct the students to complete the Personal Network Survey:**

6. **Write out how you will instruct the students to complete the Total Network Analysis:**

7. **Describe how you are going to collect the surveys once the students are finished with them:**

8. **What are some of the most important points that you must get across today?**

B.1 Data Analysis Process

Social Network Analysis

After assigning each student a numerical code, the data was entered into a spreadsheet. This was transformed into DL language, which is a format recognized by the UCInet 6 social network analysis program. Attribute databases were also created, which allowed us to identify nodes based on various characteristics in the sociograms. UCInet 6 was used for the network measures of reach centrality, betweenness centrality, degree centrality, subgroup identification, and network degree. NetDraw, a visualization program within the UCInet 6 suite, was used to create all of the sociograms. The program is also capable of certain data analysis procedures, namely highlighting degree and betweenness centrality by changing node size, and using the Girvan-Newman analysis to identify community-like structures.

Personal Network Survey

Students were assigned the same numerical code as for social network analysis, which permitted linking of attribute data gathered from the personal network survey into the social network analysis software. The remainder of the questions were entered into a spreadsheet database, and uploaded into STATA 9 statistical software. This computer program was used to generate frequency tables and descriptive statistics.

B.2 Additional Analysis – Clique Identification

Clique Analysis

Recall that as defined previously, a clique is a group that is maximally connected; that is, every node in the clique has a direct tie with every other actor in the clique. This is a strict definition that is often not easily operationalized in practice, due to very large numbers of small cliques identified, so there are several possible techniques for identifying the subgroups by relaxing the definition of clique somewhat. For this project, it was decided that the hierarchical clustering of clique overlap would initially be evaluated to determine subgroups. This type of analysis clusters the cliques based on how many nodes they have in common. This was decided because other subgroup measures were difficult to work with; for example, using an n-clique analysis (where each individual is connected to other group members with a tie of 'n' path-length or less) with Mpanga school class X yielded 800 2-cliques when the minimum group membership was 5, and increasing the minimum group membership to 10 resulted in 404 2-cliques. An n-clan is another alternative, where each individual is no further than 'n' steps away from other group members, but each connection must occur only through other group members. Unfortunately, the analysis of n-clans also gave an unmanageable number of results. Again using the example of Mpanga Class X data, there were 70 2-clans identified with a minimum group membership of 5, and there was a very high level of overlap with 26 levels (some individuals had 26 n-clans in common). The last alternative explored was using the k-plex approach, where each member must have 'n-k' ties to other members. Similar to the other relaxed clique approaches, the k-plex technique yielded too many groups to work with.

Nyakasura School – "Whom do you like as a friend?"

For clique analysis, the data must be symmetrical; that is, when person A nominates person B, then person B will also nominate person A. However, this is not always the case, and there are several possible reasons. First, person A may like person B, but the reverse is not true. Second, person B may have forgotten to mention that they had a relationship with person A. Third, person B may remember that they have a relationship with person A, but they were only allowed to nominate a limited number of individuals, and person A was left off the list. In most cases, it is assumed that forcing symmetry is acceptable practise, especially if there is a high amount of reciprocity occurring. In this study, the students were asked to nominate a maximum of seven friends, and so limits were imposed on their responses. Additionally, the level of reciprocity was quite high, so the decision to symmetrize the data was comfortably made.

A clique analysis was performed which revealed 22 cliques. The minimum number of clique members was set at 4, as 3 members revealed too many cliques to reasonably work with, and 5 members resulted in too few. There are many actors that are not in any cliques. There is a good deal of overlap between the cliques, so further analysis looks at co-group clustering. Visually, six groups with the following actors can be defined:

{17, 35, 92, 105, 50, 15, 120}
{34, 7, 133, 98, 124}
{131, 119, 13, 18, 3, 23, 138, 48, 129, 20, 11, 33}
{68, 47, 62, 118, 60, 55, 59, 67}
{8, 26, 81, 96, 9, 32, 4, 24, 32, 10, 1, 31, 39, 127, 122, 130, 73, 115}
{25, 38, 116, 117}

Nyakasura School – "Who have you talked to about sexual health matters?"

The data was symmetrized and standard clique analysis was performed. The minimum number of clique members is set at 4. 11 cliques are identified and overlap was noticed. Co-group clustering visually reveals the presence of 4 groups with the following actors:

{84, 92, 105, 109, 14}
{35, 17, 15, 105, 50, 68, 62, 92}
{17, 50, 68, 60, 62, 47, 59, 118, 100}
{39, 127, 130, 122}
Actors 92 and 105 are present in groups 1 and 2, indicating that they may be important. Similarly, actors 17, 50, and 68 are present in groups 2 and 3.

Mpanga School – "Whom do you like as a friend?"

Class X

The data was symmetrized and standard clique analysis was performed. The minimum number of clique members is set at 4, and 30 cliques are identified. Because there is considerable overlap, groups are identified using group co-membership clustering. Visually, 6 groups are identified with the following actors:

{16, 24, 28, 37}
{3, 17, 23, 29, 424}
{21, 22, 35, 204, 44, 68, 75, 80, 45, 47, 66, 65, 84, 61, 91}
{57, 58, 60, 67, 92, 82, 9, 71}
{46, 73, 78, 82, 90, 30, 42, 9, 18, 6, 51, 423, 54, 56, 58}
{73, 78, 79, 85, 70, 72, 77, 88, 421, 89}
Overlap occurs in groups 4, 5, and 6 by actors 58, 82, 73, and 78.

Class Z

The data was symmetrized and standard clique analysis was performed. The minimum group membership is 4, and 27 cliques were found. Analysis of the group membership overlap reveals the presence of 6 subgroups:

{261, 296, 311, 336}
{279, 287, 298, 331, 280}
{299, 302, 309, 327, 310, 322, 307, 317, 329,}
{258, 267, 268, 270, 271, 294, 275}
{254, 260, 264, 276, 427, 278, 273, 428, 301, 314, 308, 323, 333}
{260, 318, 320, 325, 289, 319, 339, 426, 306, 335, 324}
There is minimal individual overlap; only actor 260 appears in 2 groups.

Class Y

The data was symmetrized and standard clique analysis with a minimum group membership of 4 was performed. There were 31 cliques found and group overlap was analyzed. The following groups are visually identified:

{503, 542, 560, 561, 562, 558, 572}
{537, 539, 549, 570, 541, 555, 557, 566}
{501, 520, 528, 536, 541, 555, 516, 503, 549}
{503, 529, 531, 551, 554, 505, 510, 530, 534, 525, 535, 533, 522, 554, 538}
{507, 509, 536, 549, 569, 511, 513, 515, 544, 563}
There is considerable individual overlap in these groups. Actors 549, 541, 555, 503, and 536 are all present in more than 2 groups.

Class M

The data was symmetrized and standard clique analysis was performed. The minimum number of clique members is set at 4, and 15 cliques are identified. As there is member overlap, groups are identified using group co-membership clustering. Visually, 6 groups are identified with the following actors:

{607, 610, 615, 623, 630}

{602, 605, 621, 622, 625, 604, 613}
{616, 624, 627, 628, 617, 626, 629}
{635, 638, 645, 654, 637, 639, 648, 633, 640}
(634, 642, 646, 651, 649}
{647, 653, 658, 664}

Class P

The data was symmetrized and standard clique analysis was performed, specifying that the minimum groups size is 4. 9 cliques were found. Analysis of the group membership overlap reveals the presence of 3 subgroups:

{732, 754, 755, 765, 769, 768}
{705, 738, 740, 759, 771, 751, 716, 722, 727, 739}
{703, 710, 722, 730}
Only actor 722 is present in more than one group.

Class N

The data was symmetrized and standard clique analysis was performed. The minimum group membership is 4, and 11 cliques were found. Analysis of the group membership overlap reveals the presence of 3 subgroups:

{806, 811, 827, 836, 848}
{802, 815, 818, 831, 823, 832}
{803, 808, 810, 815, 801, 833, 823, 832, 802}
There is some overlap in the last two groups with actors 802, 815, 823, and 832 appearing in each group.

Mpanga School – "Who have you talked to about sexual health matters?"

Class X

The data was symmetrized and standard clique analysis was performed. The minimum number of clique members is set at 4, and 15 cliques are identified. Because

there is considerable overlap, groups are identified using group co-membership clustering. Visually, 5 groups are identified with the following actors:

{14, 18, 37, 38}
{45, 65, 66, 75, 91}
{22, 30, 35, 73, 6, 21, 204}
{73, 78, 89, 90, 56, 82}
{70, 72, 77, 79, 421, 56, 82, 78, 85, 88}
Actors 73, 78, 56, and 82 appear in more than one group.

Class Z

The data was symmetrized and standard clique analysis was performed. The minimum group membership is 4, and 18 cliques were found. Analysis of the group membership overlap reveals the presence of 4 subgroups:

{279, 280, 287, 331}
{254, 260, 278, 301, 314, 427, 264, 276}
{308, 314, 323, 333}
{291, 318, 320, 324, 260, 325, 335, 319, 426, 329, 339, 313}
Actor 314 appears in more than one group.

Class Y

The data was symmetrized and standard clique analysis with a minimum group membership of 4 was performed. There were 28 cliques found and group overlap was analyzed. The following groups are visually identified:

{512, 516, 518, 524, 519}
{539, 555, 566, 570, 541}
{503, 551, 554, 562, 501, 520, 528, 533, 536}
{504, 529, 530, 531, 505, 533, 562, 534, 525, 561}
{525, 533, 560, 562, 509, 558, 550, 572, 559, 561, 542, 567}
Actors 562, 533, and 561 appear in more than one group.

Class M

The data was symmetrized and standard clique analysis was performed, specifying that the minimum groups size is 3, as a group size minimum of 4 resulted in

too few cliques. 17 cliques were found. Analysis of the group membership overlap reveals the presence of 4 subgroups:

{654, 656, 670}
{616, 617, 618, 624, 627, 628}
{609, 614, 630, 612}
{614, 653, 658, 602, 605, 625, 604, 664, 615, 647, 612, 622, 662}
Only actor 614 appears in more than one group.

Class P

The data was symmetrized and standard clique analysis was performed, specifying that the minimum groups size is 3, as a group size minimum of 4 did not reveal too few cliques. 19 cliques were found. Analysis of the group membership overlap reveals the presence of 6 subgroups:

{725, 733, 735, 736}
{732, 755, 765}
{703, 710, 722, 730, 738, 764}
{761, 767, 770}
{748, 756, 759, 768}
{707, 717, 720, 705, 740, 750, 757, 766, 749, 722, 751, 771, 759, 738}

Actors 722, 738, and 759 appear in more than one group.

Class N

The data was symmetrized and standard clique analysis was performed. The minimum group membership is 3 (a minimum of 4 only resulted in 3 cliques), and 38 cliques were found. Analysis of the group membership overlap reveals the presence of 3 subgroups:

{813, 844, 861, 863, 851}
{803, 813, 837, 802, 808, 801, 817, 805, 828, 838, 810, 832, 833, 840, 815, 823, 818, 839}
{805, 821, 827, 862, 804, 840, 852, 866, 811, 850, 806, 845, 836, 848, 842, 859, 864, 855, 863}
Actors 813, 863, 805, and 840 have multiple group memberships.

