UNIVERSITY OF NAIROBI
SCHOOL OF COMPUTING AND INFORMATICS

AN ICT INTERVENTION TO PROVIDE TIMELY AND CONTEXTUALIZED REPRODUCTIVE HEALTH INFORMATION TO URBAN TEENAGERS

BY

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Submitted in partial fulfillment of the requirements of the Masters in Applied Computing

DECLARATION

I hereby declare that this project is my own work and has, to the best of my knowledge, not been submitted to any other institution of higher learning.

Student: Fredrick Omondi   **Registration Number: P51/72888/2014**

Signature: ....….   **Date:…………………………………….**

This project has been submitted as a partial fulfillment of requirements for the Masters in Applied Computing of the University of Nairobi with my approval as the University supervisor.

Supervisor: Prof Peter Wagacha

Signature: ....   **Date: ……………………………………**

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List of Abbreviations

ABC   Abstinence, Being Faithful and Condom Use
AIDS   Acquired Immune Deficiency Syndrome
ANC   Antenatal Care
ASRH   Adolescent sexual reproductive health
AYSRH   Adolescent and youth sexual and reproductive health
BCC   Behaviour change communication
CBD   Community =based Distributor of Contraceptives
CBO   Community-based Organization
CDC   Centers for Disease Control
CDF   Constituency Development Fund
CHE   Commission for Higher Education
CSO   Civil Society Organization
DTC   Diagnostic Testing and Counseling
EBI   Evidence-based intervention
FHOK   Family Health Options of Kenya
FOY   Friends of Youth
FP   Family planning
HFG   HIV Free Generation
HIV   Human Immune deficiency virus
HTC   HIV testing and counseling
ICL I   Choose Life Africa
ICPD   International Conference for Population and Development
ICT   Information Communication and Technology
IEC   Information, Education and Communication
KARHP   Kenya Adolescent Reproductive Health Program
KDHS   Kenya Demographic and Health Survey
KEMRI   Kenya Medical Research Institution
KNH   Kenyatta National Hospital
MAG   Married Adolescent Girls
MCH   Maternal Child Health
MOH   Ministry of Health (divided into MOMS and MOPHS)
NASCOP   National AIDS and STD Control Program
NOPE   National Organization of Peer Educators
PLWHA   People living with HIV and AIDS
PNC   Postnatal care
RH   Reproductive health
SRH   Sexual Reproductive health
SBCC   Strategic behavior Change Communication
SGBV   Sexual and Gender-Based Violence
STI   Sexually transmitted infection
TOT   Training of trainers
TWG   Technical working group
USAID   United States Agency for International Development
VCT   Voluntary counseling and testing
YSRH   Youth sexual and reproductive health

Abstract

Kenya Demographic and Health Survey 2014 indicates that 15% of women aged 15-19 have already given birth while 18% have begun childbearing. Research indicates that Adolescents feel that more needs to be done to make information about Adolescent Sexual Reproductive Health (ASRH) available to them in a timely and contextual manner. Early pregnancy leads to poverty in most cases. There is a need to provide timely and contextual ASRH information to youth in a personalized and on-need basis. This study aimed to provide timely and personalized ASRH information to youth with the aim of reducing dangerous trends like unintended pregnancies, STIs and abortions. The study's research methodology first step was reviewing information gaps in the existing sources of information through desktop review and through questionnaires. Focus group discussions were used to elicitate and acquire knowledge from teen counselors (domain experts). This knowledge was represented in the form of cases and rules in a knowledge-based system. A case-based reasoning system was developed through user-centered prototyping, this case based system acted as the ICT intervention that is intended to address knowledge gaps in sexual reproductive health issues affecting teenagers. The Pilot study and deployment of the system was done in Mathare Youth Sports Association. This was done by making the system available and receiving questions asked by teenagers on a separate forum. Responses generated by the system were compared to responses generated by counselors (humans).

Observations were made on questions answered correctly and questions answered wrongly. These results were used to improve the knowledge-based system developed.

The study conducted established that at least 69% of adolescents interviewed had access to mobile phones and had access to internet connectivity. This makes a mobile phone the most widely available platform to deliver the intervention on. As earlier assumed, most adolescents are uncomfortable asking sexually related questions to their parents. Most teenagers would rather ask sexually related questions anonymously.

Chapter 1 – INTRODUCTION

Background

Adolescents are individuals from 9-15 years old (WHO) are caught in between being children and being adults. They are mostly adjusting to the biological and physiologic changes their bodies are undergoing and are working to establish a sexual identification and to use these changes for their personal benefits and for the benefit of society they thrive from. Adolescents are constantly searching for personal identity and want freedom and independence of thought and action. Despite this, they continue to have a strong dependence on their parents and suffer feelings of loss in separating from them. As a response to this they identify with their peers (age mates) and tend to yield to peer pressure and conform to peer group values, behavior, and tastes in such things as clothing, food, language and entertainment.

Given the large populations of teenagers, poverty, unemployment and limited access to healthcare, a significant percentage of teenagers do not acquire life skills and consequently indulge in risky behaviors that expose them to economic and social adverse events such as crime, drug abuse, social unrest, discontinuation of education, unintended pregnancies, STIs, abortions and sometimes death. In 2011, young women below 20 years accounted for 16% of over 20,000 abortion-related complications treated annually (Teenage Pregnancy and unsafe abortions –KNHRC)

Table 1 shows teenage fertility, a metric that which the percentage of women age 15-19 who have had a live birth or who are pregnant with their first child, and the percentage of women who have begun childbearing, by selected background characteristics. This study indicates that 15% of women age 15-19 have already had a birth while 18 percent have begun childbearing (had a live birth or are pregnant with their first child). The percentage of women who have begun childbearing increases rapidly with age, from about 3 percent among women age 15 to 40 percent among women age 19. The rural-urban differences are small, indicating that early childbearing is nearly the same across place of residence. Prevalence of early childbearing is highest in the Nyanza region followed by Rift Valley and Coast; it is lowest in Central and North Eastern region. Slightly more than 3 in 10 women age 15-19 with no education have begun child bearing compared with only 12 percent among those who have a secondary or higher level of education. Similarly, teenagers from poorer households are more likely to have begun childbearing (26 percent) than are teenagers from wealthier households (10 percent). The proportion of teenagers who have begun childbearing has not changed since the 2008-09 KDHS.

Table 1. Teenage pregnancy and motherhood: Kenya Demographics and Health Survey 2014

Percentage of women age 15-19 who have had a live birth or who are pregnant with their first child, and percentage who have begun childbearing, by background characteristics, Kenya 2014

Background characteristic	Percentage of women age 15-19 who:		Percentage who have begun childbearing	Number of women
	Have had a live birth	Are pregnant with first child		
Age				
15	1.7	1.6	3.2	1,226
16	5.9	2.0	8.0	1,206
17	10.3	4.7	15.0	1,078
18	21.5	4.4	25.9	1,185
19	35.3	4.6	39.9	1,125
Residence				
Urban	14.0	3.3	17.3	1,859
Rural	15.0	3.5	18.5	3,961
Region				
Coast	16.6	4.3	20.8	604
North Eastern	8.7	3.5	12.2	143
Eastern	12.1	2.3	14.4	849
Central	7.7	2.7	10.4	600
Rift Valley	17.0	4.3	21.2	1,492
Western	14.1	2.7	16.8	790
Nyanza	19.2	3.0	22.2	874
Nairobi	13.1	4.3	17.4	467
Education				
No education	29.2	4.1	33.2	133
Primary incomplete	15.7	3.2	18.9	2,102
Primary complete	30.0	6.2	36.2	801
Secondary+	8.8	2.7	11.5	2,783
Wealth quintile				
Lowest	22.3	3.9	26.2	1,040
Second	14.5	3.9	18.4	1,220
Middle	15.8	3.4	19.1	1,331
Fourth	13.1	3.7	16.8	1,113
Highest	8.1	2.1	10.2	1,116
Total	14.7	3.4	18.1	5,820

Based on estimates from the 2009 Population and Housing Census, adolescents constitute about 24 percent of the total population this translates to 9.2 million. World Health Organization (WHO) defines adolescents as persons aged between 10 and 19 years. Adolescents are more vulnerable to STIs and pregnancy-related complications. Studies have shown that adolescent girls are more likely to die while giving birth or during pregnancy than women who are 20 years and older. Teenagers also lack comprehensive knowledge about the risks stemming from early sexual activity, as well as appropriate measures to prevent infection and pregnancy. Limited access of adolescent mothers to reproductive health services also predisposes them to higher risks of illness and in worst cases death. Understanding the RH needs and rights of adolescents is therefore central to improving the health services offered to this vulnerable group. According to the 2008/09 KDHS, about 26 percent of women and 58 percent of men between the ages of 15 and 24 who had never been married in Kenya had had sexual intercourse before the age of 18, whereas 66 percent of women and 68 percent of men who had ever married had had sexual intercourse before the age of 18. Because of 16 inadequate knowledge and high levels of sexual activity among adolescents, levels of unmet need for contraceptives and unintended pregnancies is high, with an estimated 47 percent of the births in this group being unplanned. Among married adolescents, fertility behavior and regulation remains an issue, as about 30 percent of them in the latest KDHS reported having an unmet need for FP, especially the need for spacing births. Unfortunately, adolescents experiencing an unwanted pregnancy are more likely to resort to abortions, which are often illegal and done by unskilled attendants. A 2005 report by the Ministry of Health shows that an estimated half of all pregnancies of women aged 15 to 19 are terminated.

Another study conducted by the Ministry of Health in collaboration with the Kenya Medical Association, the Federation of Women Lawyers in Kenya (FIDA-K) and Ipas Africa Alliance, indicates that about 316,560 abortions – both spontaneous and induced – are performed in the country each year, causing an estimated 20,000 women and girls to be hospitalized with related complications. This translates into a daily 'abortion rate' of about 800 procedures and the death of 2,600 women every year. The study also revealed that about 1 per cent of women admitted to public hospitals were dying from abortion-related complications and nearly 50 per cent of abortions occurred in women aged between 14 and 24.

1.1 Problem statement

Evidence shows that 15% of women aged 15-19 have already given birth while 18% have begun childbearing (Kenya Demographic and Health Survey 2014). Half of these births were unplanned. And although 50% of the 15 to 19-year-old women had initiated sexual activity, only 35% were using any method of contraception. (NCSS) 2012 Adolescents lack comprehensive knowledge about the risks stemming from early sexual activity, as well as appropriate measures to prevent infection and pregnancy. There is an urgent need to come up with interventions and policies that provide sexually reproductive health information to teenagers to increase their knowledge in the subject with the intent to avoid unwanted pregnancies, help them respond safely and pragmatically to such pregnancies when they occur, practice safe sex and avoid STIs.

1.2 Research objectives

This study intends to:
- Identify knowledge gaps in teenage reproductive health information available
- Develop an ICT intervention that provides timely sexual reproductive health information to teenagers
- Evaluate efficiencies of current interventions
- Pilot the intervention and report findings

1.3 Research questions

- What are the existing sources of teenage reproductive health information?
- How efficient are these sources of information?
- Are there existing interventions successful?

1.4 Justification

- Teenage pregnancy prevalence is very high in Kenya and in most cases leads to dropping out of school and eventually poverty
- Common sources of information regarding teenage reproductive health are not personalized.
- Sexual oriented subjects and discussions by teenagers are done in secrecy thus there is a need for an intervention that respects this.
- This proposal approach is more appropriate because it addresses the above needs

1.5 Scope:

Geographically speaking, this project is limited to Kenya and the project only aims to provide an intervention that provides personalized reproductive health information to teenagers. The project does not pay much attention to consumption of the information beyond making it available.

1.6 Significance

The socio-economic development of the country depend, to a large extent, on the ability of the teenagers to avoid unintended outcomes, which in turn have a direct bearing on several MDGs. Teenage pregnancy adversely affects the social- economic well-being of teenagers and lead to the following problems which are of national concern:

- Death due to unsafe abortions
- Poverty
- Maternal and child mortality due to immaturity and inability to get proper healthcare at such age.
- Unemployment

1.7 Limitations

- Project relies on existing channels in high schools to be run, i.e. student's phone bureau and counseling clubs
- This project purely provides useful reproductive health information to in a personalized manner, the solution does not compel the teenagers to do what the information suggests, this is due to the fact that teenagers below 18 years old are legally considered to be minors.
- The project has not put into consideration the undergoing parliamentary discussions about teenage pregnancy and contraceptives.
- This project is limited to teens who have access to internet enabled phones.

Chapter 2 Literature Review

Unintended pregnancy and STIs among adolescents is a common public health problem in industrialized, middle or low income countries (WHO 1995). In the US for example, 9% of adolescents between the ages 15 to 19 years become pregnant each year, and about half of these pregnancies end in abortions (Darroch 2001). In India, adolescent pregnancies constitute 19% of the total fertility (Mehra 2004) and an Israeli study estimated the incidence of teenage pregnancy to be 32 per 1000 adolescent girls in the country (Sikron 2003). The situation worsens as you go to low income countries. For instance in Kenya Young people in Kenya face severe threats to their health and well-being and an uphill struggle to stay in school, postpone marriage and child bearing, find gainful employment and remain free of sexually transmitted infections (STIs), including HIV. According to Kenya Demographic Health Survey (KDHS), 2008-09, 3 percent of women age 15-19 are HIV infected, compared with less than 1 percent of men age 15-19, while prevalence among women age 20-24 is over four times that of men in the same age group The data show that 3 percent of youth age 15-24 are HIV-positive. Young women age 15-24 are more vulnerable to HIV infection than men of the same age. Young people are becoming sexually active at increasingly younger age because of early physical maturity, social pressures and availability of contraceptives. At the same time, the lengthening of the socially defined period of adolescence due to increased education and delayed marriages means a large proportion of unmarried adolescents are sexually active.

2.1 Youth Reproductive Health

Source: World Bank 2012

Among the critical health problems young people face are those associated with sexuality and reproductive health, such as early, unprotected sexual activity, which has a significant bearing on both their current and future health statuses. The realization of personal goals of these young people and the socio-economic development of the country depend, to a large extent, on the ability of the youth to avoid unintended outcomes, which in turn have a direct bearing on several MDGs.

While the Government has formulated or developed many national policies, strategies and programs to address the sexual and reproductive health of young people, their sexual and reproductive health is not flagged out in the Vision 2030. Meanwhile, gaps also exist between policy and implementation whose monitoring and evaluation remain weak. Youth Empowerment Centres which were to be promoted, established and operationalized in every constituency with a view to offering integrated health services — including SRH — have taken off rather half-heartedly, there being only eight such centres by the end of 2011, against a target of 210. There are many factors that determine the levels of utilization of SRH services by young people. These include; poverty, gender issues, stigma and discriminatory laws which may curtail adolescents' access to services, including HIV prevention and treatment, education levels, assistance in humanitarian emergencies and maternal health and reproductive care for adolescent girls (UNICEF, 2012). Young people in Kenya are unlikely to seek health services, and when they do, they are not likely to get adequate services as the country's health system and human resource capacity development has been slow in evolving to respond to the needs of this age group both from program and service delivery perspectives (CSA, 2009). For example only seven percent of health facilities in Kenya offer youth friendly HIV counseling services (GOK/NCAPD, 2010), which is inadequate for current and increasing needs.
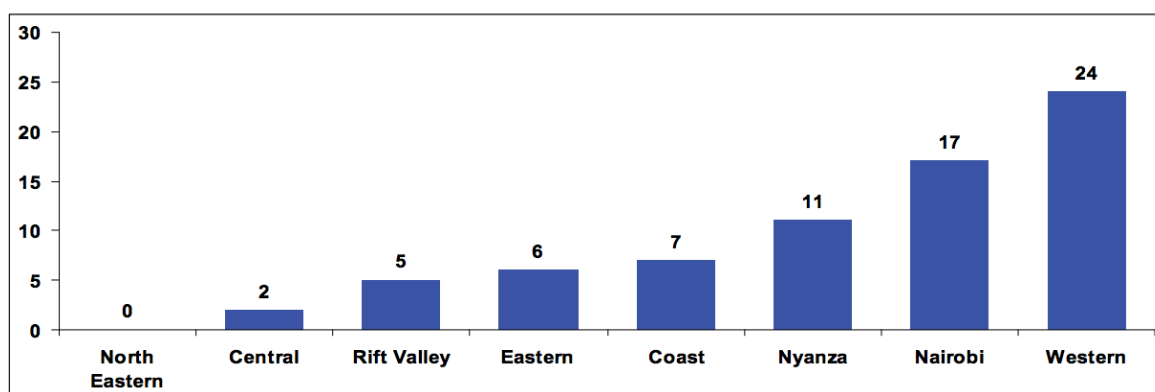
Source: Kenya Service Provision Assessment Survey (KSPA) 2010

Figure 1. Distribution of facilities offering youth friendly HIV Services

Lack of data on abortion at the national or household level makes it difficult to undertake conclusive analyses of the magnitude of the problem, such as its extent among young people. Most of the studies undertaken on abortion have been health facility-based and provide mere anecdotal insights into the magnitude of the problem in the country. Additionally, the Health Information Management System (HIMS) has a very poor base which cannot capture what happens in public (and private) health facilities.

2.2 Sexual and Reproductive Health Knowledge of Adolescents

2.2.1 Awareness and Knowledge of the Menstrual Cycle

An important benchmark for testing the sexual and reproductive health knowledge of adolescents, especially females, is awareness of the menstrual cycle. This is primarily because the efficacy of certain methods of birth control, such as the rhythm method, is largely based on a woman's (and her partner's) understanding of her ovulatory cycle. . Data shows that knowledge of fertile period increases with age, with older adolescents more likely to be aware of the physiology of the ovulatory cycle than younger ones. A higher proportion of out-of-school males and females (75% and 81%, respectively) are aware of a fertile period than those currently in school. As a corollary to knowing that there is a fertile period.

A higher proportion of out-of-school males and females (75% and 81%, respectively) are aware of a fertile period than those currently in school by socio-demographic characteristics knowledge that a woman is most likely to conceive halfway between her menstrual periods is low. Specifically, only one in five girls between the ages of 12 and 22 accurately states that pregnancy is most likely to occur halfway between their periods. Less than one in four girls, irrespective of whether they are currently in school or not, correctly states that pregnancy is most likely to occur halfway between periods. Almost 40% of girls not currently in school incorrectly believe that they are most likely to conceive right after their period ended, as compared to 27% of girls currently in school. Irrespective of the level of education, about one in three girls wrongly believe that conception is most likely right after the period had ended. Surprisingly, almost one in three girls with at least secondary level education wrongly believe that conception was most likely just before her period begins. It is however notable that about 26% of girls with secondary level education or higher rightly understand

that pregnancy is most likely to occur halfway between two periods, compared to 19% for those with only primary level education.

Table 2. Percent distribution of adolescents aged 12-22 years according to their knowledge of fertile period, by socio-demographic characteristics (Source Status Report on the Sexual and Reproductive Health of Adolescents Living in Urban Slums in Kenya)

	Male		Female	
	%	N	%	N
Age group				
12-14 years	40.4	277	50.6	249
15-19	66.9	640	76.2	623
20-22	77.8	436	84.0	449
Total	65.0	1,353	74.0	1,321
Currently in school				
No	75.0	579	80.7	654
Yes	57.4	761	67.2	655
Total	65.0	1,340	73.9	1,309
Education Level				
Primary or lower	58.6	939	70.4	914
Secondary or more	79.4	403	82.3	401
Total	64.8	1,342	74.0	1,315
Marital status				
Never married	64.1	1,258	71.4	1,025
Currently married	74.6	71	82.4	250
Formerly married	78.3	23	87.8	41
Total	64.9	1,352	74.0	1,316
Total	65.0	1,353	74.1	1,320

2.2.2 HIV/AIDS Knowledge and Testing

A comprehensive understanding of adolescent sexual and reproductive health knowledge in the Kenyan context needs to take into consideration HIV/AIDS awareness as well as uptake of HIV counseling and testing. As adolescents transition into adulthood and begin to engage in sexual intercourse, they are at risk of HIV infection and therefore, HIV/AIDS appears to be a salient component of their sexual development. Findings indicate that knowledge of HIV/AIDS is universal, with almost all male and female adolescents reporting that they had heard of HIV/AIDS. To assess uptake of HIV counseling and testing, respondents were asked if they had ever been tested for HIV and, if so, where they were tested and whether the test was requested, required or offered. Males and females aged 20- 22 were more likely to have ever been tested, followed by those aged 15-19 years. Overall, females were more likely to have been tested than male adolescents. In addition, more adolescents who were not currently in school reported ever having been tested for HIV than those who are currently in school. Adolescents with a secondary education or higher were more likely to have ever been tested than those with primary or lower education, irrespective of gender.

Currently married and formerly married girls were more than three times more likely to have been tested than never married girls. Sexually experienced adolescents, whether male or female, were much more likely to have been tested.

Table 3. Percent distribution of adolescents who report ever been tested for HIV/AIDS, by socio-demographic characteristics (Source Status Report on the Sexual and Reproductive Health of Adolescents Living in Urban Slums in Kenya)

	Male		Female	
	%	N	%	N
Age group				
12-14 years	4.5	28	40	589
15-19	19.1	180	313	913
20-22	38.5	185	340	508
Currently in school				
No	31.5	249	546	917
Yes	11.5	143	136	1065
Education level				
Primary or lower	14.5	201	420	1360
Secondary or higher	29.2	192	273	650
Marital status				
Never married	18.0	353	388	1641
Currently married	54.7	35	271	325
Formerly married	41.7	5	33	43
Sexually experienced				
Yes	35.9	233	72.0	510
No	11.5	190	14.1	183

Table 4. Reasons for testing or not testing for HIV among adolescents aged 12-22 years, by gender (Source Status Report on the Sexual and Reproductive Health of Adolescents Living in Urban Slums in Kenya)

Reason for getting tested for HIV	Male	Female	Both
To know status	52.1	34.7	42.0
Pregnant/Prenatal visit	0.2	33.9	19.8
"I'm sexually active"	0.2	0.4	0.3
Encouraged by counselor	0.8	1.8	1.4
Encouraged by peer educator	1.1	0.9	1.0
Encouraged by peers	1.1	0.6	0.8
To get married	0.3	0.0	0.1
Partner told me to	40.1	24.0	30.7
Concern about a partner	0.2	0.2	0.2
Required to get a job	0.5	0.1	0.3
Other	3.2	3.1	3.2
Total	649	900	1549
Reason for not getting tested for HIV	Male	Female	Both
Not sexually active	34.6	39.7	36.8
Not at risk for other reasons	33.5	34.9	34.1
Do not know where	4.4	4.6	4.5
Costs too much	0.3	0.3	0.3
Can get infected	0.5	0.8	0.6

2.2.3 Attitudes towards Sex and Contraception

Attitudes toward sex and conception are measured using a series of questions. Adolescents are asked to 'agree or disagree' to the following statements about sex: 'Young women should remain virgins until they marry,' 'young men should remain virgins until they marry,' and 'usually people do not plan to have sex, it just happens.' Results on attitudes toward sex and contraception are captured and are disaggregated by age categories. The majority of males and females adolescents irrespective of age report that young women should remain virgins till marriage. When the same question was asked about young men, there are similar responses with 82% of males and 87% of females believing that young men should remain virgins until marriage. This belief decreased as age increased. When adolescents are asked if they agreed that 'people usually do not plan to have sex, it just happens,' a majority of both males and females respond with a 'no.' Interestingly, the difference between those who thought sex 'just happens' and those who disagreed among adolescents ages 20-22 is not very big. In fact, almost 1 in 2 adolescents (male and female) believes sex just happens; therefore, people do not plan for it. With regards to attitudes towards contraceptive use, adolescents are asked to state if they agreed or disagreed with the following statements: 'It is smart to use birth control to prevent an unplanned pregnancy' and 'it is a good idea to use condoms to protect against getting HIV/AIDS'. The majority of both boys and girls agree that it is smart to use contraceptives to prevent unplanned pregnancies, with support increasing with age for both genders. An equally high percentage of adolescents agree that it is a 'good idea to use condoms as a way to prevent being infected by HIV/AIDS,' and agreement increases with age for both males and females. To assess perceptions about the ease of obtaining contraceptives, the question 'do you agree or disagree that it is difficult for young people to obtain birth control/contraceptives' was asked. Over 70% of adolescents (both boys and girls) disagree, implying that they believe obtaining birth control or contraceptives is not a difficult task for adolescents.

Table 5. Percent distribution of adolescents aged 12-22 years according to their attitudes towards sex and contraception (Source Status Report on the Sexual and Reproductive Health of Adolescents Living in Urban Slums in Kenya)

Attitudes towards sex and contraception								
	Male				Female			
	12-14	15-19	20-22	Total	12-14	15-19	20-22	Total
Young women should remain virgins until marriage								
No	9.0	12.6	15.6	12.2	5.8	8.3	14.8	9.2
Yes	91	87.4	84.4	87.8	94.2	91.7	85.2	90.8
Young men should remain virgins until marriage								
No	11.1	19.0	25.4	18.1	7.6	13.3	19.3	13.1
Yes	88.9	81.0	74.6	81.9	92.4	86.7	80.7	86.9
Sex just happens								
No	69.8	52.7	49.7	57.2	70.8	55.3	49.8	58.5
Yes	30.2	47.3	50.3	42.8	29.2	44.7	50.2	41.5
Smart to use contraception to prevent unplanned pregnancies								
No	25.0	14.6	10.0	16.7	18.7	11.5	6.1	12.2
Yes	75.0	85.4	90.0	83.3	81.3	88.5	93.9	87.8
Good idea use condom to prevent HIV/AIDS								
No	16.6	14.1	12.1	14.4	23.3	17.3	12.8	17.9
Yes	83.4	85.9	87.9	85.6	76.7	82.7	87.2	82.1
Difficult to obtain contraceptives								
No	73.9	73.7	73.4	73.7	73.7	73.8	75.4	74.2
Yes	26.1	26.3	26.6	26.3	26.3	26.2	24.6	25.8
N	620	946	481	2047	589	913	508	2010

2.2.4. Summary

Although awareness of HIV/AIDS is almost universal among adolescents, there exists substantial gaps in their understanding of sexual and reproductive knowledge. In particular, knowledge of the menstrual cycle is lacking, with only one in five females able to correctly identify the fertile period within the menstrual cycle regardless of their education levels. Qualitative results also highlight disconnects between SRH knowledge, attitudes and behavior among adolescents in the slums.

Narratives from these adolescents generally indicate gaps between awareness and understanding. For example, adolescents are likely to report knowing about contraceptives and where to obtain them, yet hold misconceptions about contraceptive usage and effects that do not demonstrate an understanding of contraception.

Adolescents' sexual and reproductive health-related attitudes reveal a complex range of influences on their beliefs, perceptions and attitudes. Surprisingly over 80% of respondents believe that both men and women should remain virgins until marriage. Yet, previous literature underscore differences in acceptable sexual conduct for young males and females in sub-Saharan Africa with premarital sexual activity being proscribed for girls, and boys' sexual experience being more readily accepted. There is, however a notable decrease in the proportion of adolescents holding this view as age increased among both genders. Further research elucidating the evolution of SRH attitudes with increasing age would be useful in shaping age-appropriate interventions.

Knowledge of one's HIV status is likely to help an individual make decisions that may limit the risk or vulnerability of contracting or transmitting HIV. Study indicates that a significant proportion of young men and women had been tested for HIV. However, there are substantial gender differences in HIV

testing experiences. In particular, although a greater proportion of females than males had ever been tested for HIV, males are more likely to report the use of voluntary testing and counseling (VCT) services. These gender differences in HIV testing probably reflect the role of provider-initiated testing in the context of prevention of mother to child transmission of HIV (PMTCT) services. As reported in a study by Kabiru and colleagues among adolescents, about one in two females get tested because they are pregnant. (Donatien 2013). Exploring the use of provider-initiated testing during routine healthcare visits, feasibility of which has been demonstrated in a limited range of settings, might be one avenue to reach a greater pool of young men. It might also be worth exploring the acceptability of self-testing for HIV which provides privacy.

Overall, the use of condoms and other contraceptives is quite low. Thus, it is not surprising that more than half of sexually- experienced girls had ever been pregnant with almost one in four of these pregnancies being reported as unintended. Notably, education is negatively associated with childbearing, with a substantially higher proportion of 42 out-of-school girls reporting a previous pregnancy experience. Earlier studies in Kenya have reported that 13,000 girls drop out of school annually due to unintended pregnancy. The fact that a higher proportion of-out of school girls reported a pregnancy may reflect the fact that those who become pregnant while in school drop out as a result of the pregnancy, though this directionality is only speculative.