B.3 Additional Analysis – Girvan-Newman Sociograms

Figure B.3.1: Nyakasura Friendship Network, Girvan-Newman Analysis

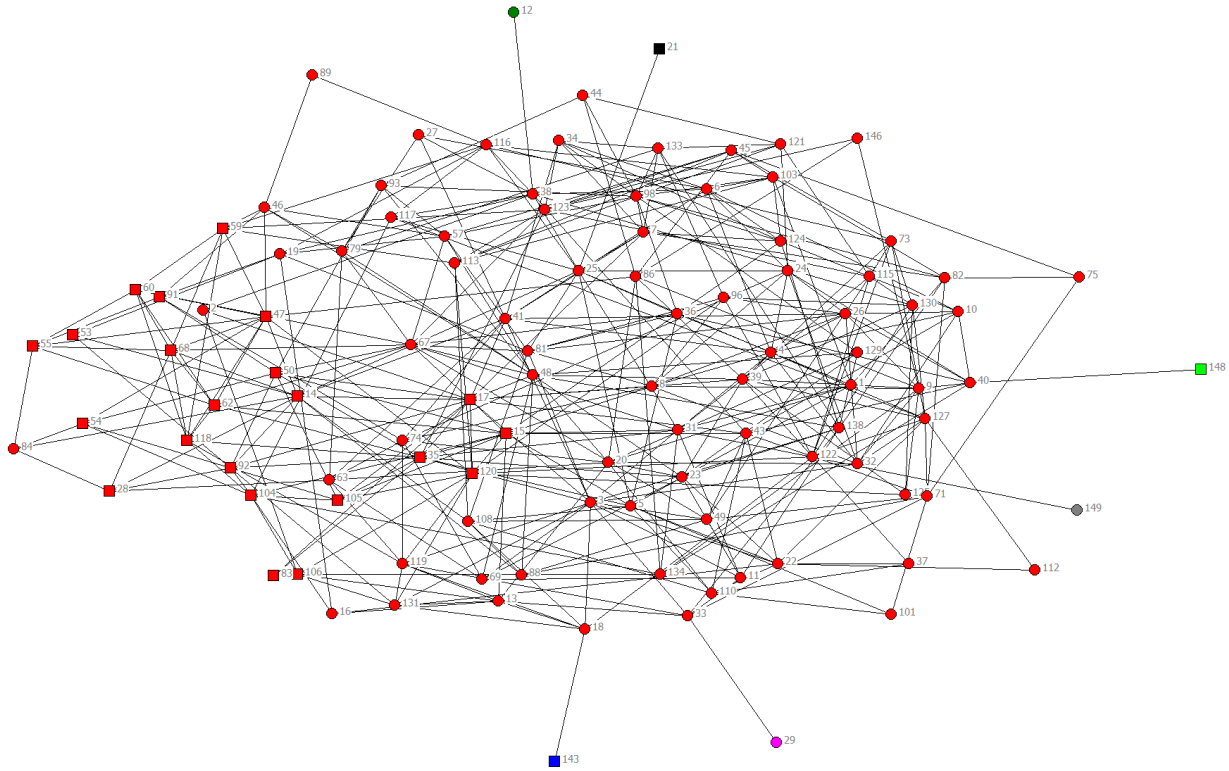


Figure B.3.2: Nyakasura Sexual Health Network, Girvan-Newman Analysis

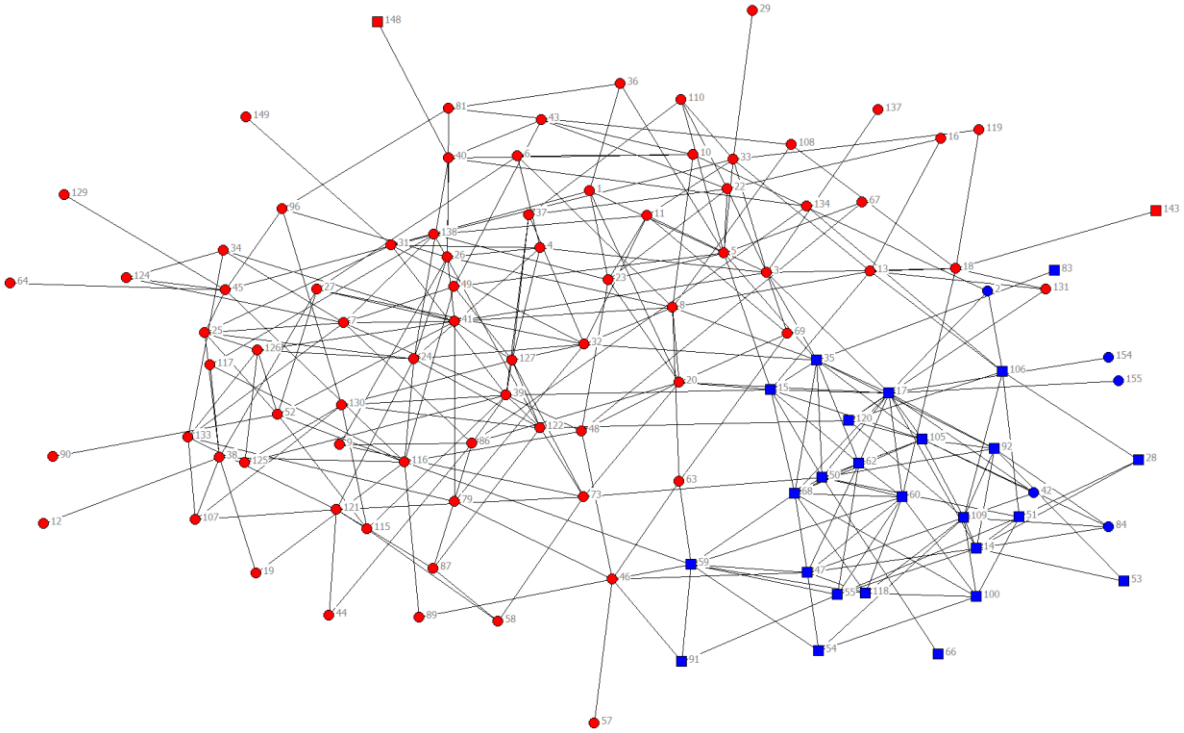


Figure B.3.3: Mpanga Sexual Health Network, Girvan-Newman, Class X

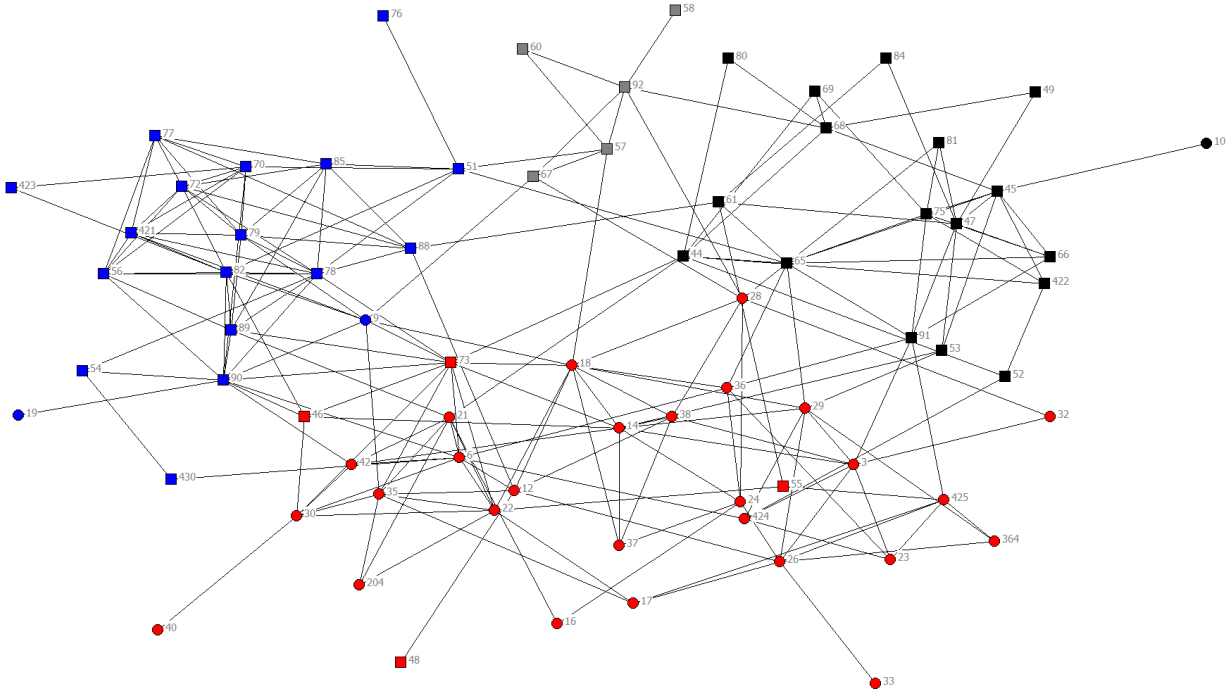


Figure B.3.4: Mpanga Friendship Network, Girvan-Newman Analysis, Class X

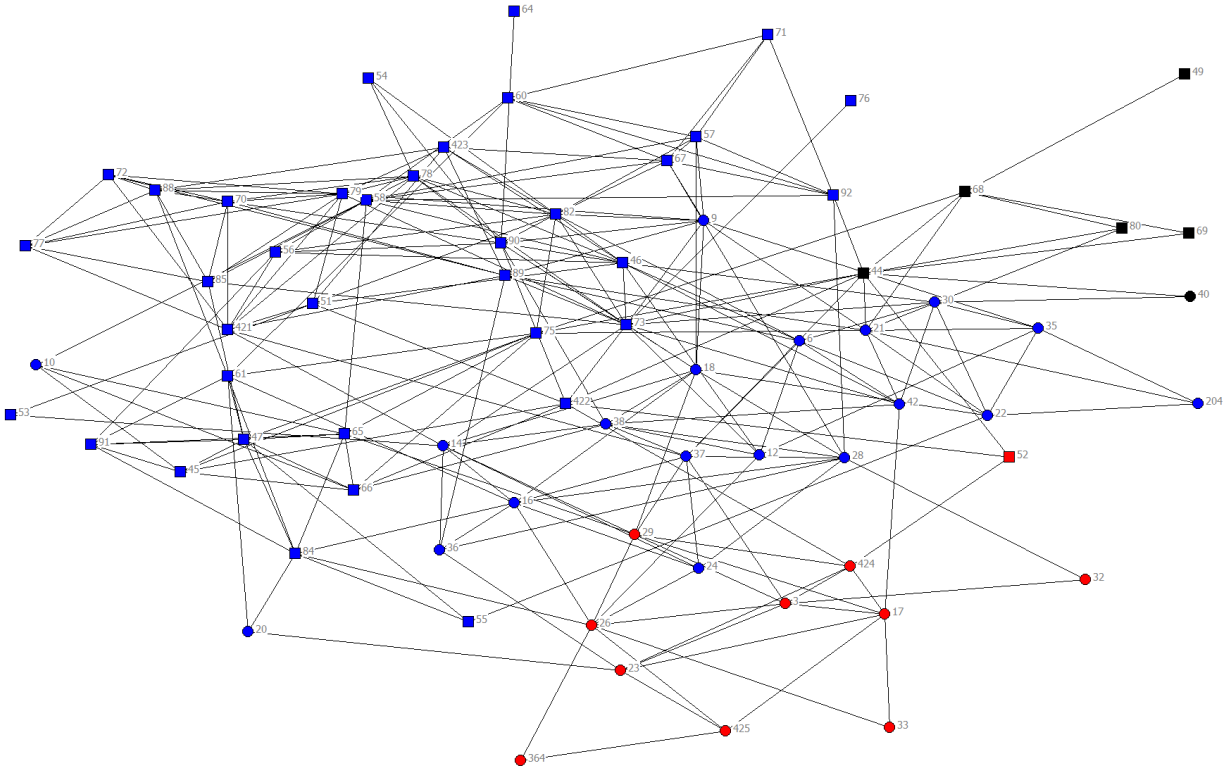