2.3 Existing sources of Information

Understanding where people get their information about HIV/AIDS is central to the design of effective campaigns and highlights appropriate channels to reach target populations. The main sources of information about HIV/AIDS in the slums by background characteristics are summarized in Table 5. The top six sources of information were radio (58.7 percent), health workers (51.1 percent), friends/relatives (49.7 percent), television (39.0 percent), school/teachers (30.3 percent), and church/mosque (23.6 percent). It is noteworthy that the proportion of women reporting radio as a source of information on STIs declined substantially between 2000 and 2012, while a greater proportion of women reported that they obtained information from television (TV) in 2012 relative to 2000. Non-traditional sources such as drama, workplace and community meetings assumed increased relevance as sources of information for women. There is a substantial increase in the proportion of respondents identifying health workers, television and school/teachers as sources of information between 2000 and 2012. Women with higher levels of education are more likely to obtain their information from formal sources (radio, TV, newspaper, pamphlets, schools and health workers), but less likely to use informal channels such as community meetings, friends and relatives. Younger women (15-19) mostly received information from radio and schools/teachers; women aged 20-24 mentioned radio and friends/relatives; and women aged 25-29 from friends and health workers. Television and radio stood out among women aged 30-39, while the oldest age group (40-49) mostly received information from community meetings and radio. Never married women are more likely to mention radio and schools/teachers as sources of HIV/AIDS information, while currently and formerly married women mostly obtained information from health workers and radio.

Most reports indicate general sources of SRH related information in the wider society, there is scarce information regarding adolescent's information preferences. In this study we carry out a questionnaire that asks adolescents about their information preferences. Results are discussed later.

The limited information available still indicate that there is no one preferred media that is most popular with adolescent. This study proceeds to analyze existing models, solutions and initiatives set up by different stakeholders to provide SRH information to adolescents in Kenya.

Table 6.   Sources of HIV/AIDS Knowledge (Source : National Cross-sectional Slums Survey 2012)

Background Characteristics	Media				Health worker	Church/ Mosque	School/ Teachers	Community Meetings	Friends/ Relatives	Work place	Drama	Other sources	Number of cases
	Radio	TV	Newspapers	Pamphlets									
Age													
15-19	49.9	33.2	9.2	18.5	18.2	30.4	48.2	4.1	37.0	0.0	0.0	4.1	590
20-24	68.8	37.9	19.4	7.5	48.3	20.7	34.0	18.1	52.0	7.9	3.8	0.0	1,027
25-29	38.5	35.5	22.1	11.8	63.7	16.6	21.1	17.8	69.6	9.5	10.4	0.0	1,043
30-39	81.0	61.0	30.5	46.7	75.0	44.0	26.4	20.7	34.7	5.5	3.8	0.0	894
40-49	60.7	23.9	0.0	0.0	51.8	0.0	0.0	63.6	12.5	23.9	0.0	0.0	338
Marital Status													
Never married	60.4	49.0	23.2	21.7	25.9	30.9	59.1	10.2	43.3	2.2	0.0	0.0	1,102
Currently married	61.8	37.2	19.8	15.0	56.2	22.3	16.7	15.9	55.7	11.6	8.1	1.2	2,345
Formerly married	44.1	27.8	6.8	6.8	81.1	14.5	24.2	48.1	39.3	0.0	0.0	0.0	388
Marital Duration (years)													
Never married	60.4	49.0	23.2	21.7	25.9	30.9	59.1	10.2	43.3	2.2	0.0	0.0	1,102
0-4	57.5	26.3	9.6	9.7	53.7	13.3	12.6	20.3	62.5	5.4	5.4	2.8	888
5-9	60.9	30.2	28.9	13.6	72.3	31.6	19.0	17.5	67.9	13.6	9.4	0.0	627
10-14	52.9	45.8	14.1	16.3	50.0	27.1	27.5	23.1	54.6	8.7	12.8	0.0	438
15+	64.7	40.9	21.2	21.2	68.8	18.8	9.8	45.5	10.4	13.4	0.0	0.0	521
Division													
Central	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	303
Makadara	55.9	38.9	38.9	0.0	43.4	37.1	83.0	19.4	61.1	0.0	0.0	0.0	404
Kasarani	90.0	35.1	30.8	30.8	90.9	0.0	26.6	16.6	20.9	0.0	0.0	0.0	404
Embakasi	79.2	56.5	28.2	28.4	49.6	56.7	42.6	24.2	70.8	15.1	13.4	0.0	1,129
Westlands	7.2	8.2	4.3	0.0	56.3	0.0	9.6	13.4	64.3	0.0	0.0	0.0	332
Kibera	80.4	52.7	22.4	17.7	27.9	7.9	37.9	19.8	12.8	10.3	0.0	3.6	559
Duration of stay in HH													
<2	53.6	34.1	12.4	13.8	52.8	30.1	32.3	22.0	54.4	5.2	5.5	0.0	1,444
2-4	66.0	45.9	35.9	29.8	53.9	24.7	23.3	19.0	58.0	8.2	8.2	2.9	955
5-7	62.2	41.8	8.7	16.2	78.6	13.6	14.4	15.1	47.4	7.6	0.0	0.0	534
8+	73.9	41.1	25.9	0.0	13.0	0.0	34.1	9.7	27.4	16.8	0.0	0.0	709
Since birth	19.3	44.4	0.0	0.0	60.3	35.0	79.6	0.0	14.6	0.0	0.0	0.0	250
Education Level													
No education	51.9	13.7	0.0	0.0	44.7	0.0	0.0	50.4	13.7	13.7	0.0	0.0	73
Primary incomplete	68.6	33.5	8.8	9.8	51.3	17.1	25.8	6.4	50.3	3.0	3.0	2.8	620
Primary complete	41.9	35.7	19.8	18.8	56.6	32.0	28.9	18.3	56.8	5.1	6.8	0.0	1,203
Secondary+	72.9	55.8	32.7	22.0	45.8	25.8	45.1	19.2	50.8	12.4	5.1	0.0	1,988
NCSS 2012 Total	58.7	39.0	18.9	15.8	51.1	23.6	30.3	18.2	49.7	7.4	4.7	0.7	3,892
NCSS 2000 Total	81.1	26.5	22.1	12.2	34.3	20.2	16.1	10.7	55.8	4.4	2.0	3.9	3,257
Note: Data on specific sources of HIV/AIDS knowledge was not captured after KDHS 1998													
Source: Nairobi Cross-sectional Slums Surveys (NCSS) 2000 & 2012													

Percent distribution of female respondents aged 15-49 years by source of HIV/AIDS knowledge, according to selected background characteristics, NCSS 2012, NCSS 2000

13

2.4 Analysis of all relevant initiatives relating out the research study.

In 2011, the Division of Reproductive Health (DRH) in collaboration with FHI 360 and financial support from United States Agency for International Development (USAID) undertook a review of adolescent and youth reproductive health programs in the country. Their approach included a desk review, interviews, mapping of youth serving organizations (YSOs), and counselor's interviews with stakeholders from the YSOs and development partners. The aim was to identify the key organizations and self-help groups involved in adolescent and youth sexual and reproductive health (AYSRH), compile a general inventory of their activities, and begin to assess the degree to which they are using evidenced-based interventions that are ready for national scale-up and have had some impact. This review was designed to enhance the DRH's ability to coordinate AYSRH activities in the country. This study goes ahead and evaluates these organizations with the aim of learning from their successes and highlighting their shortcomings with the aim of using this information to come up with interventions that can learn from past mistakes and successes.

2.4.1 Friends of youth

Family Health Options of Kenya (FHOK) in collaboration with Population Council started the Friends of Youth (FOY) intervention in Nyeri, Central province in 1994. FHOK was tasked with implementing activities while Population Council undertook the evaluation and monitoring aspects of the intervention above. The first phase was implemented from 1994 to 2001 with financial support from Rockefeller Foundation and the second phase from 2005 to 2010 with funding from Center for Disease Controls (CDC). The intervention was championed after research results revealed that young people prefer to receive information on SRH from trusted parents or parent representatives in the community. This study shows that trust is not enough. Anonymity is equally important to teens. At the same time, the research established that youth were unable to access quality SRH services due to the cost of services and they did not access services at public health facilities due to confidentiality issues.

Friends Of Youth is a community-based adult-mentoring model that involves training of a cadre of trusted adults (younger parents) in the community referred to as friends of youth (FOY). They were trained on gender-based violence, communication of sexuality issues to young people and provision of youth friendly services including VCT. The biggest shortcoming of Friends for youth is that the initiative required physical interaction between the teenager and the advisor (Friend of youth). After training, the FOYs focus on young people in the community (10-24 years old) including young people with special needs such as men who have sex with men, vulnerable girls, house helps and sex workers within an assigned geographical area with SRH information. They refer young people to designated private health facilities for HIV and SRH services they cannot provide depending on the young person's needs. The FOYs are selected by the community based on set criteria aided by a Project Advisory Committee. The Project Advisory Committee plays the role of ensuring the intervention is designed according to culturally and socially acceptable standards and this promotes acceptability and ownership.

One of the initial activities undertaken by the FOYs is to map the households, churches and schools within their area of operation. They collected information on the households including ages of household members. This was greatly affected by transportation issues.

The intervention also identifies and trains private practitioners and health officers on provision of youth- friendly services. The referred youth are given a subsidized coupon by the FOY which when presented at participating private health facilities enables the youth to access services. FHOK then reimburses the actual cost of the services rendered by the facility to the young person. This affected the sustainability of the project. The health facilities are oriented on the provision of youth-friendly services at a subsidized cost. Within schools, FOYs facilitate the formation of school health clubs and train peer educators.

National Reproductive Health Policy (2007): recognizes that adolescent and youth sexual and reproductive health is a national issue, especially in terms of access to quality information and youth-friendly services, and focuses on the varied health needs of young people.

Recognizing the dynamism in adolescent and youth programming, there will be a need for timely dissemination of data to inform the design and development of targeted programs and interventions for the ever increasing and varied needs of the youth in Kenya.

The main challenge of the initiative was Sustainability: The intervention is community driven and owned. However, the subsidy system for the cost of services at private facilities is expensive and is thus unsustainable.

2.4.2 *NimeChill* Campaign to Promote Abstinence among Urban Youth 10-14 years

Nimechill (a sheng word originating from concatenating a Swahili word and an English word means "I have chilled" or "I am abstaining") is an abstinence promotion mass media campaign. *Nimechill's* aim was to change three perceptions correlated with abstinence: social norms, self-efficacy and behavioral intentions to remain abstinent. *Nimechill's* persuasion strategy was based on positive affect (messages 19 were optimistic and encouraging, rather than risk based) and positive deviance (messages featured older youth, aged 14-16, defying early teenage sex norms).

In collaboration with DRH, NASCOP and Pathfinder International with funding from USAID, the national mass media campaign was conducted in two rounds from 2004 to 2010 by Population Service International. The campaign targeted youth aged 10-14 years in urban and peri-urban and promoted abstinence as a "cool" (trendy) choice for youth. The campaign ended in 2010 and was mainly delivered through television, radio, print, billboards, posters, T-shirts and event sponsorship. There was also an in-school component introduced later in the intervention that assisted youth to build skills to enable them to abstain. The in-school curriculum addressed communication skills, cross-generational relationships, drug and substance abuse. The intervention utilized mentorship, edutainment, mass media, essay competitions, mass media, adult behavior influencers, question boxes in schools and sharing forums to reach the youth with abstinence messages.

Achievements: An evaluation of the campaign found that there was high recall of the campaign messages among target youth. The proportion of youth reporting "never having sex" increased from 88% to 92%. Self-efficacy and intentions significantly increased over the seven month campaign period especially among youth who had high exposure or were exposed through multiple channels.

Replicability: The campaign has not been replicated elsewhere but as with all mass media campaigns it needs to be repeated regularly to have lasting impact.

Sustainability: The intervention is rather expensive as expected of mass media campaigns but worth investing in at a national level.

Intervention Materials:

CHILL Media IPC Evaluation Presentation; Evaluation of *Nimechill* Campaign to Promote Abstinence among Youth 10-14; CHILL Club Curriculum; Photographs of the campaign

2.4.3 Nishauri

This study borrows a lot from Nishauri. In light of the fact that youth are susceptible to risky sexual behavior in the sprawling informal settlement of Mathare in Nairobi, Kenya. Hardworking, single parents, who make up the majority of the population in Mathare, oftenly have little or no time to supervise or communicate with their children. This often leaves young people with the critical role of passing on information about health risks, and this can lead to extremely risky behavior if that information is incorrect.

To address this issue, a project called Nishauri was developed in close partnership with Mathare Youth Sports Association (MYSA), a youth organization with 25 years of experience of working to educate and empower young people in Mathare. Nishauri ("Please advise me" in Swahili) is a mobile

counseling service, which seeks to connect counselors trained in HIV/AIDS and STI prevention to hundreds of youth seeking answers from a safe, private source. By harnessing existing local capacities of community counselors, Nishauri brings confidential, reliable information on sexual health and other sensitive topics to a broader cross-section of youth at risk, who may otherwise be reluctant to seek in-person advising.

Nishauri employs an Unstructured Supplementary Service Data (USSD) platform, complemented by Short Messaging Service (SMS). On their mobile phones, youth users can browse most commonly sought information on various health topics, or submit their own questions and receive responses from MYSA-trained counselors-- all cost-free and confidential.

The system developed in this study largely borrows from successes of Nishauri and tries to address shortcomings of Nishauri.

2.5 Common practices in the EBIs interventions

- *Utilization of similar approaches:* Common approaches used by EBIs to reach youth with AYSRH information and services included peer educations, life skills education, youth friendly clinic and outreach services, edutainment, edu-sports, mass media, mentorship and adult behavior influencers.
- *Multi-sectoral Approach:* The EBIs collaborated with and build the capacity of various line ministries and communities with the intervention catchment area. This enhanced ownership and sustainability of the intervention beyond the initial implementers.
- *Multi-pronged Approach:* The EBIs employed various approaches simultaneously to the same target group to address the holistic SRH needs of youth and have maximum effect. For example an intervention would use peer educators, edutainment and provision of services. They also most often provided linkages to services they were not able to provide directly such microfinance or clinical services.
- *Utilization of Existing Structures:* EBIs utilized schools, health facilities, youth centres in the implementation of the interventions instead of building completely new or stand-alone structures that would not be easily integrated in the existing program and communities. In most cases they trained implementers within the existing structures and strengthened systems to support the intervention.
- *Youth Involvement:* Most of the EBIs ensured the involvement of youth and the community concern in the design and implementation of the intervention. This also facilitated ownership and sustainability of the intervention post-partner implementation period.
- *Data Capture:* All the EBIs had good data capture and documentation systems that ensured they were able to monitor and evaluate the intervention and document processes, achievements, challenges and lessons learned.

Experts suggest that in order to reduce teenage pregnancies, interventions should be designed to address multiple sexual and nonsexual antecedents that correlate with adolescent sexuality, and which may be related to the adolescents, their families, schools, communities and cultural factors - notably religion (Kirby 2002a). With regard to cultural factors, an Israeli study showed that the incidence of pregnancy was three times higher among Muslims than among Jews (Sikron 2003). This raises questions about the possible impact of faith-based interventions, which tend to start early and are often sustained for long periods at the home and community levels. Premarital or extra-marital sex whether by young or older people is seen by the larger society as a violation of morality. Most moral codes and laws that prescribe acceptable conducts of sexual relationships have their origin in major religions.

2.6 Conceptual framework

A conceptual framework has guided decisions on the design of the intervention developed in this study. The framework illustrates the process by which intervention developed approaches might affect sexual risk behaviors and related outcomes. These approaches provided by the intervention inform of advice take place in diverse and dynamic environments. The implementing organization and system, individual characteristics of youth, familial and peer support systems, community norms and resources, and policy-related factors all influence the development and selection of teen sexual reproductive health influencing approaches, the specific services provided under each category, and how services and advice are delivered. Individual, community and policy-level factors also influence prior sexual behaviors and the availability of and access to existing services, as well as participation in teen sexual reproductive influencing programs and subsequent behavioral choices and outcomes.

Program strategies provided by the intervention (column A) in the conceptual framework diagram aim to change, enhance, or supplement existing services and support that youth receive in their communities. Advice provided often provide information on health, relationship, and sex education topics, and may also address related social and behavioral issues, including life skills development, mental health, access to contraceptives and other health services and academic performance(Column B). Receipt of these additional advice is hypothesized to have favorable impacts on intermediate outcomes (Column C) that may serve as mediators of sexual risk behaviors and their consequences. For example, youth in pregnancy prevention programs might increase their knowledge about sexual behavior risks, develop more positive views on abstinence and delaying pregnancy, improve their communication skills and relationship quality, reduce consumption of drugs and alcohol, or improve their academic performance. Through these and other changes, programs aim to affect sexual risk behaviors and, in turn, the incidence of pregnancy and STDs.
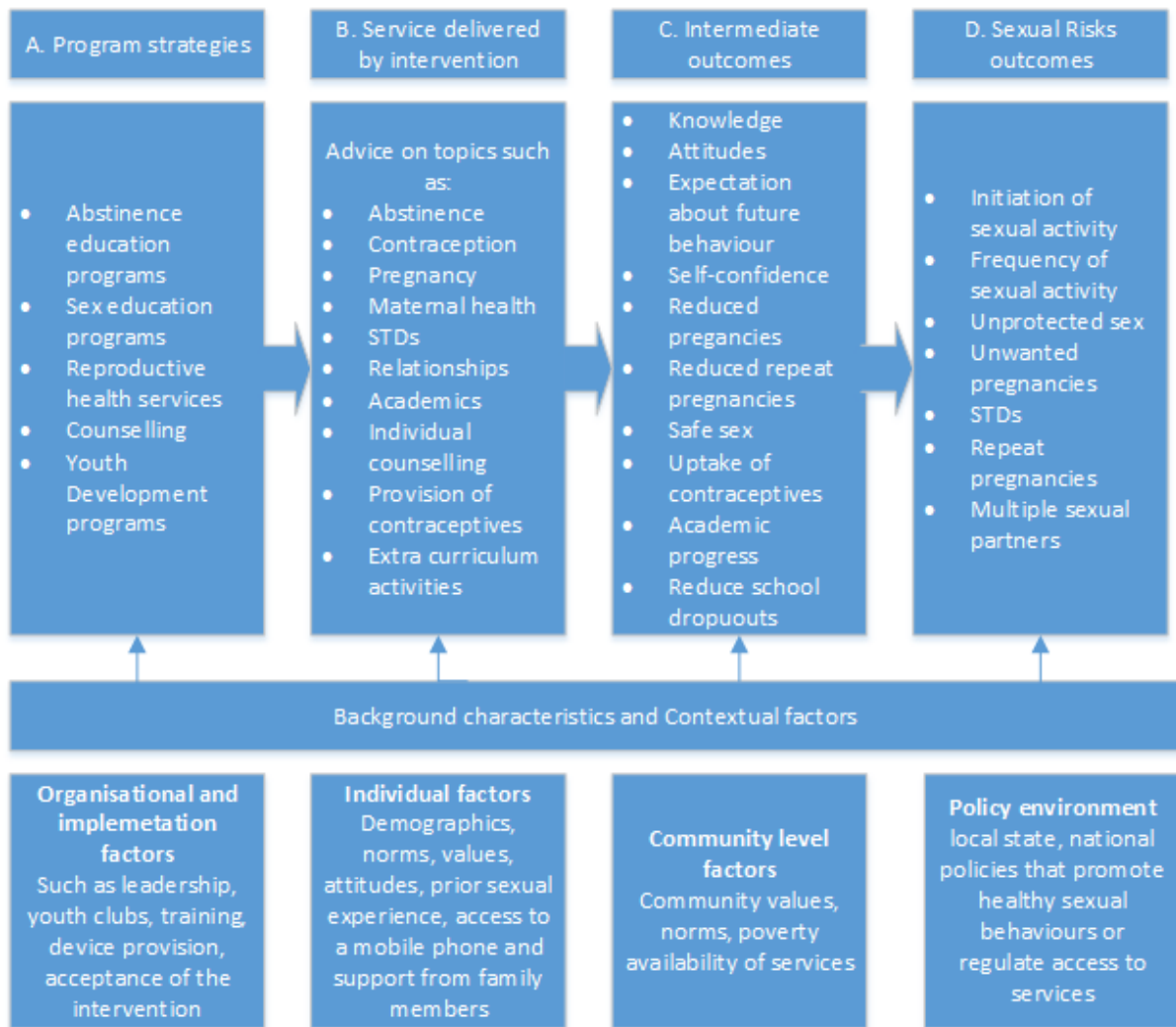
A. Program strategies

- Abstinence education programs
- Sex education programs
- Reproductive health services
- Counselling
- Youth Development programs

B. Service delivered by intervention

Advice on topics such as:
- Abstinence
- Contraception
- Pregnancy
- Maternal health
- STDs
- Relationships
- Academics
- Individual counselling
- Provision of contraceptives
- Extra curriculum activities

C. Intermediate outcomes

- Knowledge
- Attitudes
- Expectation about future behaviour
- Self-confidence
- Reduced pregancies
- Reduced repeat pregnancies
- Safe sex
- Uptake of contraceptives
- Academic progress
- Reduce school dropuouts

D. Sexual Risks outcomes

- Initiation of sexual activity
- Frequency of sexual activity
- Unprotected sex
- Unwanted pregnancies
- STDs
- Repeat pregnancies
- Multiple sexual partners

Background characteristics and Contextual factors

Organisational and implemetation factors
Such as leadership, youth clubs, training, device provision, acceptance of the intervention

Individual factors
Demographics, norms, values, attitudes, prior sexual experience, access to a mobile phone and support from family members

Community level factors
Community values, norms, poverty availability of services

Policy environment
local state, national policies that promote healthy sexual behaviours or regulate access to services

Figure 2. Conceptual Framework

Chapter 3 RESEARCH AND SYSTEM DEVELOPMENT METHODOLOGY

3.1 Research Design

This section illustrates the research process and methods that were used in the study. This study is both qualitative and quantitative in nature. Review existing literature, Conduct surveys and interviews of teenagers to establish behaviors, issues and gaps in reproductive health information as far as teenagers are concerned.

Use user-centered prototyping to develop a case base reasoning system that teenagers can ask Reproductive Health related questions anonymously and get answers on the spot
Perform a cluster-randomized control study; computer generated randomization sequence; unit of randomization- schools.

Table 7 is a brief of how each research objective was achieved.

Table 7. Research Design Table

Research Objective	Research Design
To Identify knowledge gaps in teenage reproductive health information available	Desktop literature review was done to establish teens' sexual conducts and attitudes, knowledge of Sexual reproductive health and contraceptives. Questionnaires were administered to teens drawn from the target population to establish gaps, preferences and shortcomings of existing sources
To Develop an ICT intervention that provides timely sexual reproductive health information to teenagers	An expert system was developed using user-centered prototyping that allows teens to ask personalized questions and receive immediate feedback.
To develop a knowledge base of common SRH issues/solutions affecting teenagers	Focus group discussions with teen counselors discussing questions commonly received by their solutions. Nishauri counselors and DJ B teen fan page. Cases from these sources have been documented in the Appendix
To evaluate the success of the proposed solution	A survey to establish users' satisfaction levels will be conducted. Cluster randomized control study Success indicators will be set and tested

3.2 Discovery interviews

A focus group discussion was held with 7 teen counselors to discuss with them common SRH issues affecting teenagers in Nairobi low-income areas. During this session we introduced the study concept and worked with them to come up with questionnaires to be administered by them to adolescents. The questions were initially adopted from *(Illustrative Questionnaire for Interview-Surveys with Young People -John Cleland)*. Areas covered by the counselors were Huruma,

Kahawa, Kariobangi, Githurai, Mwiki, Kahawa, Korogocho and Mathare North and Kayole. The interviewers/counselors selected interviewees/adolescents randomly at administered the questionnaires to 100 adolescents from different aforementioned area. Sample questionnaire is in the appendix section of this study. The aim of this interview was to get first hand information from adolescents on their access to mobile phones, Internet connectivity, and preferred source of information, sexual conduct and knowledge about contraceptives. The study indicated that at least 65% of adolescents interviewed had access to phones; in fact a significant proportion actually owned mobile phones. Findings of the study indicate that most adolescents feel there are inadequate sources of information for SHR issues faced by adolescents. Most adolescents reported having had sexual encounters and having dated more than one partner, this finding is consistent with information gathered from desktop literature review. The diagrams below show results of the interview.

The results below strengthen the hypothesis "Teenagers in urban areas have access to mobile phones." It is also notable that most teenagers have access to Internet connectivity. Trust and anonymity is slightly more important to teenagers than trust when teenagers ask for SRH advice. However most interviewers said there were a significant portion of teenagers who reported that the two cannot be decoupled. This study aimed at showing teenagers prefers anonymity more than anything when seeking sexually reproductive health advice. Interestingly majority of teenagers interviewed said that they felt there was enough SRH information available however they raised concerns that the information available is to general and mostly prohibits them from doing what they are doing already. This can be interpreted as too much generalized information but little personalized information. One aim of this study is to provide personalized advice to teens.

Most teenagers prefer doctors as their source of information because doctors observe confidentiality of the reporting teen (Anonymity).
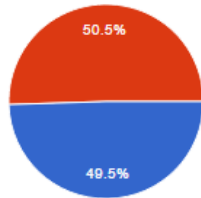
Figure 3. Summary of interview responses

100 responses

Summary

Gender
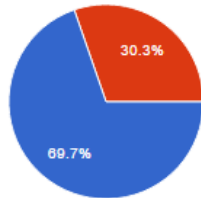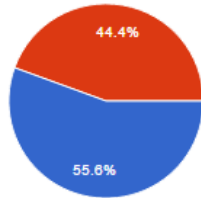
Male	49	49.5%
Female	50	50.5%

50.5%
49.5%

Do you have access to a mobile phone?

Yes	69	69.7%
No	30	30.3%

30.3%
69.7%

Does the phone connect to the internet?

Yes	55	55.6%
No	44	44.4%

44.4%
55.6%

Do you feel there is enough reproductive health information to teenagers

Yes	39	39.4%
No	60	60.6%

60.6%
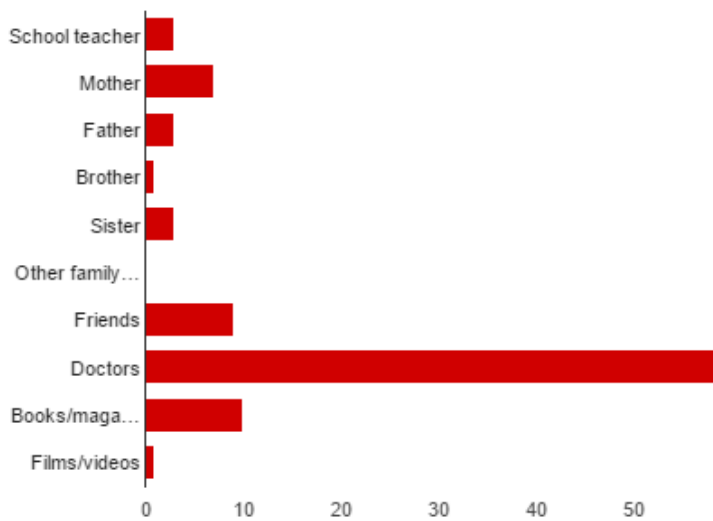39.4%
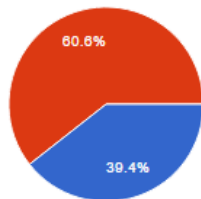
If you had a sexual related question, would you be comfortable asking someone you trust or asking a qualified professional who does not know your details
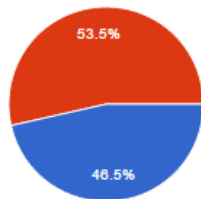
Trusted	46	46.5%
Anonymous	53	53.5%

53.5%
46.5%

Preferred [What has been the most important source of information?]

School teacher	3	3.1%
Mother	7	7.3%
Father	3	3.1%
Brother	1	1%
Sister	3	3.1%
Other family members	0	0%
Friends	9	9.4%
Doctors	59	61.5%
Books/magazines	10	10.4%
Films/videos	1	1%

3.3 Population

Kenya population is estimated to be 46,748,000 and teenager (10-19 year olds) constitute of 22.6% of the overall population. In Nairobi, adolescents make up a considerable proportion due to the high volume of young adults who migrate from rural to urban areas to look for employment. Many of them live in the numerous informal settlements, which in Nairobi for example, house between 60%and 70% of the city's residents. Adolescents living in this area constitute to 32% of Nairobi's 3.8 million population. This adolescent population of 1.2million is the target population for this study. This choice was made due to ease of logistics and high prevalence rates of STIs, abortion and unintended pregnancies.