Figure B.3.5: Mpanga Friendship Network, Girvan-Newman Analysis, Class Z

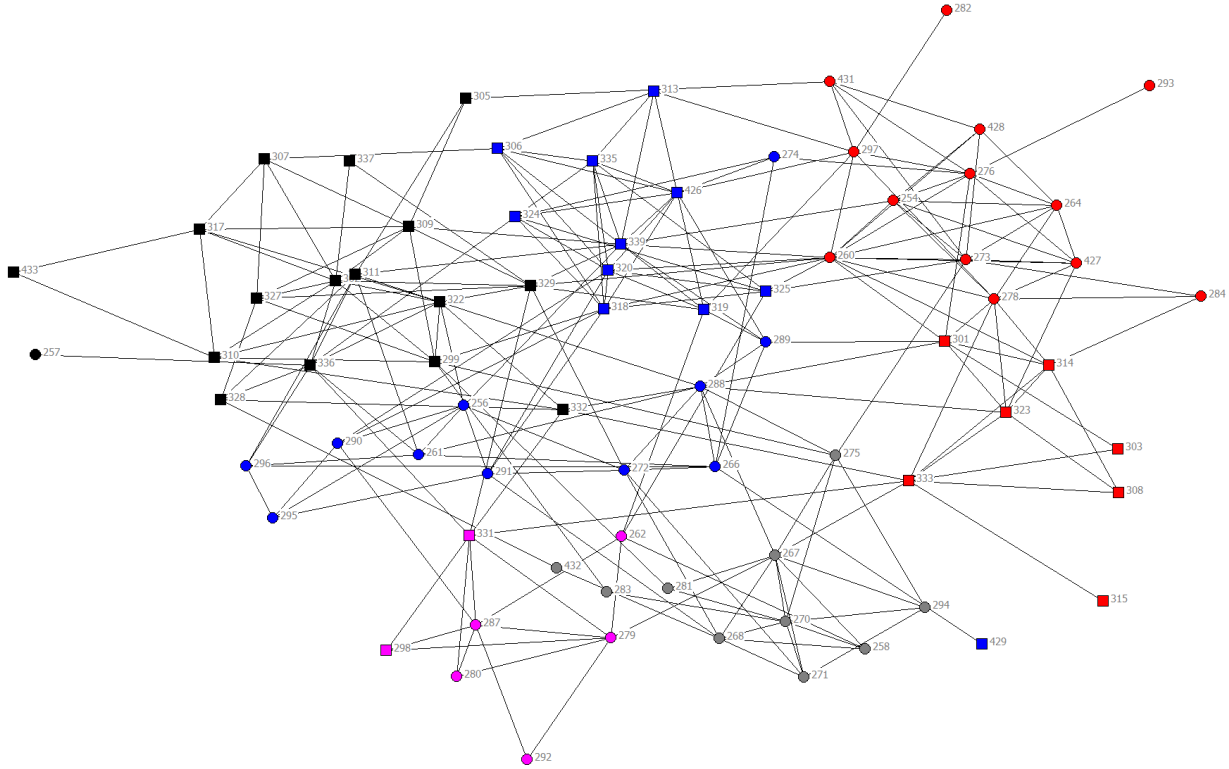


Figure B.3.6: Mpanga Friendship Network, Girvan-Newman Analysis, Class Y

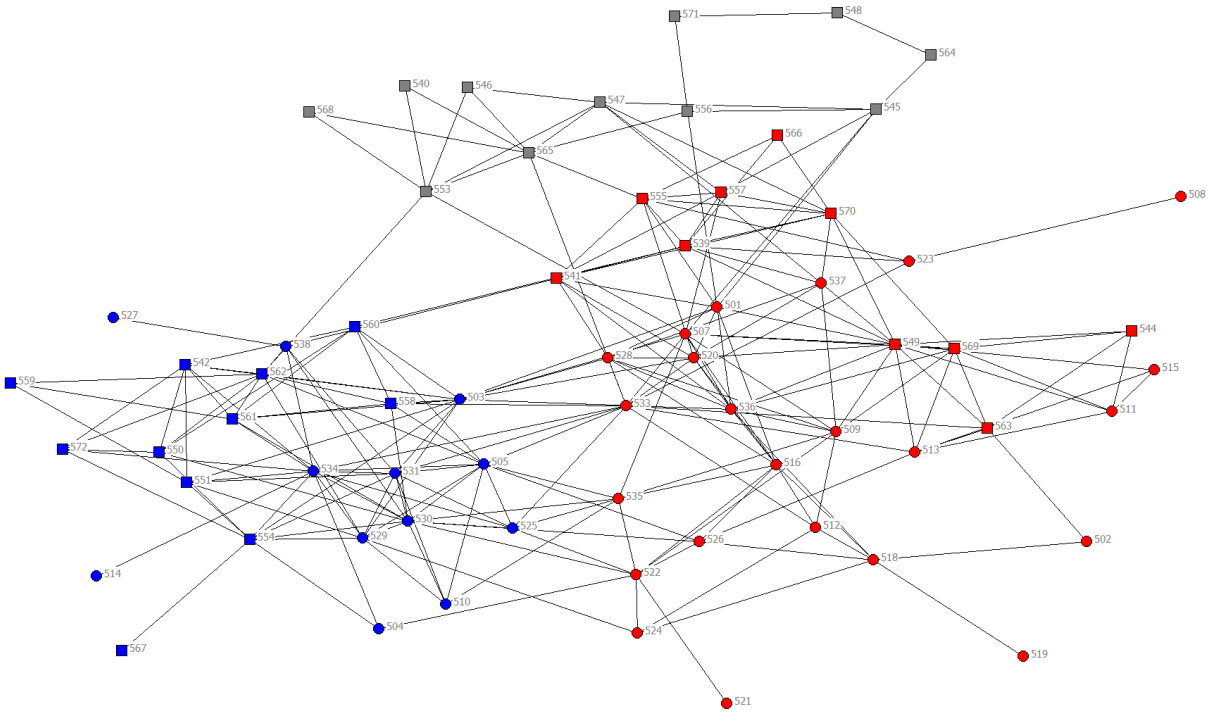


Figure B.3.7: Mpanga Friendship Network, Girvan-Newman Analysis, Class M

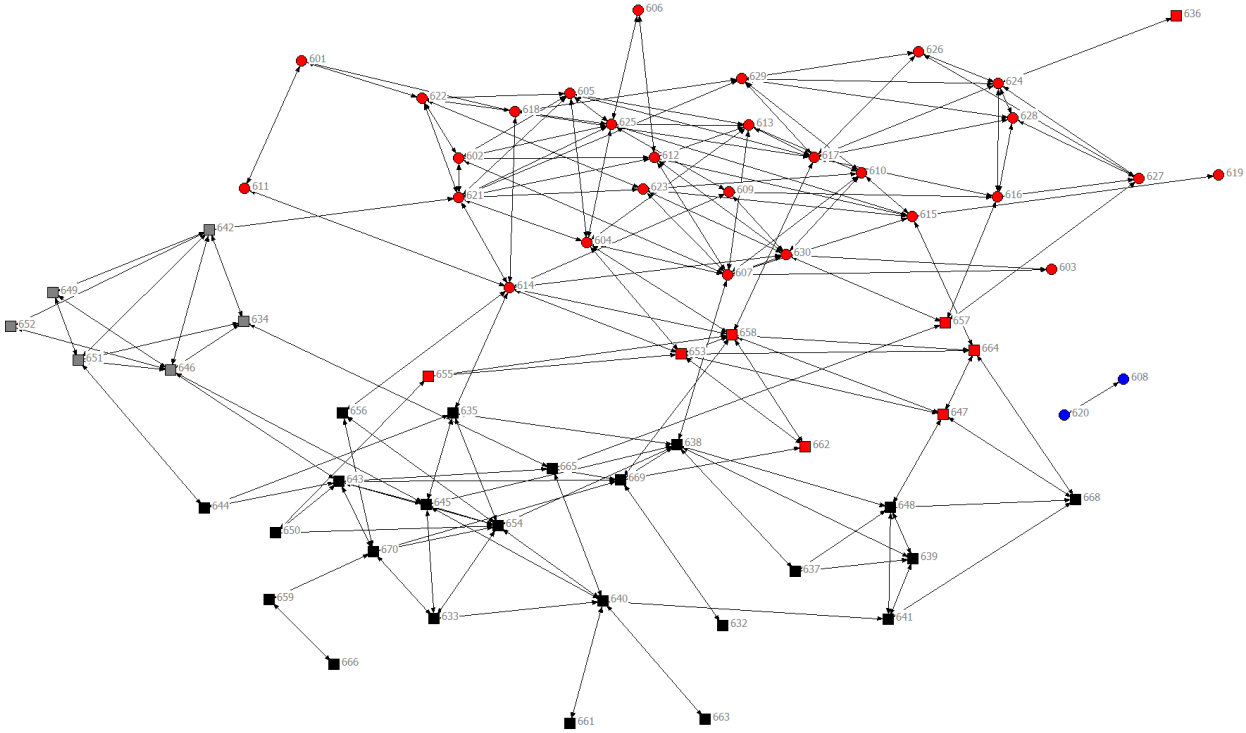


Figure B.3.8: Mpanga Friendship Network, Girvan-Newman Analysis, Class P

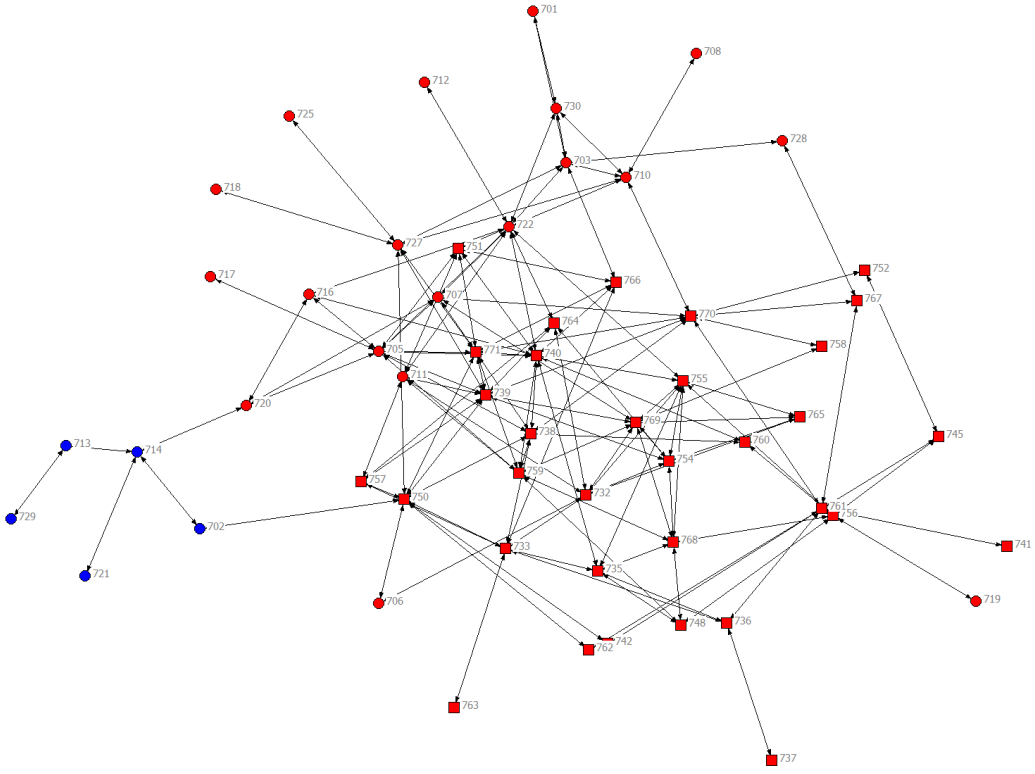


Figure B.3.9: Mpanga Friendship Network, Girvan-Newman Analysis, Class N

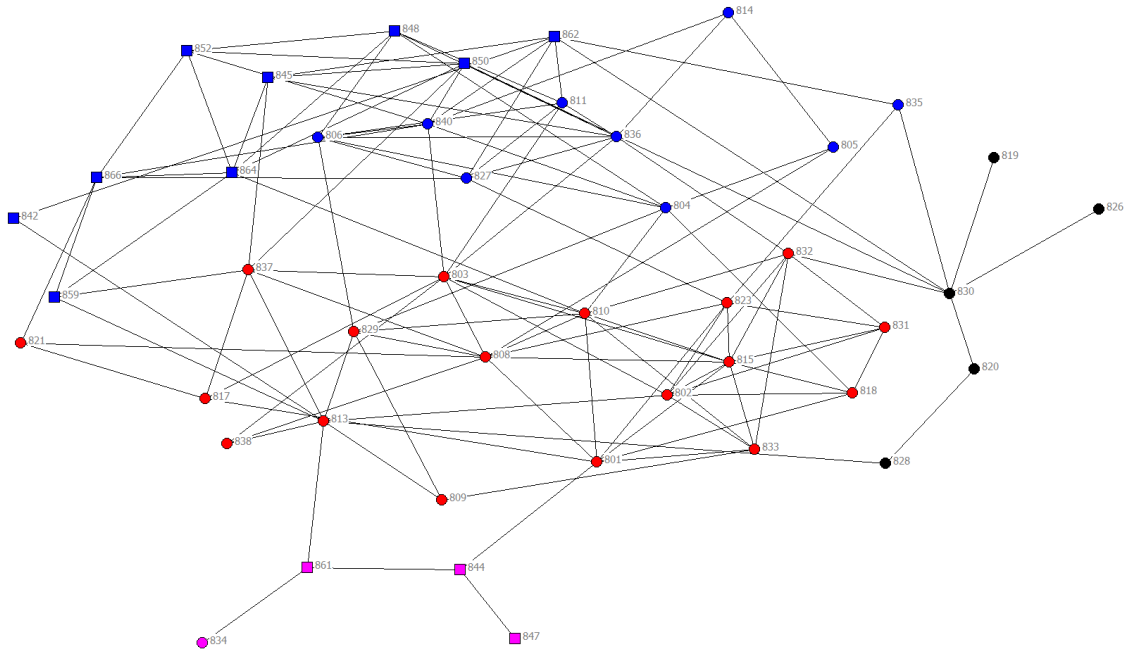


Figure B.3.10: Mpanga Sexual Health Network, Girvan-Newman Analysis, Class Z

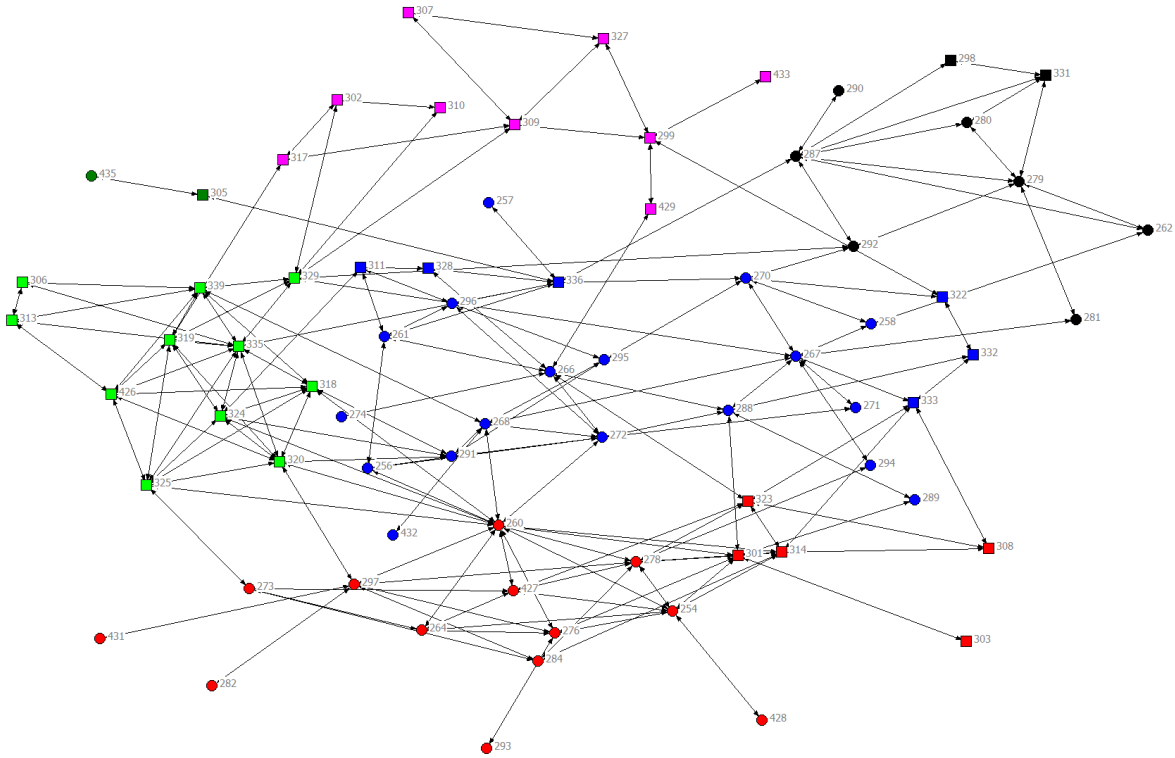


Figure B.3.11: Mpanga Sexual Health Network, Girvan-Newman Analysis, Class Y

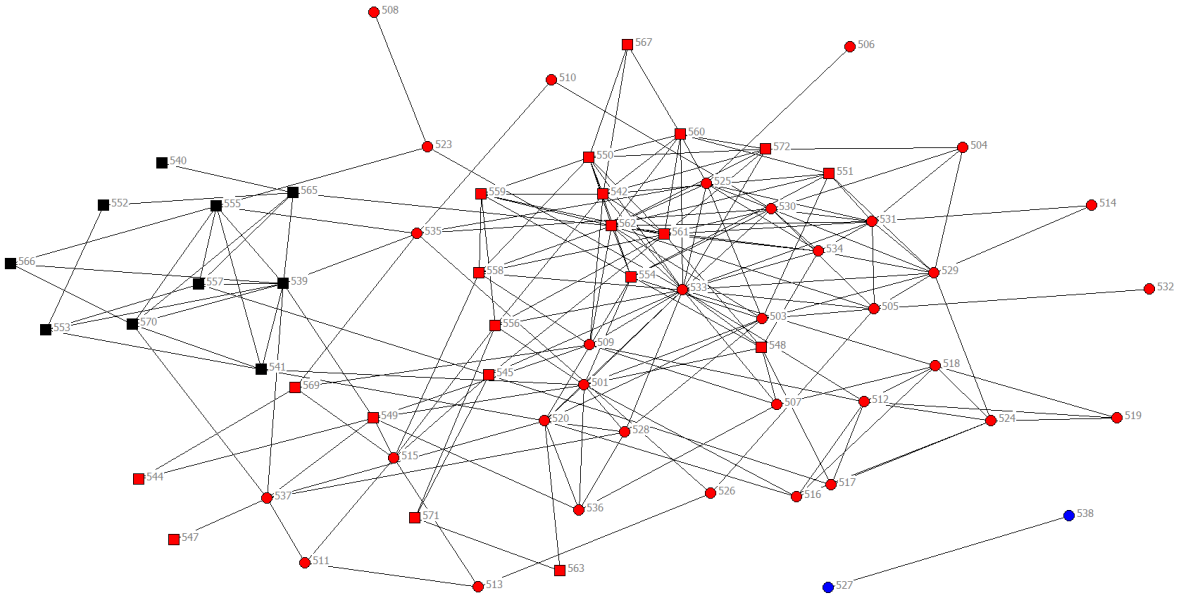


Figure B.3.12: Mpanga Sexual Health Network, Girvan-Newman Analysis, Class M

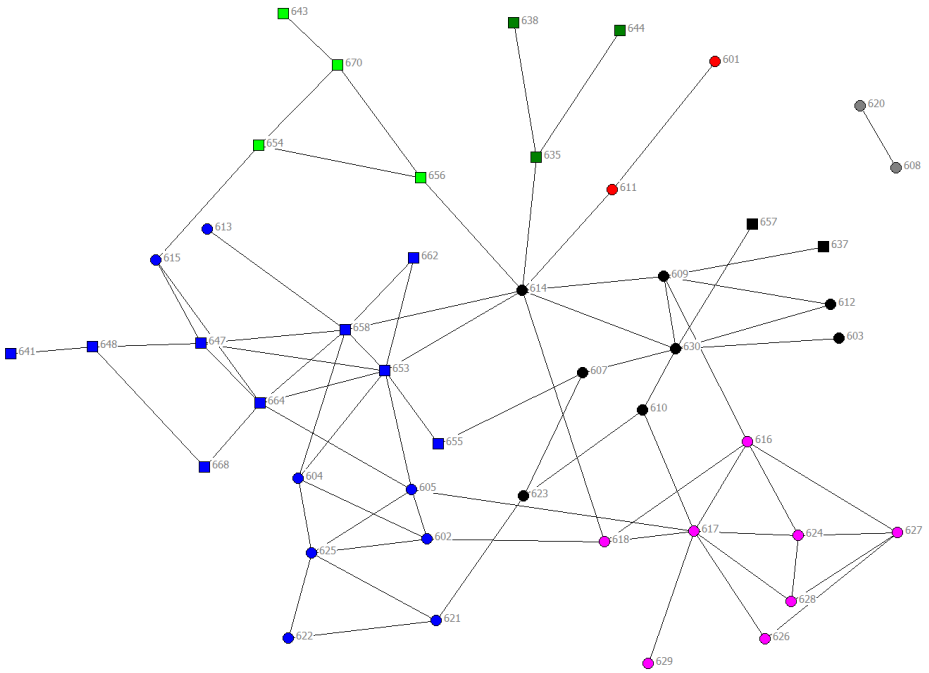


Figure B.3.13: Mpanga Sexual Health Network, Girvan-Newman Analysis, Class P

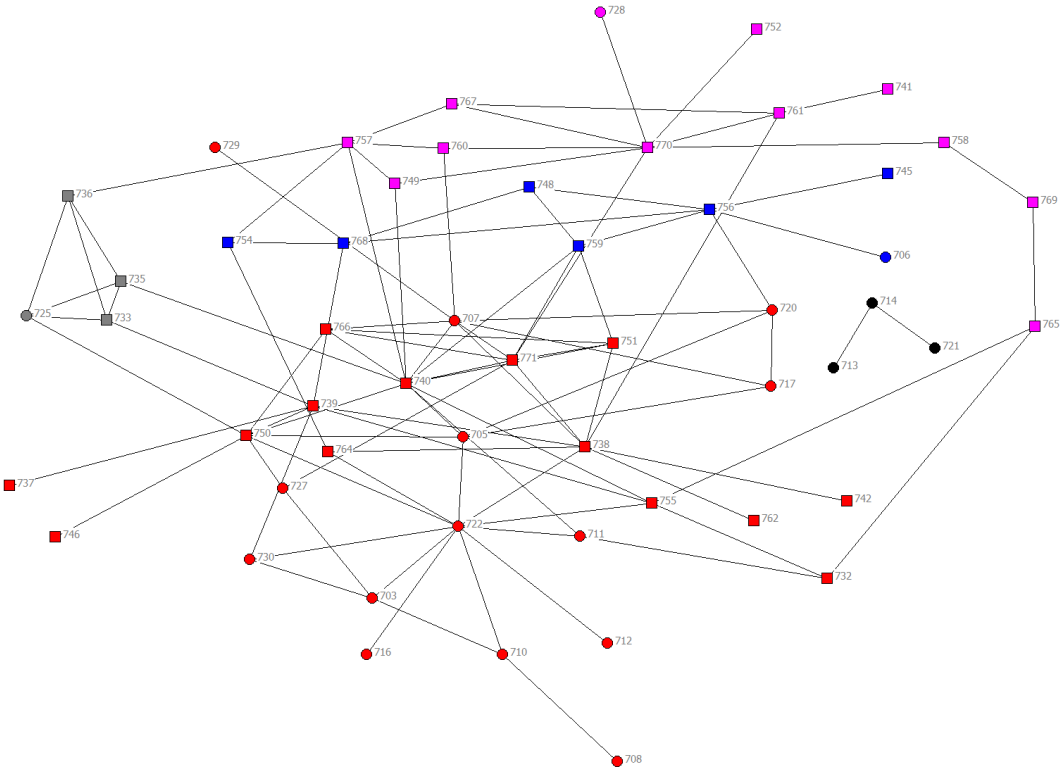
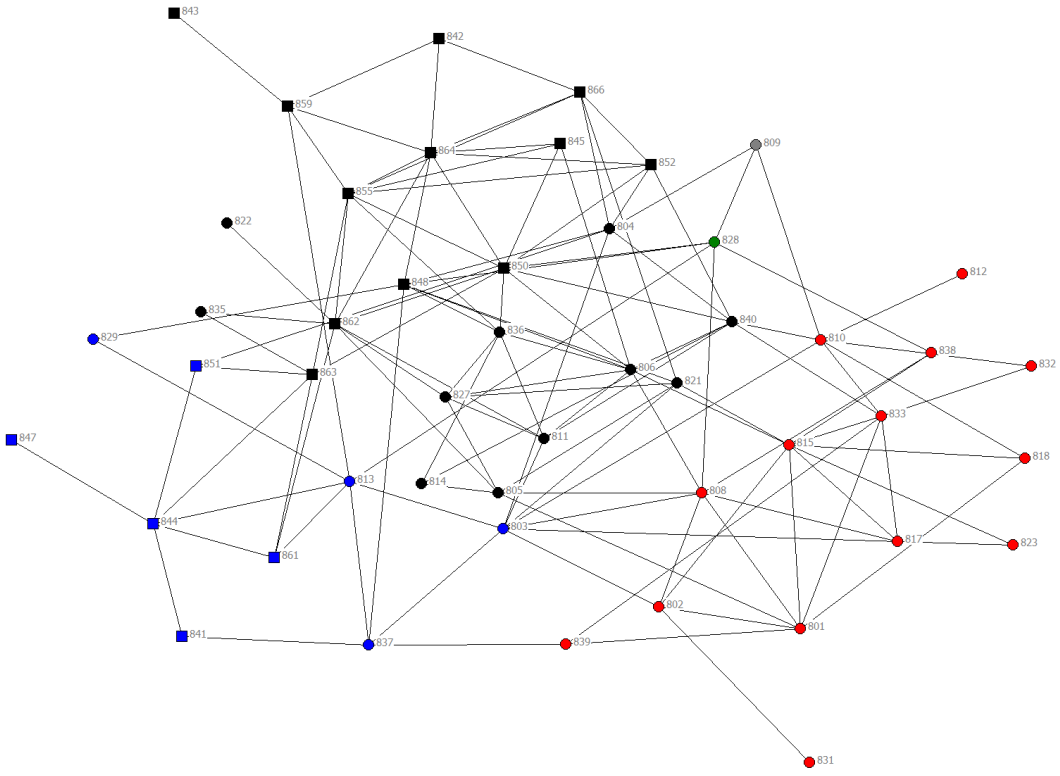