3.4 Sample size

The initial discovery interview was conducted with a sample size of 100 teenagers drawn from Huruma, Kahawa, Kariobangi, Githurai, Mwiki, Kahawa, Korogocho and Mathare North and Kayole areas in Nairobi county. Teens were selected randomly from the population. The pilot will be rolled out through a sample of ten schools. With the following criteria

- Same social class,
- Same geographical setting,
- Variance of <10% population,
- Has a peer counseling club,
- Have relatively high incidences of teenage pregnancies reported recently.

A computer randomization program will be used to generate numbers and allocate them to the ten schools. Schools with even number will form Control while schools with odd number will form be given the intervention.

3.5 Data collection tools

The study used both qualitative and quantitative data collection tools to assess the numbers and get in depth information on the subject of study. Below are the tools used for data collection.

3.5.1 Questionnaire

A questionnaire is a data collection tool consisting of a series of questions and other prompts for the purpose of gathering information from respondents about a particular subject of study. Although they are often designed for statistical analysis of the responses, this is not always the case. Questionnaires were used because of advantages over some other types of survey. These advantages include and are not limited to; they are inexpensive, do not require as much effort from the questioner as verbal or telephone surveys, and often have standardized answers that make it simple to compile data. Questionnaires in this study were used for the discovery phase of this study to determine shortcomings of current information sources and to understand teenagers' preferences when it comes to SRH issues. The questionnaire is in appendix 1. The questionnaire was adopted from from *(Illustrative Questionnaire for Interview-Surveys with Young People -John Cleland.*

Questionnaires will be used at pilot stage to access the effectiveness and shortcomings of the system developed and also to evaluate success indicators

3.5.2 Focus Discussion groups

FDG is a group discussion based on a particular topic organized for research purposes and is guided/ Facilitated by a researcher (moderator or facilitator). They are used to generate information from collective views and the meanings underneath the views. FDGs were used to collect information from teen counselors running Nishauri project at MYSA center. This data was crucial in coming up with the knowledge base of the expert system.

3.6 Success indicators

- Number of pregnancy cases reported
- Number of questions asked
- Uptake of contraceptives
- Attitude/behavioral change
- Incidents of STIs reported

3.7 Ethical considerations

Interviews were conducted in private places to protect the confidentiality of responses and enhance the comfort of respondents. Interview sessions lasted an average of 40 minutes, while the FDG lasted 70 minutes on average. The respondents personal information was not recorded thus this is anonymity. In the pilot phase written consent will be obtained from schools where the intervention will be deployed this is because the legal age for an adult in Kenya is 18 years.

3.8 System Design and Development

This section of the methodology shows software engineering best practices methodologies and conventions observed for planning, creating, testing, and deploying the ICT intervention aimed to providing timely information to teenagers who ask SRH related questions. This section further defines the elements of the intervention such as the architecture, modules and components, the different interfaces of those components and the data that goes through the intervention system. This is meant to satisfy specific needs and requirements of a business or organization through the engineering of a coherent and well-running system.

3.8.1 Functional requirements

Functional requirements specify what the system should do. In this case the proposed intervention. Below is a list of limited functional requirements that the intervention should provide at a bare minimum:

- The Intervention developed must provide the means that will allow to users to make queries regarding the direct extraction of a specific problem advice.
- The intervention developed must provide a means for a knowledge expert to add new knowledge into the system or edit existing knowledge for efficiency.

- Domain experts / counselors would like to know and understand the reasoning of the expert system and based on which formula it calculates the operational problem occurrence possibility.

- The intervention must provide a means to domain experts to validate answers with confidence level below 50%

- The intervention must keep a log of all computations and inferences made in the backend side of the system.

- The intervention must at all times communicate to the user the current state of the system by use of notifications or

- The intervention must be responsive and must adapt in different web browsers across multiple operating systems.

3.8.2 Non-Functional requirements

- Availability: The proposed intervention shall operate in any HTML enabled web browser with capabilities of connecting to the Internet. A client mobile phone or PC using HTTP protocol shall do data transmission remotely. The system should be available 24 hours a day

- Usability: The proposed intervention shall be easy to use and should be straight forward to users with simple learnability and memorability. No prior knowledge/skills will be required by a user to enable them use the intervention.
- Accessible – The system should be accessible to anyone with a wap enabled device irrespective of the device's operating system or compute capability.

- Correctness: The intervention should provide information that is correct to its users. Answers with confidence factor of below 50% will need to be validated by the expert before given to users.

- Relevancy: the intervention should be useful enough to enable Adolescents obtain timely information about SRH issues affecting them

- Anonymity – the intervention should not profile users or store user's private information. No passwords, no sign ups etc.

- Scalability – The system should be able to grow in terms of data stored and request handled without degrading.

3.8.3 Design Decision

Based on the solutions functional and non-functional requirements. Technology design decision were made and the ICT intervention was developed with the following technologies which were deemed to most appropriate in-terms of robustness, support, documentation and ease of programming:

- HTML5 and CSS for designing the web interfaces of the web application.
- PHP for developing server-side scripting codes
- Apache web server for hosting the application
- Java for semantic classification and analysis
- Prolog for developing inference engine rules

3.8.4 Use Case Diagram

A use case diagram is a graphic depiction of the interactions among the elements of a system.

A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. In this context, the term "system" refers to the intervention being developed. Use case diagrams are employed in UML (Unified Modeling Language), a standard notation for the modeling of real-world objects and systems.

Figure 4. Use case diagram

Figure 4. Use case diagram
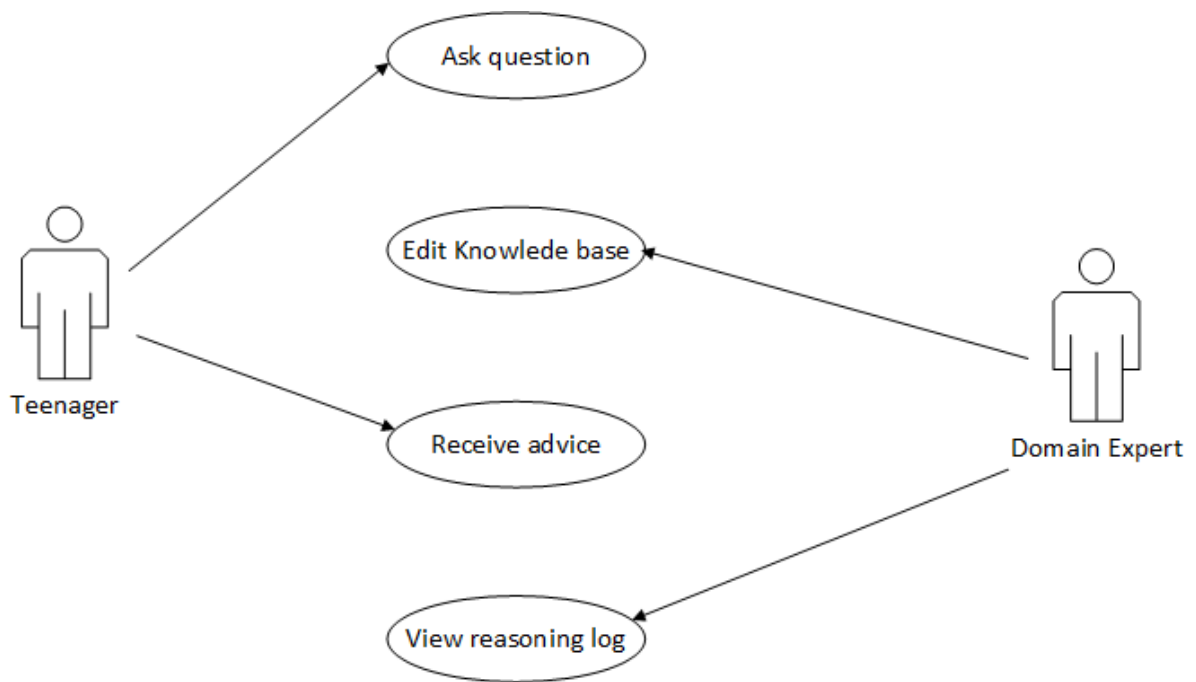
3.8.5 Expert System development Methodology
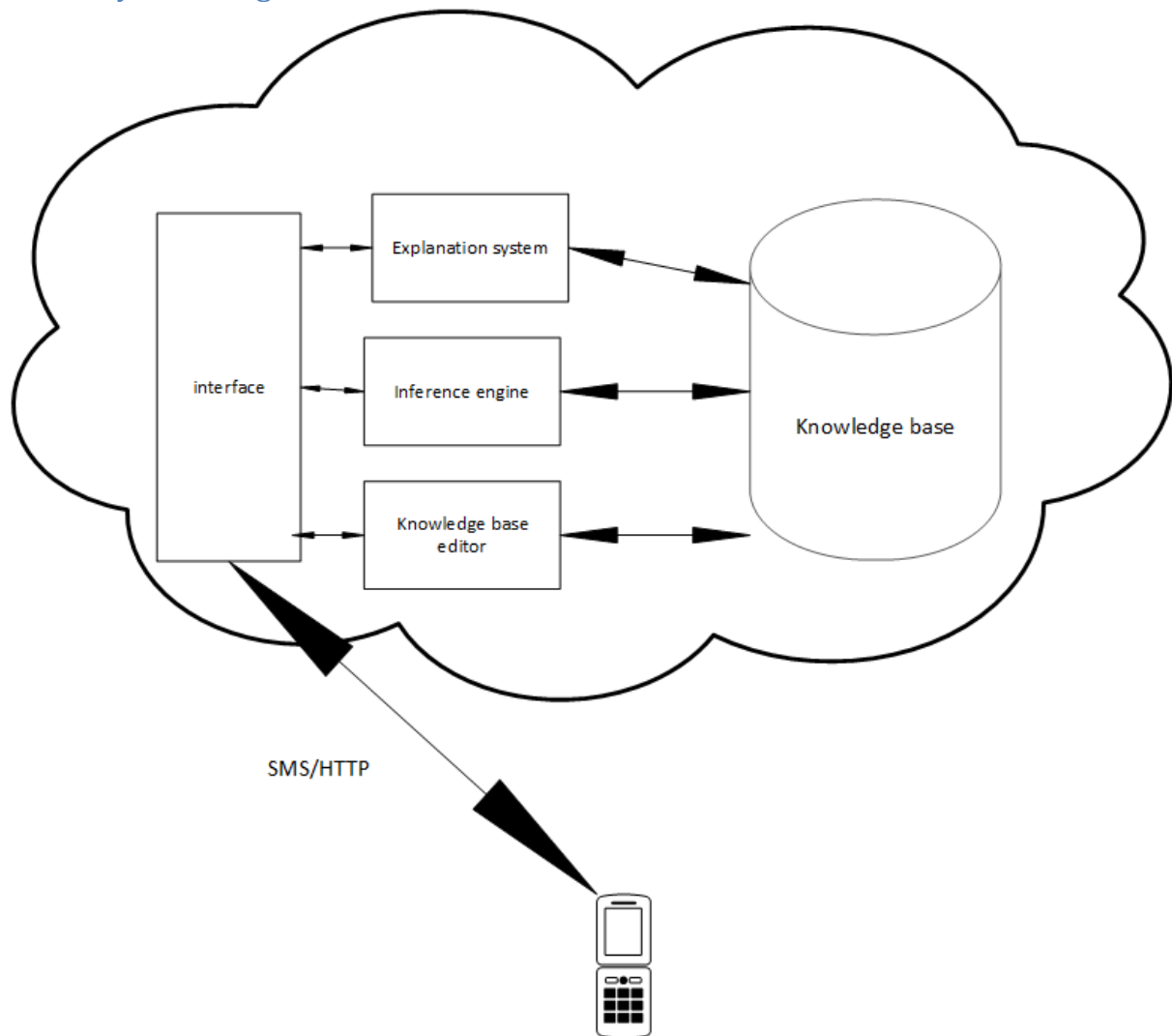
3.8.5.1 System design and architecture


Figure 5. System Design and Architecture

User interface -The user interacts with the system through which may use menus, natural language or any other style of interaction. In this case a user/adolescent interacts with the system through SMS or using a web page. The user types the question and it is sent to the expert system

Inference engine is used to reason with both the *expert knowledge*) extracted from our experts (teen counselors)) and data specific to the particular problem being solved. The expert knowledge will typically be in the form of a set of IF-THEN rules and *case specific data*, provided by the user and partial conclusions (along with certainty measures) based on this data. It uses the knowledge in the knowledge base and information provided by the user to infer new knowledge.

3.8.5.2 Techniques used by the inference engine

Case based reasoning -The basic idea is that past experiences can be remembered and adapted to guide problem solving. SRH problems/encountered and have validated solutions are reused to solve new problems. This system uses K nearest neighbor technique; the similarity of the problem (target) case to a case in the case-library for each case attribute is determined. This has been implemented using Classifier4j in Java, which finds the semantic similarities between two sentences, according to categories of their words. It is an enhancement of the Vector-Space analysis found within the Classifier4j in Java, which takes into account the semantic meanings of the words. Example of the analysis of statements is below:

Figure 6. Inference Engine Techniques
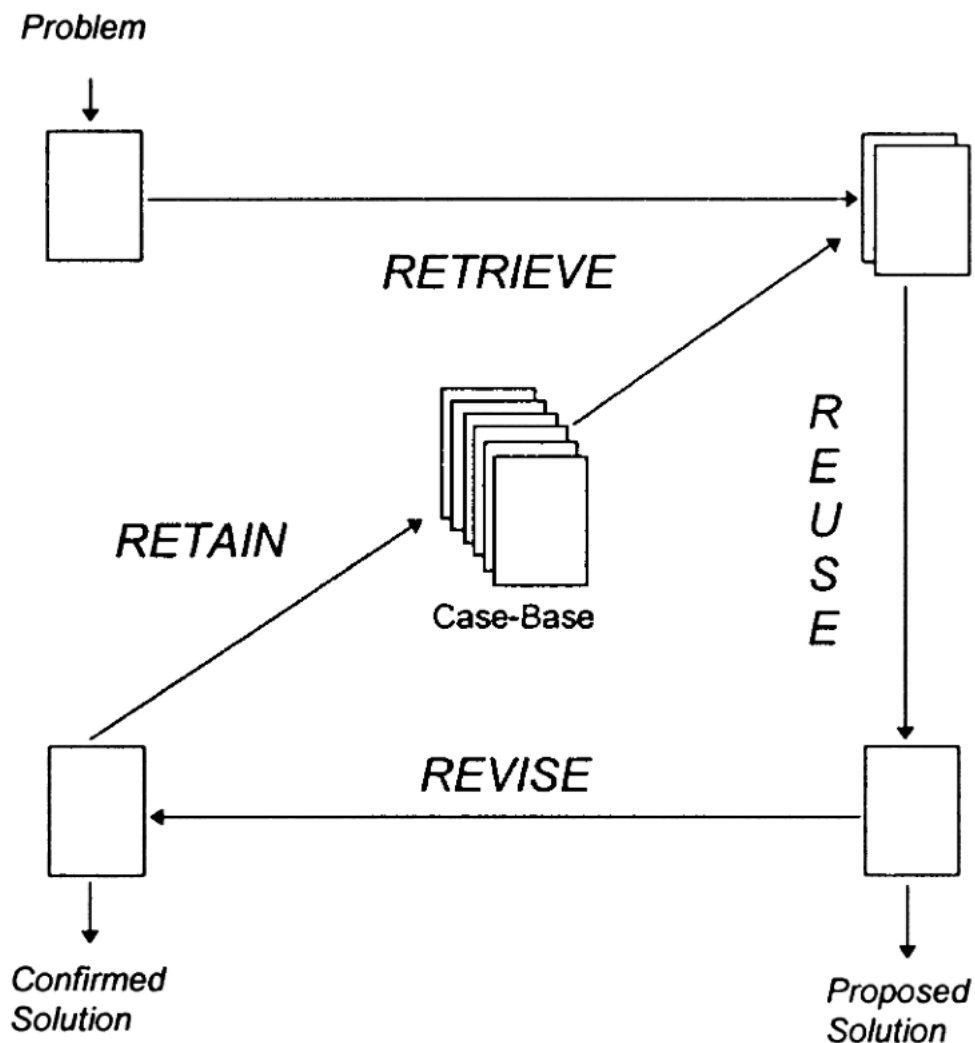
Similarity between the sentences:
Patrick and Robert have found a dog near the tree.
Patrick and Robert have never found a dog near the tree.
is: 1.0000000000000002
Similarity between the sentences:
Penina found a dog near the station.
It was a dog who found Patrick and David under the tree.
is: 0.7319250547113999

Similarity between the sentences:
Kevin found a dog near the tree.
I am fine, thanks!
is: 0.0
Similarity between the sentences:
Hello there, how are you?
I am fine, thanks! is:
0.28819520885211747

This semantic similarity is used in calculating the nearest case "neighbor" in the case base to the case in question.

If the if a case is found in the case base with a similarity of 0.6 and above, then the solution of that case is retrieved, else if the case retrieved has a similarity of less than 0.6 then the case is marked for review by the expert.
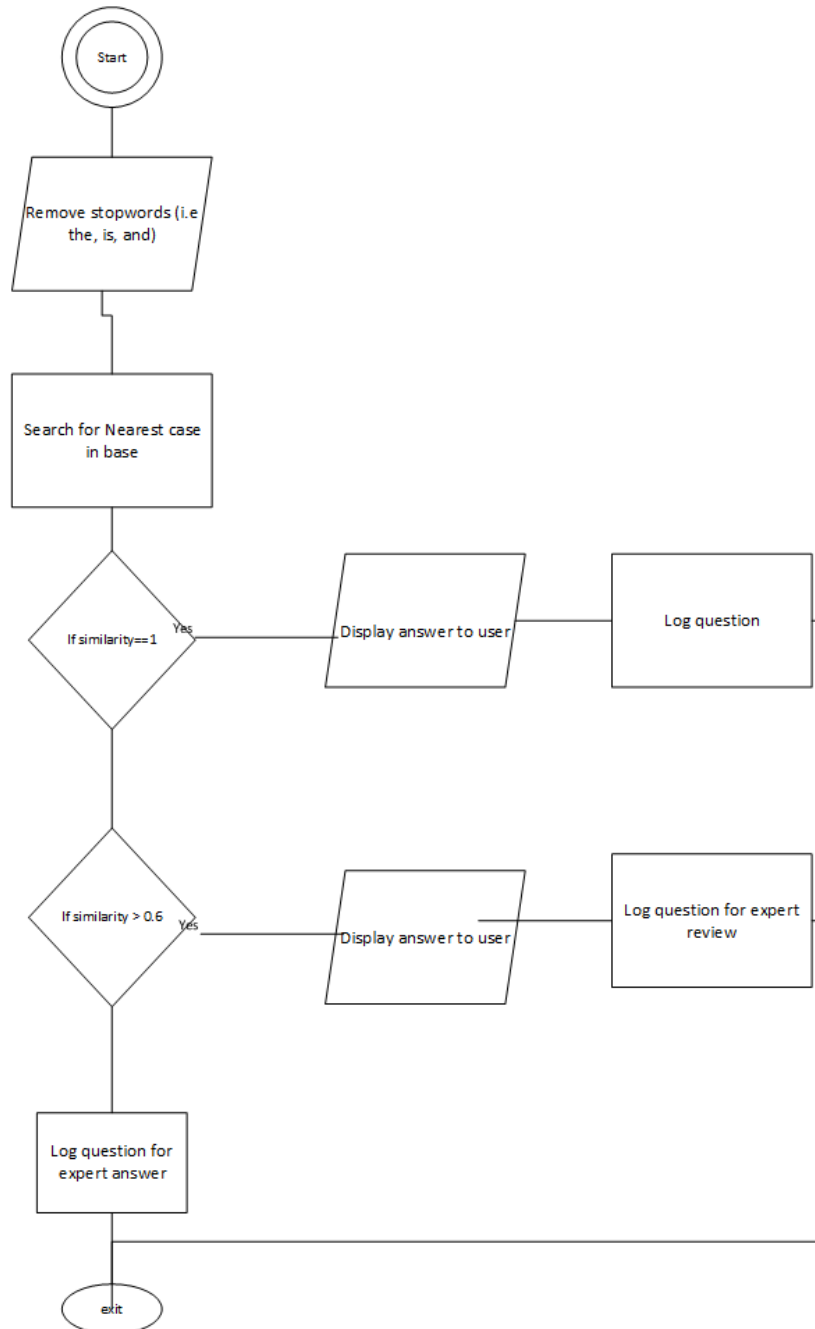
3.8.5.3 Flowchart

Figure 7. System Flow chart

Explanation subsystem which allows the program to explain its reasoning to the user.
Knowledge base editor which help the expert (peer counselor) engineer to easily update and check the knowledge base.

Knowledge base - Organized repository of knowledge consisting of concepts data, objectives requirements, rules regarding sexual reproductive health issues affecting adolescents. Knowledge base includes cases and rules. Cases and rules were formed from questions and answers from 2 different sources. Shujaaz Facebook page and Nishauri questions. A total of 500 questions and answers were used to come up with cases and rules in the knowledge base. Raw questions can be found in the appendix of this document.

3.8.6 System Testing and validation.

Validation is critical to the design and implementation of decision-making Expert Systems. Without appropriate validation, the system may make costly errors. There are numerous ways of validating an expert system. In a setting where objectivity is sought and variance is avoided, validation ascertains what a system knows, knows incorrectly or does not know. Validation ascertains the system's level of expertise and investigates the theoretical basis on which the system is based. It evaluates the reliability of decisions made by the system.

This study takes two different approaches to validate the expert system developed. First approach is to determine the semantic similarity threshold between difference cases with the aim of determining a case' nearest neighbor. The well-chosen threshold will guarantee good enough solutions are offered.

The second approach validates the system to increase the confidence factor and acceptability by:

- Ascertaining what the system knows, does not know, or knows incorrectly
- Ascertaining the level of expertise of the system
- Determining if the system is based on a theory for decision making in the particular domain
- Determining the reliability of the system

3.8.6.1 Semantic similarity threshold testing

A test data set of 100 cases was used for this exercise. Table 8 shows different thresholds and resulting responses.

Table 8. Threshold testing results

Semantic similarity threshold	Correct responses (out of 100)	Referred questions (Out of 100)	False responses (out of 100)
0.5	36	44	20
0.6	40	51	9
0.7	46	49	5
0.8	63	36	1
0.9	43	57	0

3.8.6.2 Reliability testing

One synonym for accuracy is reliability. "Reliability is the accuracy of precision of a measuring instrument". In Expert System validation, the stability of the System and the ability of the system to generate identical solutions given identical inputs measures the reliability of the system.

System Test against Itself (Sensitivity Analysis). One validation procedure

Carried out was the analysis of the expert system (intervention) sensitivity to slight changes in the knowledge base or in the weights. That is, the model was tested against itself for stability. If the system produces several solutions over minor parametric shifts, the system

may be unstable. Minor parametric shifts were added to the input questions and same answers were reproduced with a success rate of 90%.

 Standard Test Problems. Standard test problems were used in the revalidation

process. Cases were presented to the system with a reduced knowledge base. The responses received indeed exhibited that the responses indeed got better with an increased knowledge base. Same questions were asked repeatedly and results were consistent.

3.8.7. Challenges of testing expert systems

The number of test paths is extremely high since expert systems tend to be nondeterministic in nature and they are partial functions rather than complete functions.

Expert systems in most cases have to deal with incomplete data input

Expert systems are not static since they are self-modifying and need constant retesting

Expert systems need to be revalidated further in the future continuously in a periodic fashion

CHAPTER 4 DISCUSSION AND CONCLUSION

4.1 Answering Research Objectives

4.1.1   Objective 1

To identify knowledge gaps in teenage reproductive health information available

There is a growing concern about the sexual and reproductive health of adolescents. This concern has resulted from either a real or a perceived increase in adolescent sexual activity, coupled with high rates of unplanned pregnancies, early childbearing and the transmission of sexually transmitted infections, including HIV. Although many adults have difficulties in accepting young people as sexual beings, there is now a growing consensus that young people need more information and services to help them ensure their sexual and reproductive health. Many of the programs designed to make sexual and reproductive health information and services available to young people have used 'top down' approaches, based on adult-led risk and lifestyle orientation. In such programs, young people are often looked upon negatively, in terms of their problems, rather than positively, in terms of their potential and capabilities. Focus on the negative aspects of adolescent sexual and reproductive health means that young people are seen as collections of discrete problems. Furthermore, such approaches tend to view all young people as one homogeneous group when in reality adolescents are an enormously diverse group, not only in terms of age and gender, but also in terms of ability and beliefs. Such approaches therefore fail to address the vulnerabilities of particular young people and fail to contextualize sexual health within a wider framework of young people's lives.

Many adolescent girls, get pregnant, become brides and have children before they are physically, emotionally, and socially mature enough to be mothers. Married or unmarried, adolescent girls become pregnant for different reasons. For some, pregnancy is accidental and the results of experimenting with sexuality or of lack of knowledge about how to prevent conception. Others seek pregnancy and motherhood to achieve adult status or fill an emotional void, however most adolescent pregnancies have little to do with choice or mistake. This indicates that apart from peer pressure there are major underlying factors that make adolescents have irresponsible sexual behavior. These underlying factors should be addressed as they are the root cause of most adolescent misfortunes. Knowledge, companionship, guidance and care are some ways of addressing these underlying factors.

There are quite a number of campaigns aimed at encouraging the adolescent to live responsively, stay away from sex before marriage. These campaigns are lacking in the sense that adolescents are already sexually active and require campaigns that support them mostly to practice safe sex and to support them when they have unwanted pregnancies. Due to societal stigmatization, it is considered too sinful for an adolescent to get pregnant and mostly adolescents who are victims are looked down upon, blamed endlessly and used when citing bad example. It is this hostility that brings the urge and necessity for interventions and information sources that address the plight of adolescents who are sexually active and/or are already pregnant. Provide adolescent sexual reproductive health information that mostly deal with prevention is not enough to meet the ever changing needs of adolescents. More needs to be done to address these gaps.

4.1.2   Objective 2

To develop an ICT intervention that provides timely sexual reproductive health information to teenagers.

An expert system was developed as stipulated in the methodology part of this document. The system knowledge base was developed with data from domain experts who interact with youth on a day to day basis and help them address sexual reproductive health issues they are facing. The developed system acts as the intervention developed in this study for the purpose of providing timely and contextualized sexual reproductive health information to teenagers.

More about the system functionality and development has been discussed in the methodology section of this study.

4.1.3   Objective 3

To evaluate efficiencies of current interventions

Various health, youth welfare and political agencies at the global, regional and national levels have been implementing a variety of adolescents based interventions with diverse approaches to address a wide range of factors related to unintended pregnancies, abortion and irresponsible sexual behaviors among teenagers. The goals of these agencies have included, and not limited to: helping adolescents to change psychosocial risk and protective factors involving sexuality; increasing teens´ knowledge about risks and consistent and safe use of contraceptives; and skills training to support their social inclusion and personal development. Study indicates that while single interventions were not found to be effective, combinations of interventions to improve education and contraceptive access were found to reduce unintended pregnancies among adolescents. Standalone interventions have not been as impactful as anticipated.

Currently, stakeholders ranging from healthcare providers, teachers, adolescent ´parents, and policy-makers need to understand better how to set up programs that can be evidence based, practical, culturally appropriate, acceptable for adolescents, and that can guarantee good results in terms of the goals to be achieved to the satisfaction of all those involved, principally adolescents. For this to be feasible, experts are stating that interventions should address manifold factors at the same time.

For purposes of scope, this study selected one interventions to evaluate its strengths and weakness. The intervention was selected because this was the closest intervention to the intervention proposed by this study. Nishauri is similar to the developed intervention of this study in the sense that it leverages on ICT capabilities and adolescent tech-savviness to provide an intervention geared towards addressing adolescents sexual health reproductive issues. Nishauri has proven success stories and this study does not undermine it but rather enhances the concept by enhancing shortcomings of Nishauri as an intervention. Table s9 shows a few strengths and weaknesses of Nishauri as an intervention.