Figure B.3.14: Mpanga Sexual Health Network, Girvan-Newman Analysis, Class N



B.4 Additional Analysis – Peer Educator Placement Sociograms

Figure B.4.1 Mpanga Class X – Both Networks, PE Placement

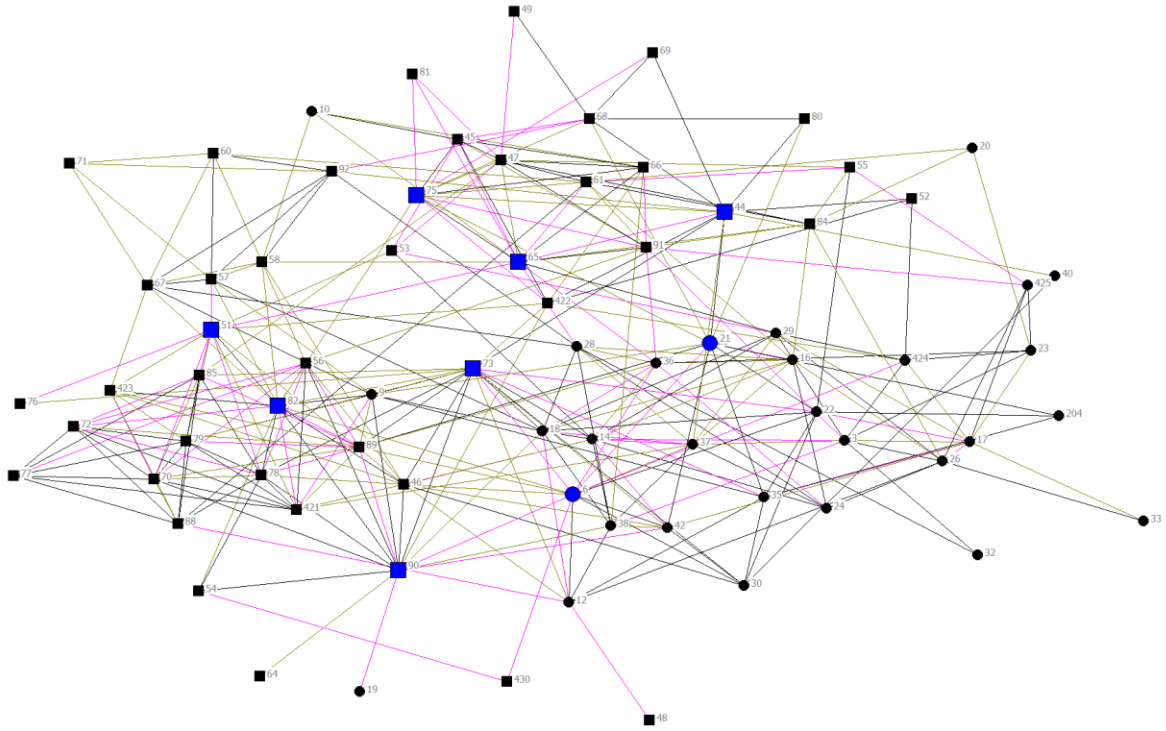


Figure B.4.2 Mpanga Class Z – Both Networks, PE Placement

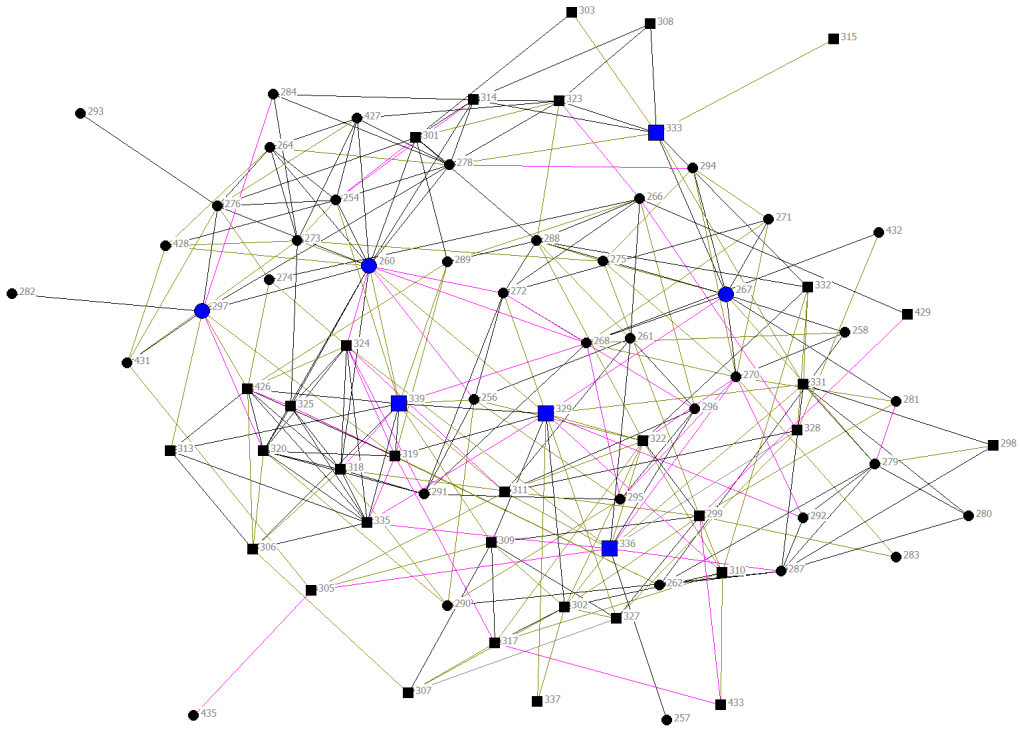


Figure B.4.3 Mpanga Class Y – Both Networks, PE Placement

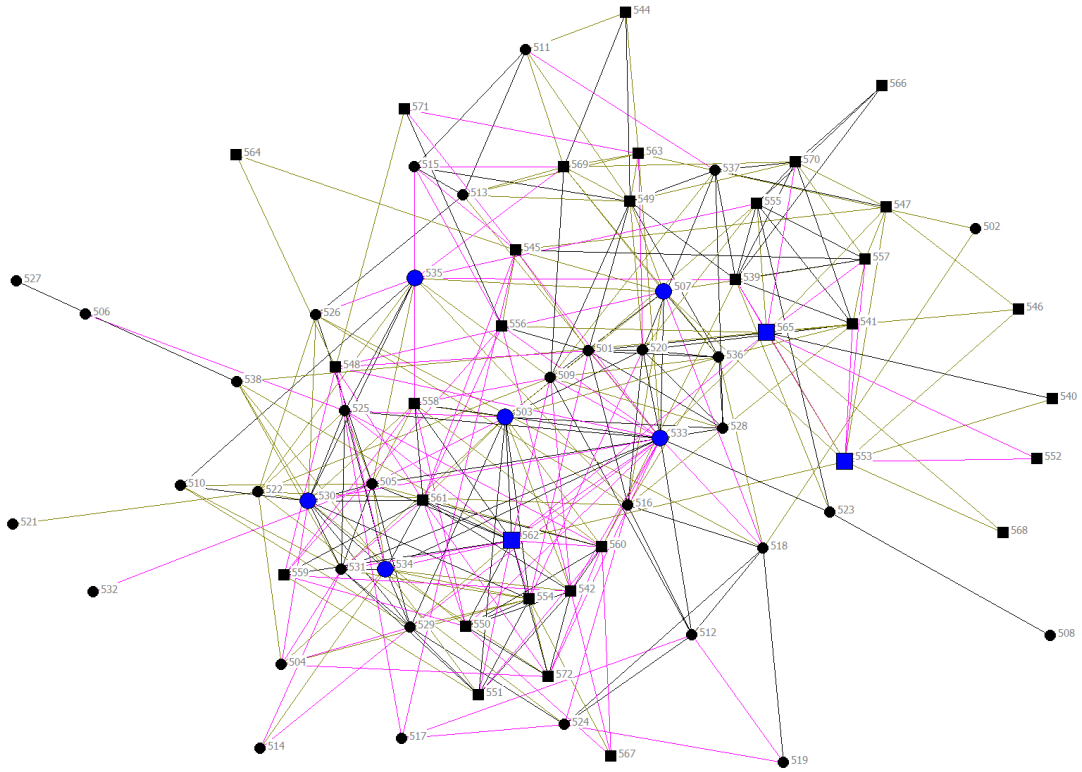


Figure B.4.4 Mpanga Class M – Both Networks, PE Placement

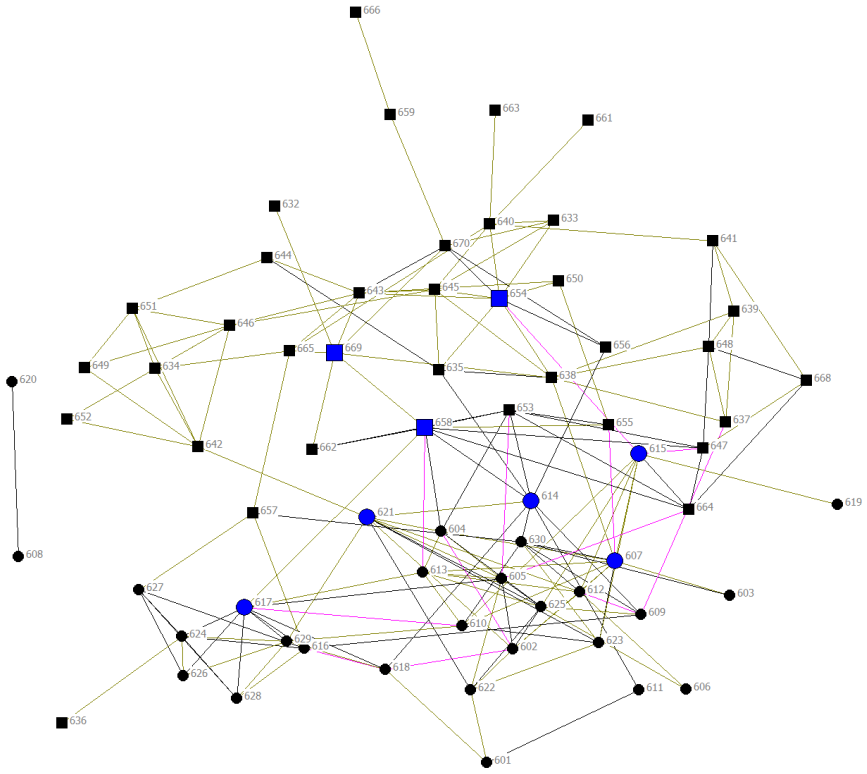


Figure B.4.5 Mpanga Class P – Both Networks, PE Placement

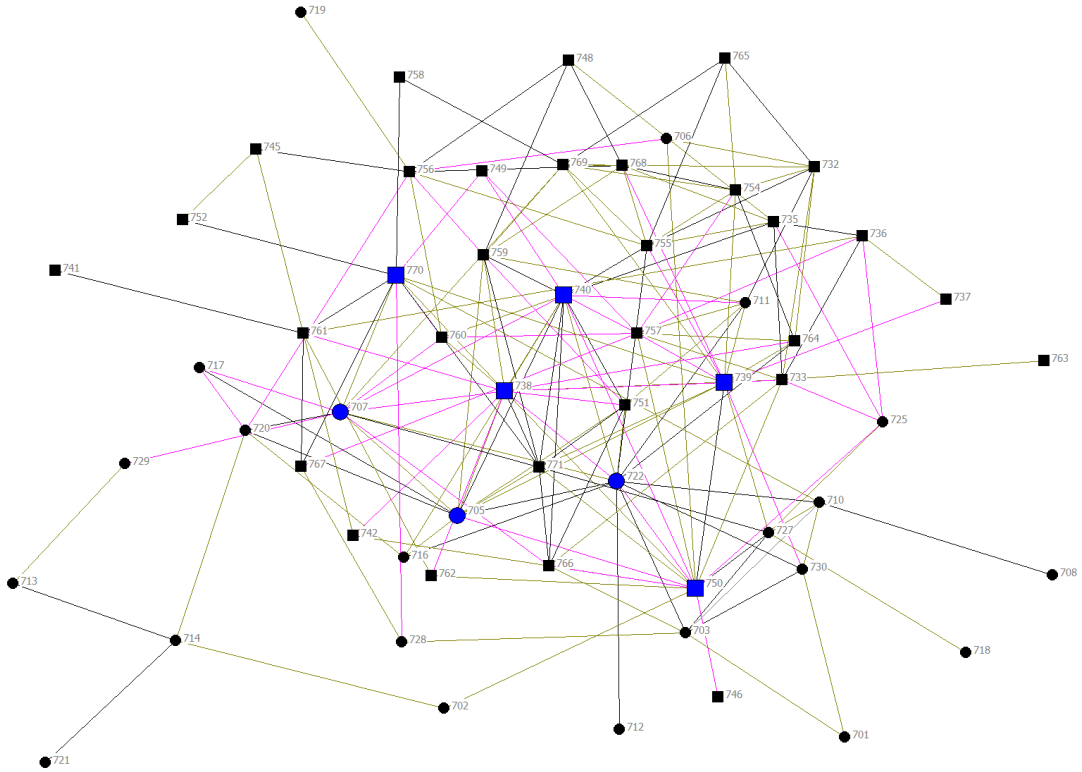
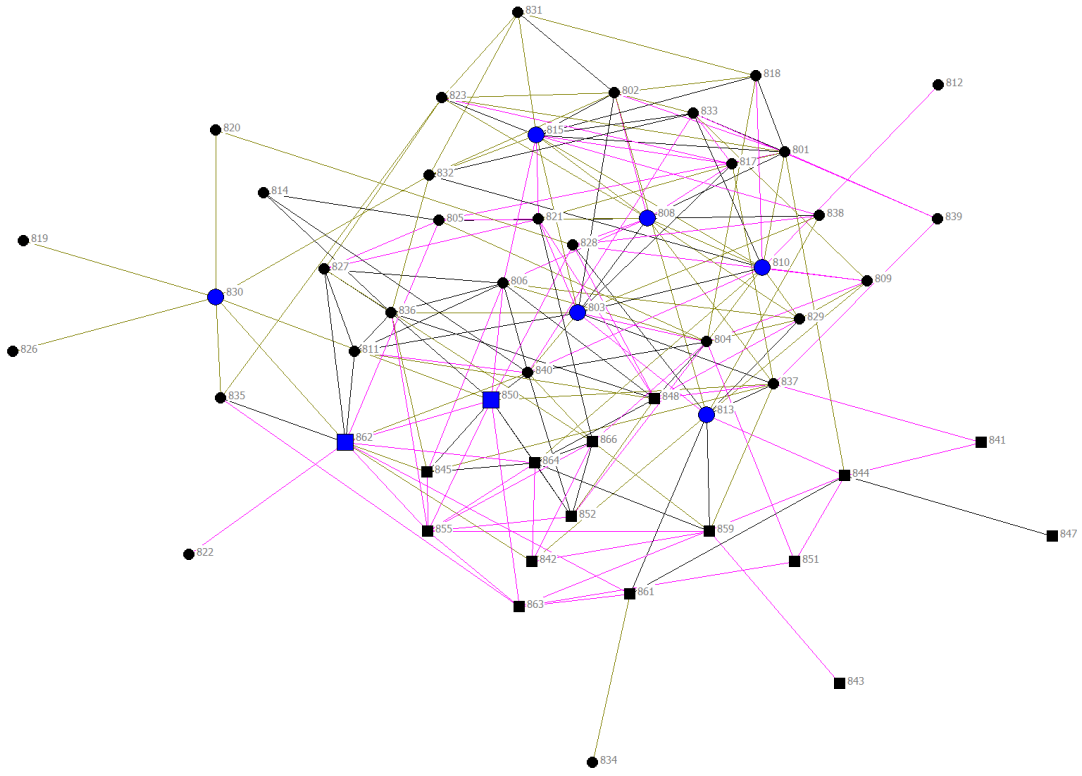


Figure B.4.6 Mpanga Class N – Both Networks, PE Placement



B.5 Additional Analysis – Personal Network Survey Complete Results

Table B.5.1: Overall Results by School and Gender, by Frequency (Percent)

Question	Response	Overall		Nyakasura School		Mpanga School		Males		Females	
How close are you to your friend?	Close	622	(61.9%)	158	(58.3%)	464	(63.2%)	323	(58.1%)	299	(66.6%)
	Very Close	383	(38.1%)	113	(41.7%)	270	(36.8%)	233	(41.9%)	150	(33.4%)
How long have you known your friend?	Less than 6 mo	103	(10.1%)	38	(13.2%)	65	(8.9%)	65	(11.3%)	38	(8.5%)
	6 mo to 1 year	152	(14.9%)	51	(17.7%)	101	(13.8%)	81	(14.1%)	71	(16.0%)
	1 to 2 years	331	(32.5%)	85	(29.5%)	246	(33.6%)	177	(30.8%)	154	(34.6%)
	3 to 6 years	156	(15.3%)	36	(12.5%)	120	(16.4%)	79	(13.7%)	77	(17.3%)
	More than 6 years	278	(27.3%)	78	(27.1%)	200	(27.3%)	173	(30.1%)	105	(23.6%)
How often do you see him/her outside of school?	Every day	426	(43.2%)	96	(34.9%)	330	(46.3%)	251	(45.4%)	175	(40.3%)
	More than 1/week	283	(28.7%)	64	(23.3%)	219	(30.8%)	141	(25.5%)	142	(32.7%)
	More than 1/month	278	(28.2%)	115	(41.8%)	163	(22.9%)	161	(29.1%)	117	(27.0%)
What is your friend's gender?	Male	529	(53.1%)	170	(60.5%)	359	(50.2%)	422	(75.9%)	107	(24.3%)
	Female	467	(46.9%)	111	(39.5%)	356	(49.8%)	134	(24.1%)	333	(75.7%)
How much do you feel that your friend understands you?	Very much	686	(66.9%)	196	(69.0%)	490	(66.0%)	393	(68.0%)	293	(65.4%)
	A little	288	(28.1%)	79	(27.8%)	209	(28.2%)	151	(26.1%)	137	(30.6%)
	Not at all	52	(5.1%)	9	(3.2%)	43	(5.8%)	34	(5.9%)	18	(4.0%)
How much do you feel that you have enjoyment with your friend?	Very much	714	(70.4%)	208	(74.0%)	506	(69.0%)	400	(69.6%)	314	(71.5%)
	A little	243	(24.0%)	57	(20.3%)	186	(25.4%)	133	(23.1%)	110	(25.1%)
	Not at all	57	(5.6%)	16	(5.7%)	41	(5.6%)	42	(7.3%)	15	(3.4%)
My friend helps me when I have a personal problem	Always	509	(48.6%)	144	(50.5%)	365	(47.9%)	279	(47.9%)	230	(49.5%)
	A little	443	(42.3%)	125	(43.9%)	318	(41.7%)	245	(42.1%)	198	(42.6%)
	Never	95	(9.1%)	16	(5.6%)	79	(10.4%)	58	(10.0%)	37	(8.0%)
My friend helps me when I need money	Always	384	(36.9%)	129	(45.3%)	255	(33.7%)	201	(34.6%)	183	(39.7%)
	Sometimes	490	(47.0%)	124	(43.5%)	366	(48.3%)	282	(48.5%)	208	(45.1%)
	Never	168	(16.1%)	32	(11.2%)	136	(18.0%)	98	(16.9%)	70	(15.2%)
My friend helps me when I have a health problem	Always	469	(45.0%)	134	(47.5%)	335	(44.1%)	247	(42.5%)	222	(48.2%)
	Sometimes	394	(37.8%)	111	(39.4%)	283	(37.2%)	223	(38.4%)	171	(37.1%)
	Never	179	(17.2%)	37	(13.1%)	142	(18.7%)	111	(19.1%)	68	(14.8%)
My friend helps me when I need information about sex	Always	341	(33.6%)	82	(29.3%)	259	(35.3%)	207	(36.2%)	134	(30.3%)
	Sometimes	293	(28.9%)	78	(27.9%)	215	(29.3%)	173	(30.2%)	120	(27.1%)
	Never	380	(37.5%)	120	(42.9%)	260	(35.4%)	192	(33.6%)	188	(42.5%)
My friend is a person who makes me feel better after talking over my worries with him/her	Always	527	(50.8%)	152	(52.8%)	375	(50.1%)	282	(48.8%)	245	(53.4%)
	Sometimes	386	(37.2%)	108	(37.5%)	278	(37.1%)	226	(39.1%)	160	(34.9%)
	Never	124	(12.0%)	28	(9.7%)	96	(12.8%)	70	(12.1%)	54	(11.8%)
My friend is able to make me feel better when I am in bad moods	Always	528	(51.7%)	145	(52.3%)	383	(51.5%)	291	(51.5%)	237	(52.0%)
	Sometimes	338	(33.1%)	90	(32.5%)	248	(33.3%)	176	(31.2%)	162	(35.5%)
	Never	155	(15.2%)	42	(15.2%)	113	(15.2%)	98	(17.3%)	57	(12.5%)
My friend makes me laugh when I am sad	Always	639	(61.1%)	189	(65.9%)	450	(59.3%)	341	(58.7%)	298	(64.1%)
	Sometimes	318	(30.4%)	86	(30.0%)	232	(30.6%)	192	(33.0%)	126	(27.1%)
	Never	89	(8.5%)	12	(4.2%)	77	(10.1%)	48	(8.3%)	41	(8.8%)