Table 9. Strengths and weaknesses of Nishauri

Strengths	Weaknesses
Has trust factor, adolescents trust the advice given since they trust the counsellors	Turnaround time is long, this works against adolescents since most adolescents don't have
Some extent has anonymity in the sense that the only information revealed to the counsellor is the adolescent phone number	It is expensive, SMSs are costly to adolescents and to the counsellors as well
Ability of counsellors to answer leading questions	Not scalable, when number of questions increase, counsellors get overwhelmed
	Heavily manual process and prone to human errors

Clinicians and policymakers often distinguish between efficacy (emphasis on internal validity) and effectiveness (emphasis on external and internal validity) of an intervention. Efficacy trials measure whether an intervention produces the expected result under ideal circumstances. Effectiveness trials measure the degree of beneficial effect under "real world" circumstances. Efficacy and effectiveness exist on a continuum. The data produced by these studies are valid to the extent that they measure what they are supposed to measure. Internal validity is the degree to which one can say with certainty that the intervention being studied is responsible for producing an effect. External validity is the degree to which one can generalize the study's findings to other populations and circumstances. To evaluate the efficacy and effectiveness of Nishauri RE-AIM (Reach Effectiveness Adoption Implementation Maintenance) framework was used. A framework designed to is designed to enhance the quality, speed, and public health impact of efforts to translate research into practice in five steps.

Table   10.   RE-AIM   definitions   and   questions

RE-AIM Dimension	Definition	Questions to Ask
Reach (individual level)	• Participation rate among intended audience and representativeness of these participants	• What percentage of the target population came into contact with or began program? • Did program reach those most in need? • Were participants representative of your practice setting?
Effectiveness (individual level)	• Impact on key outcomes and quality of life • Consistency of effects across subgroups	• Did program achieve key targeted outcomes? • Did it produce unintended adverse consequences? • How did it affect quality of life? • What did program cost as implemented and what would it cost in your setting?
Adoption (setting and/or organizational level)	• Participation rate and representativeness of setting in the evaluation	• Did low-resource organizations serving high-risk populations use it? • Did program help the organization address its primary mission? • Is program consistent with your values and priorities?
Implementation (setting and/or organizational level)	• Level and consistency of delivery across program components and different staff members	• How many staff members delivered the program? • Did different levels of staff implement the program successfully? • Were different program components delivered as intended?
Maintenance (individual and setting levels)	• At individual level: long-term effectiveness • At setting level: sustainability and adaptation of program	• Did program produce lasting effects at individual level? • Did organizations sustain the program over time? • How did the program evolve? • Did those persons and settings that showed maintenance include those most in need?

Answers

Reach – The intervention developed, Nishauri reports and average of 20 questions per day from a population of over 1 million adolescents in Nairobi. This means that a huge majority of adolescents in need are not reached by this intervention.

Effectiveness – Outcome and results from Nishauri intervention are scanty however it is notable that the number of adolescents asking questions in the platform reduced tremendously after the first few weeks, this could be attributed to weakness mentioned previously in this report. It can be argued that a number of adolescent's lives got improved from using Nishauri, however cases of teenage pregnancies, repeat pregnancies, abortions, school dropouts due to irresponsible teen sexual behavior in the area where the intervention has been deployed. The cost of running the program is prohibitive and has led to the platform being unavailable time to time due to the cost.

Adoption – population in low resource areas used the intervention to some extent. However based on Focus group discussions held, populations from low resource setting didn't use the service as much as they would have wanted due to the cost of using the intervention. The program is consistent with the implementing organization's mission and values.

Implementation – Different levels of staff were involved in implementing the program and this was crucial in winning adolescents minds since they could relate freely to the counsellors who helped in implementation of the intervention.

Maintenance – The intervention did not produce lasting effects on adolescents as anticipated. The program experiences frequent system lows and downtimes. This could be attributed to the high costs of maintenance. As it is, the program is not self-sustaining and needs funding for smooth and continuous running.

Table 11 Semantic similarity Threshold testing

Semantic similarity threshold	Correct responses (out of 100)	Referred questions (Out of 100)	False responses (out of 100)
0.5	36	44	20
0.6	40	51	9
0.7	46	49	5
0.8	63	36	1
0.9	43	57	0

4.2 Summary of Field findings

This study looked into knowledge gaps and ineffectiveness of existing source of information for adolescent reproductive health. The study also looked and tested the viability of the proposed solution to provide contextualized information before developing the solution. Here are some initial findings from the study:

Mobile phones have become the most available compute device to people in emerging areas specifically Kenya. Mobile penetration in Kenya has hit 80.2 %, this according The July-September 2014 quarter report by Communication Authority in Kenya that indicates that the number of mobile subscriptions increased to 32.8 million up from 32.2 million. This is consistent with the field findings of this study which indicated that At least 69% of adolescents interviewed had access to mobile phone. Some owned the phones while some just had reliable access to someone's phone mostly siblings and parents phones. A significant percent of these number have access to internet connectivity via mobile phones. With internet subscription fees dramatically dropping in Kenya, there has been a paradigm shift in text communication. Traditionally most people have used SMS for text communication, however Whatsapp, Viber and Nimbuzz have become the favourites for text communication especially among adolescents – the target group for this study. This could be attributed to the fact that these services are far much cheaper than traditional SMS and falling prices of smartphones locally.

Existing interventions for young people have used 'top down' approaches, based on adult-led risk and lifestyle orientation. In such initiatives, young people are often looked upon negatively, in terms of their problems, rather than positively, in terms of their potential and capabilities. The fear of being judged and looked down upon has made most adolescents to be secretive about sexual related issues they are going through. Whenever adolescents share their issues, they mostly like to do it discretion and mostly speak to people who don't know their whereabouts. Most adolescents are uncomfortable discussing sexual related issues with their parents. Most adolescents would rather discuss with a doctor, teacher friend. Anonymity is very important when it comes to adolescents. If the issue cannot be traced back to them even better. As a matter of fact the study shows that 53% of adolescents interviewed consider Anonymity as a priority over Trust when it comes to discussing sexual health related issues.

From the field study, most adolescents to the tune of 60% of adolescents interviewed reported that they felt there was enough information regarding ASRH. At first glance this looks like it contradicts this study, however adolescents feel that there is too much generalized information and its shortcomings is that it is not personalized information. This is consistent with this study's belief in the sense that there exists information and knowledge gaps on adolescents' sexual reproductive health information.

A significant proportion of the people in the society specifically adolescents' parents tend to believe that their children are staying away from sex and waiting for marriage. From the fieldwork conducted in this study, At least 68% of adolescents interviewed had had sexual intercourse. This shocking statistic shows how urgent and pressing the issue is. There is an urgent need to come up with interventions that can positively influence the sexual behaviors of adolescents.

This study also establishes that adolescents tend to have similar problems and issues. Out of 500 questions asked by adolescents, there were very few unique extraordinary questions. Most questions revolved around sexual conduct, contraceptives, relationships and pregnancies. The
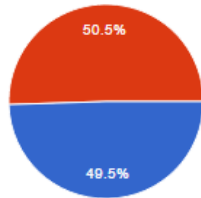
intervention developed by this study takes advantage of the fact that there are common ASRH questions asked by adolescents.

100 responses

Summary

Gender

Male	49	49.5%
Female	50	50.5%

Do you have access to a mobile phone?
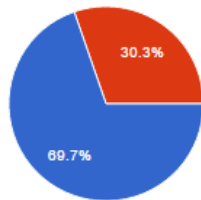
Yes	69	69.7%
No	30	30.3%

Does the phone connect to the internet?
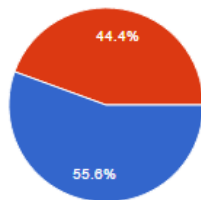
Yes	55	55.6%
No	44	44.4%

Do you feel there is enough reproductive health information to teenagers
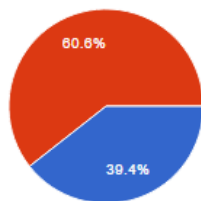
Yes	39	39.4%
No	60	60.6%

If you had a sexual related question, would you be comfortable asking someone you trust or asking a qualified professional who does not know your details
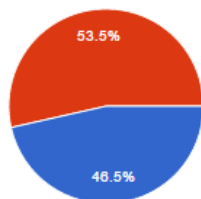
Trusted	46	46.5%
Anonymous	53	53.5%

Figure 8 Responses

40

4.3 Discussions and generalization

Most interventions developed to address Adolescent sexual reproductive health in the country are lacking have shortcomings and this is evidenced by the high number of STI infections, adolescent abortion incidences and unwanted pregnancy reported in the country. Some shortcoming of existing interventions is that they don't offer personalized and timely information, they require physical interaction which is a problem due to transportation issues and anonymity. Closest intervention to the proposed intervention was "Nishauri" - ("Please advise me" in Swahili) is a mobile counseling service, which seeks to connect counselors trained in HIV/AIDS and STI prevention to hundreds of youth seeking answers from a safe, private source. Nishauri had two major shortcomings – It is expensive since relies on SMS and need someone to pay SMS charges which makes it unsustainable. The second shortcoming is that the counsellors responded to questions from adolescents in a batch manner i.e. counsellors would respond to all received SMSs thrice a day. This is not timely information considering the fact that most adolescents don't have full time access to a mobile phone.

Generally interventions that are top down and adult centric are not likely to be as impactful as anticipated. This is because as earlier noted in this study, this types of interventions are likely to take adolescents as a collective set of problems that should be controlled. This study shows that adolescents prefer to have confidentiality and care when handled. Some interventions go to the extent of making assumptions that adolescents are kids who mainly rely on their parents' decisions. Interventions that don't incorporate adolescents' inputs at inception to implementation are also not likely to be as impactful as anticipated. Preventive interventions are also not adequate since a significant percentage of adolescents are sexual active and need post – prevention support and care to be extended to them. Taking input from various stakeholders and the principal subject – adolescents, the system developed in this study addresses the following foreseen shortcomings. It is notable that most adolescents in urban areas in Nairobi are sexually active and practice unsafe sex. This is the hard truth that most parents are yet to accept. There is need for parents to be closer with their adolescent children. From the field study we can safely conclude that there is a significant percentage of adolescents in Kenya that need care and advice beyond preventive care. More should be done to improve interactions between doctors and adolescents since based on the field study Adolescents mostly prefer to get advice on SRH from doctors due to trust and confidentiality maintained by doctors.

4.4 Limitations of the prototype

Natural language processing- most adolescents write in sheng' and sheng is dynamic and constantly changing.

Accuracy of the system will grow with increased knowledge based

Current prototype heavily relies on network connectivity

4.5 Recommendation for future work

Look for ways of processing Sheng and short-form text popularly used by adolescents. Most adolescents communicate in Sheng language which is dynamic and ever changing thus making it difficult to process it.

The developed intervention should be improved in a way that it can do local processing Localize the system such that it doesn't constantly require network connectivity to operate. As much as internet connectivity penetration is decent, sometimes most service providers in Kenya experience service downtime thus it would be very beneficial to have continuity of service when network connectivity is unavailable.

From the field study conducted, it was noted that more females interviewed have positive attitudes towards sexual reproductive health. There is need to conduct studies to reveal reasons why more female adolescence have more positive attitudes evidences by their increased uptake HIV test voluntarily compared to male adolescents.

From desktop literature review conducted, there is need to conduct studies to reveal knowledge gaps about menstrual cycle in female adolescents. Most interviewed female adolescents were not privy to the relation between their menstrual cycles and fertility

As much as adolescents don't prefer to speak to their parents on ASRH issues, parents remain the immediate human resource available to teens. Parents care about their children and having open relationships between teens and parents could be very beneficial, there is need to conduct studies to enhance sharing of ASRHs between adolescents and their parents.

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APPENDIX

Appendix 1. Questionnaire

1.1	SEX OF RESPONDENT	MALE	1	
		FEMALE	2	
1.2	What day, month and year were you born?	Day ☐☐ Month ☐☐ Year ☐☐		
1.3	How old were you at your last birthday?	Years old ☐☐ CROSS-CHECK WITH DATE OF BIRTH AND RECONCILE		
1.4	Do you have access to a mobile phone?	Yes No	1 2	
1.5	Does the phone you have access to connects to the internet?	Yes No	1 2	
1.6	What is the highest level of schooling you completed? (CIRCLE HIGHEST SCHOOL LEVEL)	Primary Secondary **Tertiary without Secondary School:** Technical Commercial or Secretarial Preparatory **Tertiary with secondary School:** Technical Commercial or Secretarial Teacher Training College (TTC) University Postgraduate	01 02 03 04 05 06 07 08 09 10	
1.7	What class/form/grade/year did you complete at this school………..?	Class/ ☐☐ Form etc		
1.8	Do you feel there is enough reproductive health information to teenagers	Yes No	1 1	

1.9 If you had a sexual related question, would you be comfortable asking someone you trust or asking a qualified professional who does not know your details.	Years ☐☐		
1.10 Do you have a boyfriend/girlfriend			
1.11 If yes above, How would you describe your relationship			
1.12 Have you ever discussed sex-related matters with your parent? If Yes Often or occasionally?	Occasionally, Often, Never		

SOURCES OF INFORMATION

		(1) Most Important	(2) Second most important	(3) Preferred
1.1 Young people learn about **puberty** - I mean the ways in which boys' and girls' bodies change during the teenage years - from many sources. They may learn from teachers at school, parents, brothers and sisters, from friends, from doctors or they may learn from books, films and magazines. What has been the most important source of information for you on this topic? And the second most important? CIRCLE MOST IMPORTANT IN COL 1 AND SECOND MOST IMPORTANT IN COL 2	School teacher	01		01
	Mother	02	01	02
	Father	03	02	03
	Brother	04	03	04
	Sister	05	04	05
	Other family members	06	05	06
			06	
	Friends	07		07
1.2 From whom, or where, would you prefer to have received more information on this topic?	Doctors	08	07	08
	Books/magazines	09	08	09
	Films/Videos	10	09	10
CIRCLE ONE ANSWER IN COL. 3	Other (Specify…………)	11 ………….	10 11 ………………	11 …………
		(1) Most Important	(2) Second most important	(3) Preferred
1.3 Now I want to ask you a similar question about sources of information on the **sexual and reproductive systems of men and women** - I mean where eggs and sperm are made and how pregnancy occurs. What has been the most important source of information on this	School teacher	01 02	01	01 02
	Mother	03	02	

1.4 From whom or where, would you prefer to receive (or prefer to have received) more information on this topic? CIRCLE ONE ANSWER IN COL. 3 (topic? And the second most important? CIRCLE IN COLS. 1 AND 2)				
Father	04	03	03
Brother	05	04	04
Sister	06	05	05
Other family members	07	06	06
Friends	08	07	07
Doctors	09	08	08
Books/magazines	10	09	09
Films/Videos	11	10	10
Other (Specify……………	……………	11	11
		………………	……………

		(1) Most Important	(2) Second most important	(3) Preferred
1.1 Now I want to ask you a similar question about sources of information on the sexual and reproductive systems of men and women - I mean where eggs and sperm are made and how pregnancy occurs. What has been the most important source of information on this topic? And the second most important? CIRCLE IN COLS. 1 AND 2.	School teacher	01		01
	Mother	02	01	02
	Father	03	02	03
	Brother	04	03	04
	Sister	05	04	05
	Other family members	06	05	06
			06	
1.2 From whom or where, would you prefer to receive (or prefer to have received) more information on this topic? CIRCLE ONE ANSWER IN COL. 3	Friends	07		07
	Doctors	08	07	08
	Books/magazines	09	08	09
	Internet	10	09	10
	Other (Specify…………… ………………)	11	10	11
		……………… ………..	11 ………………… …….	……………… ………..