He/she talks with me a lot	Agree	805	(76.8%)	231	(80.2%)	574	(75.5%)	446	(76.0%)	359	(77.9%)
	Disagree	243	(23.2%)	57	(19.8%)	186	(24.5%)	141	(24.0%)	102	(22.1%)
The two of us argue a lot	Agree	498	(49.8%)	108	(38.4%)	390	(54.2%)	287	(51.5%)	211	(47.5%)
	Disagree	503	(50.2%)	173	(61.6%)	330	(45.8%)	270	(48.5%)	233	(52.5%)
I can talk to him/her about my problems	Agree	752	(74.2%)	203	(74.4%)	549	(74.2%)	415	(72.8%)	337	(76.1%)
	Disagree	261	(25.8%)	70	(25.6%)	191	(25.8%)	155	(27.2%)	106	(23.9%)
I am able to talk with him/her about	Agree	561	(54.3%)	166	(58.9%)	395	(52.6%)	333	(58.2%)	228	(49.5%)
boyfriends/girlfriends	Disagree	472	(45.7%)	116	(41.1%)	356	(47.4%)	239	(41.8%)	233	(50.5%)
I trust him/her	Agree	827	(80.2%)	237	(86.8%)	590	(77.8%)	453	(79.6%)	374	(81.0%)
	Disagree	204	(19.8%)	36	(13.2%)	168	(22.2%)	116	(20.4%)	88	(19.0%)
I would like to be like him/her	Agree	709	(69.5%)	198	(70.7%)	511	(69.1%)	374	(66.1%)	335	(73.8%)
	Disagree	311	(30.5%)	82	(29.3%)	229	(30.9%)	192	(33.9%)	119	(26.2%)
I think that my friend would disapprove of me	Agree	498	(48.2%)	131	(45.6%)	367	(49.1%)	285	(49.1%)	213	(47.0%)
having sex before marriage	Disagree	536	(51.8%)	156	(54.4%)	380	(50.9%)	296	(50.9%)	240	(53.0%)
In the past 3 months, I've talked with him/her	Yes	651	(62.0%)	173	(60.3%)	478	(62.6%)	377	(64.2%)	274	(59.2%)
about what is right and wrong about sex	No	399	(38.0%)	114	(39.7%)	285	(37.4%)	210	(35.8%)	189	(40.8%)
In the past 3 months, I've talked with him/her	Yes	527	(50.6%)	152	(52.8%)	375	(49.7%)	281	(48.2%)	246	(53.6%)
about what he/she things about young people having sex	No	515	(49.4%)	136	(47.2%)	379	(50.3%)	302	(51.8%)	213	(46.4%)
In the past 3 months, I've talked with him/her	Yes	513	(49.4%)	120	(41.7%)	393	(52.4%)	296	(50.7%)	217	(47.8%)
about my questions on sex	No	525	(50.6%)	168	(58.3%)	357	(47.6%)	288	(49.3%)	237	(52.2%)
In the past 3 months, I've talked with him/her	Yes	379	(36.2%)	73	(25.6%)	306	(40.2%)	205	(35.0%)	174	(37.8%)
about contraception	No	667	(63.8%)	212	(74.4%)	455	(59.8%)	381	(65.0%)	286	(62.2%)
In the past 3 months, I've talked with him/her	Yes	767	(72.6%)	210	(72.2%)	557	(72.7%)	422	(71.3%)	345	(74.2%)
about preventing sexually transmitted infections	No	290	(27.4%)	81	(27.8%)	209	(27.3%)	170	(28.7%)	120	(25.8%)
I think that my friend has a boyfriend/girlfriend	Yes	468	(45.2%)	111	(40.5%)	357	(46.9%)	275	(48.2%)	193	(41.6%)
	No	567	(54.8%)	163	(59.5%)	404	(53.1%)	296	(51.8%)	271	(58.4%)
I think that my friend has had sexual relations	Yes	306	(29.8%)	64	(23.4%)	242	(32.1%)	184	(32.9%)	122	(26.2%)
	No	720	(70.2%)	209	(76.6%)	511	(67.9%)	376	(67.1%)	344	(73.8%)
I think that my friend uses contraception	Yes	264	(26.2%)	46	(18.2%)	218	(28.9%)	171	(30.8%)	93	(20.6%)
	No	743	(73.8%)	207	(81.8%)	536	(71.1%)	385	(69.2%)	358	(79.4%)
I think that my friend has had sex with a prostitute	Yes	80	(7.9%)	10	(3.7%)	70	(9.4%)	49	(8.9%)	31	(6.8%)
	No	930	(92.1%)	259	(96.3%)	671	(90.6%)	504	(91.1%)	426	(93.2%)
I think that my friend has received money or gifts	Yes	198	(19.2%)	22	(8.1%)	176	(23.2%)	97	(17.1%)	101	(21.8%)
for sex	No	833	(80.8%)	250	(91.9%)	583	(76.8%)	471	(82.9%)	362	(78.2%)
In the past 3 months, I have listened to the radio	Yes	616	(59.7%)	185	(67.5%)	431	(56.9%)	343	(60.0%)	273	(59.3%)
with my friend	No	416	(40.3%)	89	(32.5%)	327	(43.1%)	229	(40.0%)	187	(40.7%)
In the past 3 months, I have gone dancing with my	Yes	217	(21.4%)	70	(25.5%)	147	(19.9%)	135	(23.9%)	82	(18.3%)
friend	No	797	(78.6%)	204	(74.5%)	593	(80.1%)	431	(76.1%)	366	(81.7%)
In the past 3 months, I have attended a sports event	Yes	714	(70.4%)	200	(75.2%)	514	(68.7%)	420	(75.4%)	294	(64.3%)
with my friend	No	300	(29.6%)	66	(24.8%)	234	(31.3%)	137	(24.6%)	163	(35.7%)
In the past 3 months, I have drank alcohol with my	Yes	66	(6.5%)	10	(3.7%)	56	(7.4%)	40	(7.1%)	26	(5.7%)
friend	No	957	(93.5%)	260	(96.3%)	697	(92.6%)	525	(92.9%)	432	(94.3%)
In the past 3 months, I have smoked cigarettes with	Yes	35	(3.4%)	4	(1.5%)	31	(4.1%)	24	(4.3%)	11	(2.4%)
my friend	No	984	(96.6%)	263	(98.5%)	721	(95.9%)	540	(95.7%)	444	(97.6%)
In the past 3 months, I have gone shopping with	Yes	565	(55.3%)	135	(50.0%)	430	(57.2%)	291	(51.5%)	274	(60.0%)

my friend	No	457	(44.7%)	135	(50.0%)	322	(42.8%)	274	(48.5%)	183	(40.0%)
In the past 3 months, I have used drugs with my friend	Yes	61	(5.9%)	15	(5.5%)	46	(6.0%)	37	(6.4%)	24	(5.2%)
	No	974	(94.1%)	258	(94.5%)	716	(94.0%)	538	(93.6%)	436	(94.8%)
I have seen my friend smoke	Yes	115	(11.1%)	11	(4.0%)	104	(13.6%)	68	(11.8%)	47	(10.2%)
	No	923	(88.9%)	265	(96.0%)	658	(86.4%)	507	(88.2%)	416	(89.8%)
I have seen my friend drink alcohol	Yes	124	(11.9%)	24	(8.8%)	100	(13.1%)	80	(13.9%)	44	(9.5%)
	No	916	(88.1%)	250	(91.2%)	666	(86.9%)	497	(86.1%)	419	(90.5%)

Table B.5.2: Results of Close Vs. Very Close Friend, by Frequency (Percent)

Question	Response	Overall About Close Friend		Overall About Very Close Friend		Male About Close Friend		Male About Very Close Friend		Female About Close Friend		Female About Very Close Friend	
How long have you known your friend?	Less than 6 mo	57	(15.5%)	40	(6.7%)	38	(17.0%)	22	(7.1%)	19	(13.3%)	18	(6.3%)
	6 mo to 1 year	59	(16.1%)	82	(13.7%)	32	(14.3%)	41	(13.2%)	27	(18.9%)	41	(14.3%)
	1 to 2 years	106	(28.9%)	211	(35.3%)	67	(29.9%)	102	(32.9%)	39	(27.3%)	109	(38.0%)
	3 to 6 years	62	(16.9%)	84	(14.1%)	32	(14.3%)	41	(13.2%)	30	(21.0%)	43	(15.0%)
	More than 6 years	83	(22.6%)	180	(30.2%)	55	(24.6%)	104	(33.5%)	28	(19.6%)	76	(26.5%)
How often do you see him/her outside of school?	Every day	142	(40.9%)	268	(45.4%)	93	(43.5%)	149	(49.5%)	49	(36.8%)	119	(41.2%)
	More than 1/wk	99	(28.5%)	171	(29.0%)	60	(28.0%)	69	(22.9%)	39	(29.3%)	102	(35.3%)
	More than 1/mo	106	(30.5%)	151	(25.6%)	61	(28.5%)	83	(27.6%)	45	(33.8%)	68	(23.5%)
What is your friend's gender?	Male	186	(51.8%)	317	(53.9%)	152	(69.4%)	248	(81.3%)	34	(24.3%)	69	(24.4%)
	Female	173	(48.2%)	271	(46.1%)	67	(30.6%)	57	(18.7%)	106	(75.7%)	214	(75.6%)
How much do you feel that your friend understands you?	Very much	185	(51.1%)	471	(77.6%)	125	(55.8%)	250	(79.1%)	60	(43.5%)	221	(75.9%)
	A little	151	(41.7%)	114	(18.8%)	83	(37.1%)	51	(16.1%)	68	(49.3%)	63	(21.6%)
	Not at all	26	(7.2%)	22	(3.6%)	16	(7.1%)	15	(4.7%)	10	(7.2%)	7	(2.4%)
How much do you feel that you have enjoyment with your friend?	Very much	202	(56.1%)	474	(79.1%)	134	(58.8%)	243	(78.1%)	68	(51.5%)	231	(80.2%)
	A little	128	(35.6%)	102	(17.0%)	72	(31.6%)	52	(16.7%)	56	(42.4%)	50	(17.4%)
	Not at all	30	(8.3%)	23	(3.8%)	22	(9.6%)	16	(5.1%)	8	(6.1%)	7	(2.4%)
My friend helps me when I have a personal problem	Always	135	(36.4%)	345	(56.2%)	84	(37.7%)	177	(55.7%)	51	(34.5%)	168	(56.8%)
	A little	190	(51.2%)	228	(37.1%)	111	(49.8%)	117	(36.8%)	79	(53.4%)	111	(37.5%)
	Never	46	(12.4%)	41	(6.7%)	28	(12.6%)	24	(7.5%)	18	(12.2%)	17	(5.7%)
My friend helps me when I need money	Always	105	(28.6%)	255	(41.4%)	60	(26.9%)	124	(38.8%)	45	(31.3%)	131	(44.3%)
	Sometimes	182	(49.6%)	281	(45.6%)	111	(49.8%)	156	(48.8%)	71	(49.3%)	125	(42.2%)
	Never	80	(21.8%)	80	(13.0%)	52	(23.3%)	40	(12.5%)	28	(19.4%)	40	(13.5%)
My friend helps me when I have a health problem	Always	136	(36.9%)	307	(50.2%)	76	(34.2%)	154	(48.4%)	60	(40.8%)	153	(52.2%)
	Sometimes	151	(40.9%)	215	(35.2%)	92	(41.4%)	112	(35.2%)	59	(40.1%)	103	(35.2%)
	Never	82	(22.2%)	89	(14.6%)	54	(24.3%)	52	(16.4%)	28	(19.0%)	37	(12.6%)
My friend helps me when I need information about sex	Always	126	(34.8%)	204	(34.3%)	85	(38.6%)	115	(36.7%)	41	(28.9%)	89	(31.7%)
	Sometimes	103	(28.5%)	173	(29.1%)	64	(29.1%)	98	(31.3%)	39	(27.5%)	75	(26.7%)
	Never	133	(36.7%)	217	(36.5%)	71	(32.3%)	100	(31.9%)	62	(43.7%)	117	(41.6%)
My friend is a person who makes me feel better after talking over my worries with him/her	Always	148	(40.2%)	355	(58.4%)	80	(36.0%)	184	(58.2%)	68	(46.6%)	171	(58.6%)
	Sometimes	161	(43.8%)	193	(31.7%)	104	(46.8%)	105	(33.2%)	57	(39.0%)	88	(30.1%)
	Never	59	(16.0%)	60	(9.9%)	38	(17.1%)	27	(8.5%)	21	(14.4%)	33	(11.3%)
My friend is able to make me feel better when I am in bad moods	Always	167	(45.8%)	335	(55.6%)	101	(45.9%)	173	(55.8%)	66	(45.5%)	162	(55.5%)
	Sometimes	131	(35.9%)	192	(31.9%)	76	(34.5%)	90	(29.0%)	55	(37.9%)	102	(34.9%)
	Never	67	(18.4%)	75	(12.5%)	43	(19.5%)	47	(15.2%)	24	(16.6%)	28	(9.6%)
My friend makes me laugh when I am sad	Always	198	(53.1%)	408	(66.3%)	107	(47.3%)	213	(67.0%)	91	(61.9%)	195	(65.7%)
	Sometimes	140	(37.5%)	159	(25.9%)	97	(42.9%)	82	(25.8%)	43	(29.3%)	77	(25.9%)
	Never	35	(9.4%)	48	(7.8%)	22	(9.7%)	23	(7.2%)	13	(8.8%)	25	(8.4%)
He/she talks with me a lot	Agree	261	(69.2%)	499	(81.8%)	166	(72.2%)	250	(78.9%)	95	(64.6%)	249	(85.0%)
	Disagree	116	(30.8%)	111	(18.2%)	64	(27.8%)	67	(21.1%)	52	(35.4%)	44	(15.0%)
The two of us argue a lot	Agree	167	(46.4%)	294	(50.5%)	99	(45.4%)	168	(55.8%)	68	(47.9%)	126	(44.8%)