REVIEW 3.20 AND 4.1, 4.5, 4.8 AND TICK APPROPRIATE BOX

4.12 Respondent has **not reported** sexual Intercourse ☐ ↓

Respondent has reported sexual intercourse ☐ → 4.14

4.13 I want to make certain that I have the correct information. Have you ever had sexual intercourse in your whole life?	Yes	1
	No	2 → 4.21

4.14 In your whole life how many people have you had sexual intercourse with?	No. ☐☐	
4.15 How long ago did you last have intercourse with a woman/man? IF LESS THAN ONE WEEK, ENTER 00 WEEKS	Weeks ago ☐☐ Or Months ago ☐☐	
4.16 On that last occasion did you or your partner do anything to avoid pregnancy?	Yes 1 No 2 → 4.18	
4.17 What method was used?	Condom 1 Pill 2 Injection 3 Withdrawal 4 Safer Period 5 Other …………………………… 6	
4.18 MALES: Have you ever made a girl or woman pregnant? IF YES How many times? FEMALES: Have you ever been pregnant? IF YES How many times?	No. ☐☐ Never 0 Not Sure 9 → 4.19	
4.19 Thinking of the most recent pregnancy, did you want the pregnancy at that time or not want it?	Want 1 Not want 2	
4.20 What happened to the (last) pregnancy?	Currently pregnant 1 Abortion 2 Miscarriage 3 → Section 5 Live-birth 4 Not sure 5	

People may have mixed reasons for not having intercourse. I will read out some reasons. Please tell me for each reason whether it applies to you or not.	Applies	Not applies	Don't Know/ Not Sure	
4.21 I don't feel ready to have sex.	1	2	3	
4.22 I have not had the opportunity.	1	2	3	
4.23 I think that sex before marriage is wrong	1	2	3	
4.24 I am afraid of getting pregnant	1	2	3	
4.25 I am afraid of getting HIV/AIDS or another sexually transmitted infection.	1	2	3	
4.26 And now I have a question about your future plans about sexual intercourse. Which of these statement best describes your plans. READ OUT (a) I plan to wait until marriage (b) I plan to wait until I am engaged to be married (c) I plan to wait until I find someone I love (d) I plan to have sexual intercourse when an opportunity comes along	(a) Marriage 1 (b) Engagement 2 (c) Love 3 (d) Opportunity 4			
4.27 Do you feel any pressure from others to have sexual intercourse? IF YES A great deal or a little?	A great deal 1 A little 2 None 3			→ Section 6
4.28 From whom do you feel pressure? PROBE CIRCLE ALL THAT APPLY	Friends 1 Relatives 2 Work colleagues 3 Partner/special friend 4 Other ………………………………… 5 …………………………………………….			

Appendix 2. Questions collected from Nishauri

Question	Frequency
Difference btw HIV and Aids	10
How can you get infected with HIV	1
Is condom 100% safe	15
How can you knw if some one has HIV	3
Is there treatment for HIV	7
What are STIs	5
Can stis treated	1
Symptoms of STIs	5
Is ther a link btwn HIV and STIs	4
What is safer sex	6
From what age one can use family planning	10
Are there side effects of using family planning	12
How often one can use posner2	11
Does contraceptives prevent HiV	1
Does contraceptives prevent HiV	1
Origin of HIV	2
Where can u get help incase of a rape	7
Does condom affect a mans libido	5
Can one get HIV when u shower immediately after sex	7
What can you do when you turn out HIV Positive	5
What are ARVs	6
Is VCT important	5
What is the meaning of FRIENDS WTH BENEFITS	2
How can I know if I love her or I like her	7
How can a woman help a man apart from sex	4
How can I help a person who is addicted to bang	1
Is HIV a Virus	1
Are STI/STDS truely exist	4
Can hiv be transmitted through kissing	15
Can E-pills cause cancer	4
When I hear about condoms, I hear people say "when used correctly." What does that really mean? I thought it was pretty obvious how to use one, but now I'm worried that I'm doing something wrong. Do condoms break a lot?	1
What is the NuvaRing and how effective is it?	3
What is the Today Sponge?	1
What is the birth control patch?	1
What is Implanon? Does it really last three years?	4
can i get pregnant if i has sex during my period?	8
Can fingering or a hand job lead to pregnancy or an STD	6
Can I get a sexually transmitted disease (STD), including HIV, from kissing	4

Do condoms work	3
Do I need to use protection during oral sex	2
How can you avoid getting a sexually transmitted disease (STD)	8
How do they test for sexually transmitted diseases (STDs)	4
I have a cold sore. Does that mean I have herpes	1
I have a smell and slight discharge coming out of my vagina. What is it, and is it normal	1
I think I might have a sexually transmitted disease (STD). How do I find out for sure, and how do I tell my partner	2
If both my partner and I have the same sexually transmitted disease (STD), is it OK to stop using condoms for sex	1
If I carry a condom, do I look like I was expecting sex	1
If my partner and I are both virgins, is there any way we could have a sexually transmitted disease (STD)	2
Is HIV the same thing as AIDS? Do all people with AIDS die from it	6
Is it possible to have a sexually transmitted disease (STD) and not have any symptoms? If so, how can I know if my partner is infected	7
I'm on the Pill and my partner and I have been tested for sexually transmitted diseases (STDs). Can we stop using condoms	4
I've heard chlamydia and gonorrhea are curable with antibiotics, so what's the big deal if I get it	4
My partner just got tested and found out that s/he has a sexually transmitted disease (STD). I'm upset and scared. I'm not sure how to react. Could I have an STD? Should I get tested	3
What are the different kinds of sexually transmitted diseases (STDs)	8
What do I do if a condom breaks	11
What if my partner doesn't want to use condoms	1
What is a condom	2
What is a female condom and how does it work	5
What is herpes	1
What is HIV and how do you get it	3
What is human papillomavirus (HPV)? Is it the same thing as genital warts	1
What is trichomoniasis	1
When can I get tested for HIV	1
When I have sex, I pull out before I ejaculate and nothing bad has ever happened. So, why do people always say pulling out is risky	1
does pre cum have usually have any sperms	9
i have an itchy vagina what may it be?	7
How do I use a condom	3
Can I get a sexually transmitted disease (STD), including HIV, from kissing	5
Can you get pregnant from pre-cum	6
How does pregnancy happen	3
I missed my period. What's going on	1
If a girl gets her period, can she be pregnant	7
Is there a safe time of the month to have sex and not get pregnant	9
The condom broke. What can I do, and what are the chances of pregnancy	6
When I have sex, I pull out before I ejaculate and nothing bad has ever happened. So, why do people always say pulling out is risky	2
Is it normal to get erections for no reason	7
Does long-term cigarette smoking really cause impotence	2
Is it normal to have hair "down there"? Should I shave my pubic hair	3
I'm a guy, but I have what looks like a girl's breasts. Why is this happening	1
I'm afraid that my vagina is too smelly to have oral sex. What should I do?	3
What are yeast infections? How do you get rid of them?	8

What are wet dreams?	2
What are "blue balls?"	2
What happens during menstruation (a period) and does it hurt?	1
What is a hymen?	3
What is a urinary tract infection (UTI)?	9
What is a vulva?	1
What is bacterial vaginosis?	1
What is circumcision and does it affect sexual performance?	1
What is the prostate?	2
What's the difference between the scrotum and testicles?	2
When a guy ejaculates how much semen is there? What is the clear fluid that comes out of a guy's penis before he ejaculates?	3
When does puberty happen and what changes?	2
Why do I have breasts?	1
Can guys be raped, too?	3
I'm being abused. What can I do?	1
My best friend went to a party and someone brought my friend a drink. Before my friend knew it, s/he was in another room, unable to move. My friend was raped. What happened?	1
What is date rape? What is acquaintance rape?	1
What is statutory rape?	3

Appendix 3. Questions collected from DJ B

Question	Frequency
Umekata quni replay:nilikuwa nataka kk xhw uku isiolo machali awataki kutumia sefty,sukam uwashw.	1
xi pouwar kutumia inplants	1
Yap its bkoz x wake hakua ana bother ku use protection xo he xays he isnt adaptd 2 cds	1
Ajez,kuna quiz flani nataka kujua ans yake,dem akiwa vajo den atumie cd anaweza pata bal?	1
Aje dj b waitin 4 thi shw mazee nina dem wngu bt tuna shda ikikam kwa mambo na sex anadai tuhave unprtected sex i ned hlp nampnda bt c ezi hve sex wdaut prtction	1
Are condoms safe	5
Shuja dj b mimi ni jd mushima kutoka sotik nimesoma story ya mapenzi naona menki kusu condom	1
Wazi,nmekuwa na friend ambaye tunafanya job pamoja na anataka tukuwe pamoja naye.n vibaya boyie?please niadvice.	1
Nitumie advice ya relationship between chali na mazi yake	1
nguvu:xo many boys who r ma frnds r pasuing 2 bkam ma lver en am nt intrestd in them wat do i do bcz thy r ma frnds en we help each other in so many thngs wat do i do?	5
xaxa imgn bashte yng alipata ball na aitumia protection xawaxawa na hakuma anataka xaxa unaweza mhelp aje plz	1
Shujaa,isnt true that mwenye alkubreak virgnity yako hawez kukuacha?	2
Stres zangu nlkuwa na mrembo nlyempenda xana na xaxa 2lkoxana nko katika kdato cha nne ntafanya aje nanampenda na nataka kuxoma	1
Vipi mzeiya...btw im undergoing a cituation whereby i swesskua na mchick mmoja azn lazima niwe nao kadhaa ndo nifeel lyk am cuwl reason being ile tym mybe itahapen lyk one of them adai kuringa i'll still hve an option...so my quiz comez here...naduu kitu right kweli?	2
MPANGOZ' Hi DjB, aky nlkua nataka kkask ka uko kw rlshnshp na hauna feeling t yua patna unaeza do wat plz	1
rafi yangu hapa anaulizia eti mke wake harithiki lkini jama anampa karibu 1h lakini arithiki ebu jibu yye?	1

Hae djb n vizuri ku use piis?	4
Nielezee mambo ya contraceptives.	1
Wangwan Mi Bradda.Mimi Mambo Na Family Plannin Hupata Kwa Mabesty.But Huwa Mwangalifu Sana Juu Wengi Wao Huwa Wapotovu.	1
Moto is it gud 4 a psn 2 replace his wife or huzi after death. Cynthia kutoka gilo	1
N nn hufanya haswa kwa dem na chali wakiwa in love then wana doule cross	1
NGUVU, ningetaka advice kabla ya kuingia kwa relatioship.	7
Nko na dem ananilke pia mi na antalka nimrushie ma vybz na cna nittumie plz dj boyie	1
moto. mm n mkristo budangu n pastor na nina mchumba na mwisilam na nna mpenda sana na sikotayar kumuacha na wazaz wangu wamekataa nifanye nn??	1
okei denkz..nipe jibu pliz. dem wangu anadai aqo na boll bul i doubt ju i xlept with her 3 wek ag...o...inaweza kuwa ya chali mwingne	1
Mpangoz kama cko tayari naweza kwenda clinic na kupewa advice na kenye ni tafanya	1
MOTO DJ B boi wko akikuxhw ati yey ndiye atakumarry afta campo n umemada 4th dix yr en ur a virgin gal en andai kubrk ur purity uyu boi ako criaz ama n playa	1
Niko na chali na nampenda sana lakini anadai tudu sex namistaki nitadu?	8
dj b. bibi akiwa ni tasa ni poa kumufukuza. yusuf from thika.	1
Mpangoz,am 22 old age using no plant to secure future,am i so young to use it?DJ B	1
Niko na dem.. mwenye inanikibixaa. nikiabia tutumia protection anaakasirika?	1
dj b mtu akitumia cd inamaanixha hawaaminiani cndio ?	3
Dj b nilickia chali mwingne akisema eti life saver ziko expensive xna cku hizi.hajui zimejazwa na utamu ama nn ndo zimekuwa expensive.swali c ni za bure hosi ama?	1
Ni lazima nitumie condom wakati wa sex	6
Helow DJ B, in which age is a person surpos to use family planing?	4
Afu jo kupiga dem kuni bila CD kuna ngori yoyote koz wengi jo uwika CD muimu?	2
DJB KWa nini ukih'v sex na boy huwaana tell wengi?.	1
Hii mambo ya homosexsual we unaionaje mtu wangu.	4
Aki dj b kuna mzee alikuwa hana ni told to have sex na yeye	1
hapana nataka kujua kama ananluv ama niaje juu ctaki nkue namba 2	6
Mambo DJ B! Dem anaweza kaa 4 how long after sex ndo arealise amexhika ball? plz answer me	1
Mi nasema kwamba mniadvice vile naeza stop masturbation	9
Injectables zina side effects.	1
k...myn ilkua quiz, how shld i overcome ii situation y kufanto madem kla tym??	2
Okolea'am in dillemma.ave gt five guys who are chasing me,wanting 2 marry me.nmewakataza bt bado wana insist.nifanye?	1
Imagne kunamachali wananidai yap pia mi huwalyke bt wote wanadai kubrake ma virginity nikiwashw c wa pei waski bytha wananipe xtres xana wht kan i do?	1