	Disagree	193	(53.6%)	288	(49.5%)	119	(54.6%)	133	(44.2%)	74	(52.1%)	155	(55.2%)
I can talk to him/her about my problems	Agree	240	(65.9%)	468	(79.6%)	147	(66.5%)	240	(77.9%)	93	(65.0%)	228	(81.4%)
	Disagree	124	(34.1%)	120	(20.4%)	74	(33.5%)	68	(22.1%)	50	(35.0%)	52	(18.6%)
I am able to talk with him/her about	Agree	195	(52.8%)	333	(55.3%)	124	(55.6%)	184	(59.5%)	71	(48.6%)	149	(50.9%)
boyfriends/girlfriends	Disagree	174	(47.2%)	269	(44.7%)	99	(44.4%)	125	(40.5%)	75	(51.4%)	144	(49.1%)
I trust him/her	Agree	280	(75.1%)	498	(83.6%)	169	(75.1%)	251	(82.8%)	111	(75.0%)	247	(84.3%)
	Disagree	93	(24.9%)	98	(16.4%)	56	(24.9%)	52	(17.2%)	37	(25.0%)	46	(15.7%)
I would like to be like him/her	Agree	220	(59.6%)	441	(74.9%)	129	(57.8%)	214	(70.9%)	91	(62.3%)	227	(79.1%)
	Disagree	149	(40.4%)	148	(25.1%)	94	(42.2%)	88	(29.1%)	55	(37.7%)	60	(20.9%)
I think that my friend would disapprove of me	Agree	175	(46.9%)	294	(49.1%)	112	(48.5%)	153	(49.5%)	63	(44.4%)	141	(48.6%)
having sex before marriage	Disagree	198	(53.1%)	305	(50.9%)	119	(51.5%)	156	(50.5%)	79	(55.6%)	149	(51.4%)
In the past 3 months, I've talked with him/her	Yes	215	(57.0%)	406	(66.6%)	141	(61.8%)	211	(66.6%)	74	(49.7%)	195	(66.6%)
about what is right and wrong about sex	No	162	(43.0%)	204	(33.4%)	87	(38.2%)	106	(33.4%)	75	(50.3%)	98	(33.4%)
In the past 3 months, I've talked with him/her	Yes	173	(46.6%)	330	(54.1%)	104	(46.2%)	163	(51.3%)	69	(47.3%)	167	(57.2%)
about what he/she things about young people having sex	No	198	(53.4%)	280	(45.9%)	121	(53.8%)	155	(48.7%)	77	(52.7%)	125	(42.8%)
In the past 3 months, I've talked with him/her	Yes	173	(46.5%)	318	(52.7%)	113	(50.0%)	170	(53.8%)	60	(41.1%)	148	(51.6%)
about my questions on sex	No	199	(53.5%)	285	(47.3%)	113	(50.0%)	146	(46.2%)	86	(58.9%)	139	(48.4%)
In the past 3 months, I've talked with him/her	Yes	134	(35.4%)	225	(37.1%)	82	(35.7%)	112	(35.4%)	52	(35.1%)	113	(38.8%)
about contraception	No	244	(64.6%)	382	(62.9%)	148	(64.3%)	204	(64.6%)	96	(64.9%)	178	(61.2%)
In the past 3 months, I've talked with him/her	Yes	271	(71.5%)	453	(73.5%)	159	(69.1%)	233	(72.8%)	112	(75.2%)	220	(74.3%)
about preventing sexually transmitted infections	No	108	(28.5%)	163	(26.5%)	71	(30.9%)	87	(27.2%)	37	(24.8%)	76	(25.7%)
I think that my friend has a boyfriend/girlfriend	Yes	185	(49.5%)	256	(42.6%)	113	(49.8%)	142	(46.7%)	72	(49.0%)	114	(38.4%)
	No	189	(50.5%)	345	(57.4%)	114	(50.2%)	162	(53.3%)	75	(51.0%)	183	(61.6%)
I think that my friend has had sexual relations	Yes	131	(35.7%)	157	(26.3%)	77	(35.2%)	94	(31.2%)	54	(36.5%)	63	(21.2%)
	No	236	(64.3%)	441	(73.7%)	142	(64.8%)	207	(68.8%)	94	(63.5%)	234	(78.8%)
I think that my friend uses contraception	Yes	113	(30.7%)	137	(23.5%)	79	(35.3%)	83	(28.0%)	34	(23.6%)	54	(18.9%)
	No	255	(69.3%)	445	(76.5%)	145	(64.7%)	213	(72.0%)	110	(76.4%)	232	(81.1%)
I think that my friend has had sex with a prostitute	Yes	38	(10.5%)	35	(6.0%)	25	(11.4%)	17	(5.8%)	13	(9.0%)	18	(6.2%)
	No	325	(89.5%)	551	(94.0%)	194	(88.6%)	277	(94.2%)	131	(91.0%)	274	(93.8%)
I think that my friend has received money or gifts	Yes	84	(22.7%)	106	(17.6%)	44	(19.6%)	47	(15.4%)	40	(27.4%)	59	(19.9%)
for sex	No	286	(77.3%)	495	(82.4%)	180	(80.4%)	258	(84.6%)	106	(72.6%)	237	(80.1%)
In the past 3 months, I have listened to the radio	Yes	213	(57.3%)	372	(62.2%)	131	(58.0%)	188	(61.6%)	82	(56.2%)	184	(62.8%)
with my friend	No	159	(42.7%)	226	(37.8%)	95	(42.0%)	117	(38.4%)	64	(43.8%)	109	(37.2%)
In the past 3 months, I have gone dancing with my	Yes	83	(23.2%)	125	(21.0%)	57	(26.0%)	72	(23.5%)	26	(18.8%)	53	(18.3%)
friend	No	274	(76.8%)	471	(79.0%)	162	(74.0%)	235	(76.5%)	112	(81.2%)	236	(81.7%)
In the past 3 months, I have attended a sports event	Yes	233	(63.8%)	442	(75.0%)	152	(68.8%)	239	(80.5%)	81	(56.3%)	203	(69.5%)
with my friend	No	132	(36.2%)	147	(25.0%)	69	(31.2%)	58	(19.5%)	63	(43.8%)	89	(30.5%)
In the past 3 months, I have drank alcohol with my	Yes	23	(6.3%)	40	(6.7%)	14	(6.3%)	23	(7.5%)	9	(6.3%)	17	(5.8%)
friend	No	342	(93.7%)	559	(93.3%)	207	(93.7%)	283	(92.5%)	135	(93.8%)	276	(94.2%)
In the past 3 months, I have smoked cigarettes with	Yes	14	(3.8%)	21	(3.5%)	11	(4.9%)	13	(4.3%)	3	(2.1%)	8	(2.7%)
my friend	No	351	(96.2%)	572	(96.5%)	214	(95.1%)	286	(95.7%)	137	(97.9%)	286	(97.3%)
In the past 3 months, I have gone shopping with	Yes	194	(52.6%)	346	(58.4%)	114	(50.9%)	161	(53.5%)	80	(55.2%)	185	(63.6%)
my friend	No	175	(47.4%)	246	(41.6%)	110	(49.1%)	140	(46.5%)	65	(44.8%)	106	(36.4%)
In the past 3 months, I have used drugs with my	Yes	19	(5.1%)	37	(6.2%)	11	(4.9%)	22	(7.1%)	8	(5.4%)	15	(5.1%)

friend	No	354	(94.9%)	563	(93.8%)	215	(95.1%)	286	(92.9%)	139	(94.6%)	277	(94.9%)
I have seen my friend smoke	Yes	53	(14.2%)	57	(9.5%)	32	(14.1%)	34	(11.1%)	21	(14.3%)	23	(7.8%)
	No	321	(85.8%)	545	(90.5%)	195	(85.9%)	273	(88.9%)	126	(85.7%)	272	(92.2%)
I have seen my friend drink alcohol	Yes	48	(12.8%)	69	(11.4%)	30	(13.2%)	44	(14.2%)	18	(12.2%)	25	(8.5%)
	No	327	(87.2%)	534	(88.6%)	197	(86.8%)	265	(85.8%)	130	(87.8%)	269	(91.5%)

Table B.5.3: Results by Gender of Friend Nominated, by Frequency (Percent)

Question	Response	Males by Males		Females by Males		Males by Females		Females by Females	
How close are you to your friend?	Close	248	(62.0%	57	(46.0%)	69	(67.0%)	214	(66.9%)
	Very Close	152	(38.0%	67	(54.0%)	34	(33.0%)	106	(33.1%)
How long have you known your friend?	Less than 6 mo	37	(9.0%)	23	(17.7%)	8	(7.7%)	27	(8.5%)
	6 mo to 1 year	59	(14.4%)	18	(13.8%)	17	(16.3%)	51	(16.0%)
	1 to 2 years	129	(31.4%)	38	(29.2%)	38	(36.5%)	104	(32.7%)
	3 to 6 years	57	(13.9%)	16	(12.3%)	13	(12.5%)	62	(19.5%)
	More than 6 years	129	(31.4%)	35	(26.9%)	28	(26.9%)	74	(23.3%)
How often do you see him/her outside of school?	Every day	194	(49.6%)	46	(35.1%)	37	(35.6%)	132	(42.4%)
	More than 1/week	84	(21.5%)	48	(36.6%)	34	(32.7%)	96	(30.9%)
	More than 1/month	113	(28.9%)	37	(28.2%)	33	(31.7%)	83	(26.7%)
How old is your friend?	(Mean)								
How much do you feel that your friend understands you?	Very much	296	(71.5%)	83	(62.9%)	65	(63.1%)	213	(66.4%)
	A little	101	(24.4%)	37	(28.0%)	34	(33.0%)	94	(29.3%)
	Not at all	17	(4.1%)	12	(9.1%)	4	(3.9%)	14	(4.4%)
How much do you feel that you have enjoyment with your friend?	Very much	311	(75.5%)	78	(60.0%)	69	(65.7%)	227	(72.8%)
	A little	88	(21.4%)	31	(23.8%)	32	(30.5%)	74	(23.7%)
	Not at all	13	(3.2%)	21	(16.2%)	4	(3.8%)	11	(3.5%)
My friend helps me when I have a personal problem	Always	208	(50.7%)	57	(43.2%)	48	(45.7%)	164	(49.5%)
	A little	171	(41.7%)	56	(42.4%)	44	(41.9%)	145	(43.8%)
	Never	31	(7.6%)	19	(14.4%)	13	(12.4%)	22	(6.6%)
My friend helps me when I need money	Always	161	(38.8%)	33	(25.6%)	45	(42.1%)	128	(39.3%)
	Sometimes	202	(48.7%)	63	(48.8%)	41	(38.3%)	150	(46.0%)
	Never	52	(12.5%)	33	(25.6%)	21	(19.6%)	48	(14.7%)
My friend helps me when I have a health problem	Always	184	(44.7%)	50	(38.5%)	41	(38.3%)	166	(50.9%)
	Sometimes	165	(40.0%)	40	(30.8%)	45	(42.1%)	116	(35.6%)
	Never	63	(15.3%)	40	(30.8%)	21	(19.6%)	44	(13.5%)
My friend helps me when I need information about sex	Always	147	(36.1%)	50	(39.4%)	34	(34.3%)	91	(29.0%)
	Sometimes	126	(31.0%)	31	(24.4%)	20	(20.2%)	92	(29.3%)
	Never	134	(32.9%)	46	(36.2%)	45	(45.5%)	131	(41.7%)
My friend is a person who makes me feel better after talking over my worries with him/her	Always	208	(50.4%)	59	(44.7%)	55	(52.9%)	172	(52.6%)
	Sometimes	160	(38.7%)	56	(42.4%)	34	(32.7%)	118	(36.1%)
	Never	45	(10.9%)	17	(12.9%)	15	(14.4%)	37	(11.3%)
My friend is able to make me feel better when I am in bad moods	Always	216	(53.7%)	62	(47.3%)	56	(53.8%)	171	(52.6%)
	Sometimes	127	(31.6%)	40	(30.5%)	30	(28.8%)	116	(35.7%)
	Never	59	(14.7%)	29	(22.1%)	18	(17.3%)	38	(11.7%)
My friend makes me laugh when I am sad	Always	241	(58.2%)	78	(59.1%)	72	(68.6%)	210	(63.3%)
	Sometimes	140	(33.8%)	43	(32.6%)	26	(24.8%)	91	(27.4%)
	Never	33	(8.0%)	11	(8.3%)	7	(6.7%)	31	(9.3%)
He/she talks with me a lot	Agree	327	(78.6%)	88	(67.7%)	74	(71.2%)	265	(80.8%)
	Disagree	89	(21.4%)	42	(32.3%)	30	(28.8%)	63	(19.2%)
The two of us argue a lot	Agree	211	(53.6%)	59	(47.6%)	47	(47.5%)	148	(46.4%)
	Disagree	183	(46.4%)	65	(52.4%)	52	(52.5%)	171	(53.6%)

I can talk to him/her about my problems	Agree	292	(73.0%)	92	(70.8%)	66	(68.0%)	250	(78.9%)
	Disagree	108	(27.0%)	38	(29.2%)	31	(32.0%)	67	(21.1%)
I am able to talk with him/her about boyfriends/girlfriends	Agree	237	(59.1%)	71	(54.6%)	51	(50.0%)	156	(47.6%)
	Disagree	164	(40.9%)	59	(45.4%)	51	(50.0%)	172	(52.4%)
I trust him/her	Agree	322	(80.5%)	98	(77.2%)	82	(78.8%)	271	(82.4%)
	Disagree	78	(19.5%)	29	(22.8%)	22	(21.2%)	58	(17.6%)
I would like to be like him/her	Agree	260	(65.7%)	84	(65.6%)	71	(69.6%)	241	(74.6%)
	Disagree	136	(34.3%)	44	(34.4%)	31	(30.4%)	82	(25.4%)
I think that my friend would disapprove of me having sex before marriage	Agree	200	(49.3%)	62	(46.6%)	42	(42.0%)	148	(45.7%)
	Disagree	206	(50.7%)	71	(53.4%)	58	(58.0%)	176	(54.3%)
In the past 3 months, I've talked with him/her about what is right and wrong about sex	Yes	272	(65.7%)	73	(55.7%)	56	(53.8%)	195	(59.1%)
	No	142	(34.3%)	58	(44.3%)	48	(46.2%)	135	(40.9%)
In the past 3 months, I've talked with him/her about what he/she things about young people having sex	Yes	198	(48.1%)	64	(49.6%)	56	(54.9%)	172	(52.4%)
	No	214	(51.9%)	65	(50.4%)	46	(45.1%)	156	(47.6%)
In the past 3 months, I've talked with him/her about my questions on sex	Yes	213	(51.7%)	57	(43.8%)	54	(53.5%)	152	(46.9%)
	No	199	(48.3%)	73	(56.2%)	47	(46.5%)	172	(53.1%)
In the past 3 months, I've talked with him/her about contraception	Yes	145	(35.1%)	43	(32.8%)	40	(38.8%)	119	(36.3%)
	No	268	(64.9%)	88	(67.2%)	63	(61.2%)	209	(63.7%)
In the past 3 months, I've talked with him/her about preventing sexually transmitted infections	Yes	304	(72.9%)	90	(67.7%)	78	(74.3%)	240	(72.7%)
	No	113	(27.1%)	43	(32.3%)	27	(25.7%)	90	(27.3%)
I think that my friend has a boyfriend/girlfriend	Yes	200	(49.8%)	54	(41.5%)	49	(45.8%)	132	(40.1%)
	No	202	(50.2%)	76	(58.5%)	58	(54.2%)	197	(59.9%)
I think that my friend has had sexual relations	Yes	125	(32.1%)	44	(34.4%	34	(31.8%)	74	(22.3%)
	No	265	(67.9%)	84	(65.6%)	73	(68.2%)	258	(77.7%)
I think that my friend uses contraception	Yes	112	(28.7%)	43	(34.7%)	27	(26.2%)	52	(16.2%)
	No	278	(71.3%)	81	(65.3%)	76	(73.8%)	269	(83.8%)
I think that my friend has had sex with a prostitute	Yes	26	(6.7%)	11	(8.9%)	7	(6.6%)	21	(6.5%)
	No	361	(93.3%)	113	(91.1%)	99	(93.4%)	303	(93.5%)
I think that my friend has received money or gifts for sex	Yes	63	(15.9%)	24	(18.3%)	28	(26.4%)	66	(20.0%)
	No	333	(84.1%)	107	(81.7%)	78	(73.6%)	264	(80.0%)
In the past 3 months, I have listened to the radio with my friend	Yes	253	(62.8%)	68	(52.7%)	56	(53.3%)	207	(62.5%)
	No	150	(37.2%)	61	(47.3%)	49	(46.7%)	124	(37.5%)
In the past 3 months, I have gone dancing with my friend	Yes	80	(20.2%)	40	(31.5%)	16	(16.7%)	61	(18.8%)
	No	317	(79.8%)	87	(68.5%)	80	(83.3%)	264	(81.2%)
In the past 3 months, I have attended a sports event with my friend	Yes	314	(79.9%)	74	(59.7%)	58	(55.8%)	223	(68.4%)
	No	79	(20.1%)	50	(40.3%)	46	(44.2%)	103	(31.6%)
In the past 3 months, I have drank alcohol with my friend	Yes	25	(6.3%)	5	(4.0%)	8	(7.6%)	17	(5.2%)
	No	373	(93.7%)	120	(96.0%)	97	(92.4%)	309	(94.8%)
In the past 3 months, I have smoked cigarettes with my friend	Yes	12	(3.0%)	8	(6.3%)	5	(4.8%)	5	(1.5%)
	No	382	(97.0%)	120	(93.8%)	99	(95.2%)	319	(98.5%)
In the past 3 months, I have gone shopping with my friend	Yes	211	(53.4%)	62	(48.4%)	47	(45.2%)	212	(65.0%)
	No	184	(46.6%)	66	(51.6%)	57	(54.8%)	114	(35.0%)
In the past 3 months, I have used drugs with my friend	Yes	21	(5.2%)	8	(6.2%)	5	(4.8%)	18	(5.5%)
	No	382	(94.8%)	122	(93.8%)	99	(95.2%)	311	(94.5%)

I have seen my friend smoke	Yes	50	(12.4%)	13	(10.0%)	11	(10.3%)	32	(9.7%)
	No	353	(87.6%)	117	(90.0%)	96	(89.7%)	297	(90.3%)
I have seen my friend drink alcohol	Yes	60	(14.8%)	14	(10.9%)	12	(11.3%)	31	(9.4%)
	No	346	(85.2%)	115	(89.1%)	94	(88.7%)	299	(90.6%)

C.1 Personal Network Survey

What is your name? (write clearly) _____

1. How many friends do you have?	Number:_____		
2. Of the friends you normally spend time with, how many of them are males and how many are females?	Number of males:_____ Number of females:_____ Don't know/remember:_____		
3. How many of your friends do not go to school?	Number:_____		
4. How many of your friends are in a different class than you?	Number:_____		
5. What are the initials of your 3 closest friends?	_____	_____	_____
6. How close are you to _____?			
1. Very close	1	1	1
2. Close	2	2	2

Context

7. Why are you close to _____?			
1. Same hometown	1	1	1
2. Respect	2	2	2
3. Trust	3	3	3
4. Related (family)	4	4	4
5. Fun	5	5	5
6. Knowledgeable	6	6	6
7. Experienced	7	7	7
8. Helpful	8	8	8
88. Other (Specify:_____)	88	88	88
99. Don't know	99	99	99
8. How long have you known _____?			
1. Less than 6 months	1	1	1
2. 6 months to 1 year	2	2	2
3. 1 to 2 years	3	3	3
4. 3 to 6 years	4	4	4
5. More than 6 years	5	5	5
9. How often do you see _____ outside of school?			
1. Every day	1	1	1
2. More than once a week	2	2	2
3. More than once a month	3	3	3

10. Where did you meet _____?	_____	_____	_____
	_____	_____	_____

Characteristics/Attributes

11. Is _____male or female?			
1. Male	1	1	1
2. Female	2	2	2
12. How old is _____?	_____	_____	_____

Connection

13. How much do you feel that _____ understands you?			
1. Very much	1	1	1
2. A little	2	2	2
3. Not at all	3	3	3
14. How much do you feel that you have enjoyment with _____?			
1. Very much	1	1	1
2. A little	2	2	2
3. Not at all	3	3	3
15. What characteristics do you like about _____?	_____	_____	_____
	_____	_____	_____

Support and Exchange

16. ____helps me when I have a personal problem			
1. Always	1	1	1
2. Sometimes	2	2	2
3. Never	3	3	3
17. ____ helps me when I need money			
1. Always	1	1	1
2. Sometimes	2	2	2
3. Never	3	3	3
18. ____helps me when I have a health problem			
1. Always	1	1	1
2. Sometimes	2	2	2
3. Never	3	3	3
19. ____helps me when I need information about sex			
1. Always	1	1	1
2. Sometimes	2	2	2
3. Never	3	3	3

20. ____ is a person who makes me feel better after talking over my worries with him/her			
1. Always	1	1	1
2. Sometimes	2	2	2
3. Never	3	3	3
21. ____ is able to make be feel better when I am in bad moods			
1. Always	1	1	1
2. Sometimes	2	2	2
3. Never	3	3	3
22. ____makes me laugh when I am sad			
1. Always	1	1	1
2. Sometimes	2	2	2
3. Never	3	3	3
23. He/she talks with me a lot			
1. Agree	1	1	1
2. Disagree	2	2	2
24. The two of us argue a lot			
1. Agree	1	1	1
2. Disagree	2	2	2
25. I can talk to him/her about my problems			
1. Agree	1	1	1
2. Disagree	2	2	2
26. I am able to talk with him/her about boyfriends/girlfriends			
1. Agree	1	1	1
2. Disagree	2	2	2
27. I trust him/her			
1. Agree	1	1	1
2. Disagree	2	2	2
28. I would like to be like him/her			
1. Agree	1	1	1
2. Disagree	2	2	2
29. I think that ___ would disapprove of me having sex before marriage			
1. Agree	1	1	1
2. Disagree	2	2	2

Information and Communication

30. In the past 3 months, I've talked with ____ about what is right and wrong about sex			
1. Yes	1	1	1
2. No	2	2	2

31. In the past 3 months, I've talked with ____ about what he/she thinks about young people having sex			
1. Yes	1	1	1
2. No	2	2	2
32. In the past 3 months, I've talked with ____ about my questions on sex			
1. Yes	1	1	1
2. No	2	2	2
33. In the past 3 months, I've talked with ____ about contraception			
1. Yes	1	1	1
2. No	2	2	2
34. In the past 3 months, I've talked with ____ about preventing sexually transmitted infections			
1. Yes	1	1	1
2. No	2	2	2

Norms and Perceived Behaviours

35. I think that ____ has a boyfriend/girlfriend			
1. Yes	1	1	1
2. No	2	2	2
36. I think that ____ has had sexual relations			
1. Yes	1	1	1
2. No	2	2	2
37. I think that ____ uses contraception			
1. Yes	1	1	1
2. No	2	2	2
38. I think that _____ has had sex with a prostitute			
1. Yes	1	1	1
2. No	2	2	2
39. I think that ____ has received money or gifts for sex			
1. Yes	1	1	1
2. No	2	2	2

Activities

40. In the past 3 months, I have listened to the radio with ____			
1. Yes	1	1	1
2. No	2	2	2

41. In the past 3 months, I have gone dancing with ____			
1. Yes	1	1	1
2. No	2	2	2
42. In the past 3 months, I have attended a sports event with ____			
1. Yes	1	1	1
2. No	2	2	2
43. In the past 3 months, I have drank alcohol with ____			
1. Yes	1	1	1
2. No	2	2	2
44. In the past 3 months, I have smoked cigarettes with ____			
1. Yes	1	1	1
2. No	2	2	2
45. In the past 3 months, I have gone shopping with _____			
1. Yes	1	1	1
2. No	2	2	2
46. In the past 3 months, I have used drugs with ____			
1. Yes	1	1	1
2. No	2	2	2
47. I have seen ____ smoke			
1. Yes	1	1	1
2. No	2	2	2
48. I have seen ____ drink alcohol			
1. Yes	1	1	1
2. No	2	2	2

THIS IS THE END OF THE SURVEY. MAKE SURE YOU HAVE ANSWERED ALL OF THE QUESTIONS AND WRITTEN YOUR NAME CLEARLY. FOLD YOUR SURVEY IN HALF.

C.2 Total Network Analysis Survey

Please answer the following questions. Your answers will be confidential (secret).

1. What is your **full name**? (write clearly) _____

2. How old are you? _____

3. What is your gender? (male or female) _____

The next two questions ask about other students in your grade. Please clearly write up to 7 (seven) full names that best answer the questions. You do not have to fill all of the spaces. If you have more than 7 possible answers, please rank your answers and list the top 7 students.

3. <u>In your class,</u> whom do you like as a friend?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

4. <u>In your class,</u> whom have you talked to about reproductive/sexual health issues with in the last three months?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

THIS IS THE END OF THE SURVEY. FOLD PAPER IN HALF WHEN FINISHED.

Network Analysis of Social Relationships to Inform Peer Education in Uganda

Hello,

My name is Amanda Nischuk and I am a public health sciences graduate student at the University of Alberta in Canada. I am working with Basic Health Services in Fort Portal to learn more about the types of relationships with your classmates and friends, and how this knowledge can help us find out about the health and social behaviours that are presently taking place in your school.

Procedure: You will be asked to fill out a survey questionnaire, in which you tell us some details about your relationship with the people that you interact with closely at school. This survey may take up to 45 minutes to complete.

Benefits: The results from the survey will be used to help us better understand how youth communicate with one another and how this may influence the decisions that they make. This sort of information can help youth program planners work to provide more appropriate health and social programs.

Risks: I do not expect any negative effects of this research on you personally.

Confidentiality: To make sure that answers are kept confidential the following procedures will take place:

1. Your name will be changed into a numerical code that only myself and my supervisor in Canada will have access to.
2. You have the right to not answer any questions that make you feel uncomfortable
3. You can withdraw from the study at any time without any problems
4. Only my supervisor in Canada and I will have access to the information that you provide
5. The information you provide will be kept in a safe place for at least five years after the study is done. The information will be kept in a locked cabinet in the office of Dr. Lory Laing, Department of Public health Sciences, at the University of Alberta, Canada.

All information will be held confidential (or private) except when professional codes of ethics or legislation (or the law) requires reporting.

The information gathered for this study may be looked at again in the future to help us answer questions. If so, the ethics board will first review the study to ensure the information is used ethically.

In case of any questions please contact:

Network Analysis of Social Relationships to Inform Peer Education in Uganda

Principal Investigator:
Amanda D. Nischuk
Public Health Sciences
University of Alberta, Canada

Please answer the following questions by circling yes or no.

Do you understand that some of your students will be participating in a research study?	Yes	No
Have you read and received a copy of the attached Information Sheet?	Yes	No
Do you understand the benefits and risks involved in your students' taking part in this research study?	Yes	No
Have you had an opportunity to gain more information by asking questions and discussing the study?	Yes	No
Do you understand that your students are free to withdraw from the study at anytime for any reason and do not have to give a reason?	Yes	No
Do you understand the issue of confidentiality amongst the respondents? Do you understand who will have access to their records/information?	Yes	No
Do you understand who will have access to the data?	Yes	No

This study was explained to me by: _____
Date: _____

Principal
I agree to allow selected students from my school to take part in this research study

Printed name of Principal	Signature of Principal	Date

Witness
I believe that this person signing this form understands clearly what is involved in the study and volunteer's consents to the participation of his or her students

Signature of Investigator	Printed Name	Date

Network Analysis of Social Relationships to Inform Peer Education in Uganda

Hello,

My name is Amanda Nischuk and I am a public health sciences graduate student at the University of Alberta in Canada. I am working with health experts from BHS in Fort Portal to learn more about the types of relationships that occur between your students and their friends, and how this knowledge can help us find out about the health and social behaviours that are presently taking place in your school.

Procedure: Your students will be asked to fill out a survey, in which they tell us some details about their relationship with the people that they interact with closely at school. This survey may take up to 30 minutes to complete.

Benefits: The results from the survey will be used to help us better understand how youth communicate with one another and how this may influence the decisions that they make. This sort of information can help youth program planners work to provide more appropriate health and social programs.

Risks: I do not expect any negative effects of this research on your students.

Confidentiality: To make sure that answers are kept confidential the following procedures will take place:

1. Student names will be changed into a numerical code that only myself and my supervisor in Canada will have access to.
2. The student has the right to not answer any questions that make you feel uncomfortable
3. The student can withdraw from the study at any time without any problems
4. Only my supervisor in Canada and I will have access to the information that the student provides
5. The information the student provides will be kept in a safe place for at least five years after the study is done. The information will be kept in a locked cabinet in the office of Dr. Lory Laing, Department of Public health Sciences, at the University of Alberta, Canada.

All information will be held confidential (or private) except when professional codes of ethics or legislation (or the law) requires reporting.

The information gathered for this study may be looked at again in the future to help us answer questions. If so, the ethics board will first review the study to ensure the information is used ethically.

In case of any questions please contact: