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Perspectives of Adolescents, Parents, Service Providers, and Teachers on Mobile Phone Use for Sexual Reproductive Health Education

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Abstract: Mobile health (mHealth) programs offer opportunities to improve the sexual and reproductive health (SRH) of adolescents by providing information. This paper reports the findings of a study carried out in Homabay County, Kenya, to assess stakeholders' perspectives on access to and use of mobile phones by adolescents for SRH education. We aimed to establish whether mobile phones could facilitate access to SRH information by adolescents and the barriers to be addressed. This was a qualitative exploratory study involving adolescents, parents, teachers, health care workers, and community health volunteers. Data were collected through focus group discussions (FGDs) and key informant interviews (KIIs), and were analyzed through thematic and content analysis. Respondents lauded mHealth as an effective and efficient approach to adolescent SRH education with a potential to promote the learning of useful SRH information to influence their behavior formation. Respondents pointed out bottlenecks such as the limited ownership of and inequitable access to phones among adolescents, logistical barriers such as lack of electricity, internet connectivity, and the impact of phones on school performance, which must be addressed. The usefulness of mHealth in adolescent SRH education can be enhanced through inclusive program formulation and co-creation, implemented through safe spaces where adolescents would access information in groups, and supported by trained counselors.

Keywords: adolescents; sexual and reproductive health; mobile health; service access; service utilization; health education; comprehensive sexuality education and health equity

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1. Introduction

Young people under the age of 25 years account for 43% of the world's seven billion people. Adolescence, defined as 10–19 years, is a crucial period in life, during which young people undergo extensive biological, psychological, and sociological changes. It is a crucial time for lifelong health development, and improving health behaviors at this stage of life contributes to the health of future generations, as described by Hindin and Fatusi (2009) and Dick and Ferguson (2015). Sexual and reproductive health (SRH) is integral to health and wellbeing during adolescence and beyond. Empirical evidence over the past 20years has highlighted the challenges faced by adolescents in accessing SRH information and services, particularly regarding contraception to prevent unplanned pregnancy. mHealth is increasingly used to deliver health interventions, including adolescent SRH. However, knowledge gaps remain regarding the utilization and effectiveness of these programs.

Research findings indicate that early sexual debut is a key contributing factor for adolescent pregnancy. SRH knowledge is one important enabler of contraception related behavior in adolescents (Mmari and Sabherwal 2013).

Kenya, like other low- and middle-income countries (LMIC), has poor adolescent (SRH) indicators. About 18% of the adolescent girls in Kenya are estimated to become pregnant during adolescence, which is coupled with an unmet demand for family planning services (Kenya National Bureau of Statistics 2015). About 13,000 girls drop out of school every year in Kenya due to early unintended pregnancy. Homabay County has the highest prevalence rate of teenage pregnancy in the country, which is higher than the national rate of 18% (Kenya National Bureau of Statistics 2015). Furthermore, adolescents aged 10–19 years contribute to 28% of all new HIV infections in Homabay County (Kenya National Bureau of Statistics 2015). Hence, the Kenya National Health Sector Strategic Plan 2015–2020 has recognized adolescent SRH as a priority within the essential health care package.

The use of mobile and wireless technologies (mHealth) has the potential to transform health service delivery globally and support the achievement of the United Nations (UN) Sustainable Development Goals (SDGs) in LMICs. According to the International Telecommunication Union, almost the entire world population (97 per cent) lives within reach of a mobile cellular signal (ITU 2019). Mobile health (mHealth) interventions use mobile phones for patient monitoring devices, personal digital assistants (PDAs), or other wireless devices to provide health information to change health behaviors and outcomes (WHO 2011). The content for an mHealth app can be standardized, tailored, and have interactive features, with a potentially higher impact than face-to-face interventions, due to a wide reach at a lower cost. mHealth interventions are ideally suited for adolescents owing to their widespread use of smart phones and internet.

mHealth programs offer opportunities to improve SRH for adolescents by providing information and support, but further research is required to inform the development of tailored approaches for adolescents (Vahdat et al. 2013; Mitchell et al. 2011; Gonsalves et al. 2015; Akinfaderin-Agarau et al. 2012; Rokicki and Fink 2017). Researchers Akinfaderin-Agarau et al. (2012) and Feroz et al. (2019) define mHealth as a "medical and public health practice supported by mobile devices". Overall, mHealth interventions for adolescents have demonstrated increased SRH knowledge and behavior (Rokicki et al. 2017), and have increased the use of reproductive health interventions or services (Rokicki et al. 2017; Unger 2019; L'Engle et al. 2013). Kay et al. (2011) highlight the knowledge gaps in mHealth for adolescents in LMICs. A systematic review by L'Engle and colleagues noted that only 3out of the 35 articles included in the review were from LMICs (L'Engle et al. 2016). Strassberg et al. (2014) add that published research from Sub-Saharan Africa is particularly sparse, hence there is a need for further research into effective content creation, implementation approaches, and guidelines.

Despite their promise, and although mHealth programs are increasingly used to provide health information and deliver interventions, including adolescent SRH, there is still a dearth of knowledge about the utilization and effectiveness of these programs and the required characteristics of mHealth interventions across socio-demographic profiles. In this paper, we report findings of a qualitative study carried out in Homabay County to explore perspectives of adolescents, parents, service providers, and teachers on mobile phone ownership, access, and use for SRH information by adolescents in an effort to understand if mobile phones have the potential for integration into adolescent SRH services. We aimed to establish if mHealth could facilitate the access of SRH information, especially by adolescents at risk of teenage pregnancy, and whether adolescents might even participate in or engage with SRH-related content delivered on mobile phones, as well as the required characteristics for effective mHealth interventions.

In order to better understand the potential to deliver mobile phone-based SRH to adolescents in resource-limited settings with poor adolescent SRH indicators, we addressed the following questions:

(i) What are the experiences of adolescents of the use of mobile phones in Homabay County?
(ii) What are the perceived disadvantages and constraints in mobile phone use by adolescents?
(iii) How can the perceived constraints in adolescents' use of mobile phones be addressed?

2. Methods

2.1. Study Design and Methods of Data Collection

This was a qualitative exploratory study seeking to gain an understanding of the experiences of adolescents concerning their mobile phone ownership, access, and use. The notion is that the approach allows us to explore the issue from the perspective of adolescents, looking at the lived experience of the individuals (Davis 1995). The sociological approach explains how people live their lives in their context. Within this inquiry, our objective was to assess the phenomenon of phone ownership, access, and use among adolescents. The interview guides were specifically developed for this study to capture the lived experience as expressed by adolescents but also the perspectives of parents, teachers, and service providers on the utilization of mobile phones by adolescents and the factors influencing it.

The study population included adolescents, parents, teachers, health care workers from hospitals and health centers, and community health workers in Homabay County. Qualitative data were collected through focus group discussions (FGDs) and key informant interviews (KIIs) by experienced researchers who were also trained in young people sensitivity on sexual and reproductive health issues as well as language preferences. We purposively selected individuals from all the sub-counties for a total of 25 FGDs, consisting of community health volunteers (CHVs) (5), fathers (5), mothers (5), adolescent girls (5), and adolescent boys (5). Each of the FGDs had a minimum of 8 participants and maximum of 12 (Appendix A).

For key informant interviews (KIIs), we purposively selected 5 primary school heads, 5 secondary school heads, and 9 health facility leaders. A summary of KII participants is presented in Appendix B.

For adolescent minors below the age of 18 years, parents provided informed consent by signing a consent form on behalf of the students, and students were asked for assent to participate in the study. All students above the age of 18 provided written consent to participate. To ensure high quality data, the principal investigator (PI) and study coordinators supervised the data collection and reviewed issues arising in the field each day to ensure fidelity with the study protocol by each study team. The study protocols and consent forms were reviewed and approved by relevant institutional ethics review boards in the UK (University of Hull) and Kenya (Masinde Muliro University Ethical Review Board). The national research clearance certificate and permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI).

2.2. Data Analysis

For all qualitative data, dual English-local language speakers on the study team transcribed and translated the audio-recorded interviews into English. Interview transcripts were analyzed through thematic and qualitative content analysis (Vaismoradi et al. 2013) using the NVivo qualitative analysis software package version 12. Thematic analysis was based on a descriptive phenomenological tradition, thematizing meaning using a descriptive approach, with a focus on lived experiences (Sundler et al. 2019). The following stages were followed in the analysis. We developed analysis and coding frameworks based on the themes presented in the specific research questions and categories of the respondents in the protocol. We coded the narratives (transcribed interviews involving two coders) and uploaded them in the NVivo software packages by the different categories of respondents. The coding process identified similarities, outliers, and recurring themes in the interviews. We created charts and analysis matrixes using headings from the thematic framework. Headings and emerging sub themes were added as suggested by the data during analysis.

3. Findings

3.1. Phone Use by Adolescents and Preferred Platforms

The majority of the FGD and KII respondents of all the categories identified phone calls and text messaging as being commonly used among adolescents. Other uses mentioned were: playing games, searching for information, reading, entertainment (watching videos, movies, and listening to music), and taking photos and videos (Table 1). There was no difference in preferred platforms between genders. The most cited usages by girls and boys were chatting, SMS, listening to music, and watching movies. Service providers emphasized the aspect of searching for information and health knowledge.

Table 1. Use of, preferred platforms, and benefits of mobile phones by respondent category.

Themes	Main Findings	Boys	Girls	Mothers	Fathers	CHV	Providers	Teachers
Use	Calls	+	+	+	+	+	+	+
	SMS	+	+	+	+	+		+
	Games	+	+		+			+
	Reading	+						
	Watching videos, movies	+	+	+	+	+		
	Listening to radio, music	+	+	+	+			+
	Photos/video	+	+			+	+	+
	Info search, fashion, porn	+	+	+	+		+	
	Getting news		+					
Platforms	WhatsApp	+	+++	+		+	+	+
	Google	+	++	+	+		+	+
	Facebook	++	+++	+	+	+	+	+
	Twitter	+	+				+	+
	Instagram	+	++				+	+
	YouTube	++	+				+	+
	Manager	+						
	Betting sites	+			+			
	Music platforms.	+						
	Internet		+					
	Snapchat			+				
Benefits	Fast information reach	+	+	+	+	+	+	++
	Learning SRH information	+	++	+++		+	+	++++
	Effective, efficient		+		+		+	++
	Privacy						+++	++
	Clinic appointments						++	
	Education platforms		+		+		+	+++
	Relevance		+				+++	
	Bridge generation age gap				+			
	Exchange ideas					+		+++
	Financial transactions			+				
	Appealing			+		+		
	Access							++
	Correct misconceptions							++

+ Indicates frequency of responses mentioned by the specific category of respondents. ++ indicates the response was mentioned more than twice by the specific category of respondents. +++ indicates the response was mentioned more than three times by the specific category of respondents. ++++ indicates the response was mentioned more than four times by the specific category of respondents.

Almost all respondents from all categories mentioned WhatsApp, Google, and Facebook as the platforms preferred by adolescents (Table 1). Adolescents, health service providers, and teachers also mentioned Twitter, You Tube, and Instagram. Facebook and WhatsApp were the most popular platforms mentioned by both the boys and girls, in addition to service providers and teachers, who also mentioned the same platforms as the adolescents, including You Tube, Instagram, and Twitter. However, parents and CHVs did not see these platforms to be popular among adolescents. Other platforms mentioned espe-

cially by adolescent boys included manager, betting sites, music platforms, and Snapchat (Table 1).

3.2. Benefits of Mobile Phone Use by Adolescents

Among all participants, teachers expressed the most potential benefits of mobile phone use by adolescents, identifying several advantages, including learning SRH information. Commonly cited benefits fell under four categories: ease of information access; learning enhancement; effective/efficient means of education; and bridging the intergenerational gap. Girls cited a number of benefits, which included fast information search, the learning of SRH information (which was much emphasized), efficiency and effectiveness, relevance, and education platforms. On the other hand, adolescent boys mentioned only two benefits, which were fast information search and the learning of SRH information.

3.2.1. Ease of Information Access to Reach Large Numbers

All participants expressed the view that information provided through phones can create awareness quickly and can reach a wider intended audience (Table 1). "*Through mobile phone messaging you can reach many people*", commented a male in school, aged 14–18 (FGD B04). This view was supported strongly by the parents, CHVs, health service providers, and even teachers. Mothers emphasized that the use of phones is good because adolescents would be able to search for SRH information. "*It is efficient, effective and will reach a large number of adolescents especially in educating them on SRH information*".—Mother respondent (FGD M19).

Boys added the element of calling for help, especially in emergencies or in a crisis, and ease of transferring money, which was supported by the mothers, while girls added entertainment and making friends. "*I also support the need to bring the information through the phones because most young people like using their phones seriously*" remarked a mother respondent (FGD M16). A health service provider added "*They can get the information about sexually transmitted infection (STI), and also the HIV which is good for them because they can get the right information through the mobile phone*".—Explained a medical superintendent (KII H12).

Teachers supported this view, adding that adolescents using mobile phones would receive first-hand information, read it at their own pace, analyze, and understand it. They also thought that mobile phones would be a great tool for campaigns. Adolescents would share information among themselves towards the desired reproductive health behavior formation. A teacher gave an example.

> *"We can form WhatsApp groups or post information on Facebook, and through these they access and get enlightened"*—Head teacher (KII T02).

Teachers explained that adolescents were inquisitive and wanted to know more information, hence mobiles phones would be a great way to meet their SRH information needs, as phones are an easy means of communication, which are faster in relaying information. "*Smart phones access internet faster and brings information in a clearer way even pictorials and videos*", stressed a teacher (KII T04).

3.2.2. Enhances and Promotes Learning of Critical Information

The respondents expressed the importance of mobile phones in enhancing learning useful information, which included SRH information among adolescents regarding behavior change and behavior formation, such as the need to abstain from sex and the importance of using a condom to avoid HIV and STI infections. The majority of both boys and girls mentioned that through the phone they were able to learn about diseases, health education, and receive advice. "*It can be good because it will help to reduce the number of HIV infections*", explained a male in school, aged 14–18 (FGD B05).

"*It can give information about new emerging disease so that young boys can know about it early enough*", added another male in school, aged 14–18 (FGD B05). A male in school, aged 14–18 (FGD B04), added:"*It can be good because it can reduce the number of abortion. It is good*

because sometimes when someone is sick they can access the information about the illness from the phone". "*For me I think it can help more so when you went somewhere and you have been attacked you can call other people to come and help you*", said a male in school, aged 9–13 (FGD B01).

Girls added that they would learn about the remedies of such problems as having cramps during periods. The majority were of the view that mobile phone sources of SRH information were good because they provided a learning platform and gave advice, so they considered them trustworthy. All respondents agreed that most of the SRH information was appropriate, educative, and current. "*We get SRH educative materials on phone which will help me change my bad behavior*", explained a female, school-attending adolescent, aged 14–18 (FGD G08).

Parents (both mothers and fathers) and health service providers added that young people could learn how to protect themselves from sexually transmitted diseases and about existing family planning methods and their advantages and disadvantages. The majority of mothers supported the idea that young people could receive useful information through phones. They felt that young people could inquire and learn more about SRH information; for example, girls could receive information on issues pertaining to monthly periods, how to avoid pregnancy, and the steps of action in case one became pregnant. They added that SRH information via mobile phones would improve the lives of young people by increasing their knowledge, and that mobile phone messaging of SRH information was a useful learning platform for adolescents. This view was supported by CHVs, adding that mobile phones helped in searching for useful information. However, fathers did not mention the learning of SRH information as a benefit of adolescents' use of mobile phones.

Fathers and service providers added that phones could aid learning and research for adolescents. "*phones can be used to teach and educate young people in so many ways number one the phone can help them in researching on SRH latest information and it can be of help in educating them when they have questions regarding an issue, they can also use it to research about exams and revision and you they can get past revision papers*", explained a father (FGD F13). "*Like searching for information on abortion once a lady's pregnant, they will really want to know how abortion is done. How is it being managed and then they get some few drugs there and then they look at how they can get those drugs. See that is the right information they will get we can get that information*", said a nurse service provider (KII H11).

The aspect of searching for information, learning, and research was among the advantages strongly expressed by teachers. They mentioned that phones enabled students to conduct research for their homework and conduct academic group discussions through chat groups, to learn about growth and development; therefore, they felt it was a good tool, which they were already using. Information accessed via a phone could help to satisfy adolescents' curiosity about the bodily changes they may experience and their desire to learn about new information. In their view, searching for advice or particular SRH information were the driving forces for adolescents' use. "*If they are exposed to this information then I want to believe that they will be better off. If you tell them that they are going to get pregnant when they have sex, then they now think that if I don't want to get pregnant they are given an option of going to put that thing family planning*", explained a senior teacher (KII T01).

Respondents concluded that if adolescents used their phones for the intended purposes, then phones were good. *But if the phones are used to give useful information then they just use it". "Yeah—But you know with them they don't go into those deep one. If they can use this phone in a very positive manner, an educate manner they can Google, they can you know they can open the phone read. You get information from the phone that can empower them*", explained a teacher (KII T03).

3.2.3. Effective and Efficient

Mothers mentioned the effectiveness of using videos via mobile phones to educate young people because it was appealing to their age and they could be exposed to many different things through this medium.

"*It will be beneficial to them as they will be able to know and understand the effects of engaging in unhealthy relationships at a tender age, unlike if it is left for the parents to talk to them of which most of them will not take it seriously. So it will be better for them to decide on their own what exactly they want to do with their lives*", explained a mother (FGD M18).

This view was supported by service providers and teachers. They mentioned both positive and negative effects. The general feeling was that a mobile phone was a powerful learning tool if adolescents and parents were sensitized and educated on the importance of SRH messages delivered through phones.

Teachers stressed that phones were a powerful learning tool, especially for SRH, where privacy is required. "*Mobile phones can be used as a great tool for campaign. Where one, they can share information amongst themselves for the desired behavior regarding reproductive health, and hence enhance the campaign. So in that regard, it would be of great help. It can enable us reach a good number within a short period. For example we can form WhatsApp groups or post information on Facebook and get enlightened*", explained a school principal (KII T10).

The privacy aspect was also highlighted by health service providers, who expressed the importance of mobile phones in accessing sensitive information at an individual level. They added its usefulness in making hospital appointments. They viewed receiving mobile phone information as relevant and educative, particularly if the language was simple and acceptable; this view was supported by CHVs, who also emphasized the need to use simple language.

3.2.4. Helps to Bridge Intergenerational Gap

Fathers added that SRH messaging via mobile phones would bridge the information gap between parents and adolescents. "*I think it is useful to use phones because as a parent, you might have such information to share with your child but there is shyness which will not allow you to share with her or him some information. Therefore, phones can make him/ her receive all the information without any shyness*", explained a father (FGD F11).

CHVs and teachers supported this view, stressing the importance of the exchange of ideas, dialogue, and advice. Thus, adolescents were able to access phones via parents, friends, and relatives, particularly smart phones. "*Those who then don't have, will definitely when they find someone with a phone, they will be there. They want to learn. And you know once the youth . . . somebody has learnt something they will tell their colleagues*" (KII T09).

A teacher explained that, "*some of the adolescents that did not own mobile phones were able to use phones from their parents*". "*Some parents give permission to use their phones to his or her child to use some give them I don't deny that*," said a deputy principal teacher (KII T06).

Teachers added that phones could be used to correct misconceptions, suggesting that the proper presentation of information would help to clarify some of the misconceptions. "*The positive effect is that if we filter the information and the correct information given to the youth, I believe they will learn the right things. And they will also try to do the right things and avoid doing the negative things that they get through I call it "dirty media*", explained a head teacher (KII T02).

3.3. Challenges and Constraints

While acknowledging the benefits of mobile phone use by adolescents, as outlined above, the participants recognized a number of challenges and constraints, ranging from cost, poor logistics, and access issues to potential misuse, impact on school performance, and limited technical knowledge.

3.3.1. Cost

All respondents recognized cost as a challenge when considering purchasing a phone (mentioned by different groups of participants, except girls, fathers, and service providers) (Table 2). Additionally, respondents found it expensive to buy bundles and repair a faulty phone. This view was supported strongly by parents, teachers, and service providers. They explained that phones were expensive, and required money to access any content.

Adolescent boys, more than adolescent girls, strongly expressed the high cost of buying phones and bundles as a barrier to accessing SRH information through mobile phones. Boys expressed that, in their opinion, many adolescents would miss out on the SRH information through mobile phones if they had to buy bundles to access SRH information sent through the phone. "*Using a phone needs money and we cannot afford to get the money so that's a challenge*", explained a male in school, aged 9–13 (FGD B02). Another male respondent in school, aged 9–13 (FGD B01), added, "*Accessing phone for adolescents like us is not easy because we are still in school and we cannot have enough money to afford buying a phone so it might force some to steal or we can take from another person*".

Table 2. Challenges with mobile phones by respondent category.

Themes/Sub-Themes	Main Findings	Boys	Girls	Mothers	Fathers	CHV	Providers	Teachers
Cost	Buying phone, bundles, betting, demanding	++++	+	+++	+++	++++	++	++
	Leads to stealing	++		++		+		+++
Impact on school performance	Through addiction	++	++	+++		+	+	+
Misuse	Porn, misinformation may promote loose morals, early sex	+++	+++	++++	++++	++++	+++	++++
	Betting, bad company	+++		++++	++++			++++
	Cheating exams							++++
Poor logistics	Connectivity	+	+					++
	Charging	+	+		++	+	+	
	Analogue	+			+			+
No privacy, confidentiality	Sharing, e.g., with parents	+				+		
Limited access	Accessing smart phone, not allowed in school, phone loss	+	+	+	+	+	++	++
Parental control	Difficult, limited access		+	+		+	+	
Relevance of info	For age, language, style	+	++			+		+
Stigma	Being judged negatively by peers, parents, society	+	++			+	++	
Knowhow	Info access, misinterpretation		+	+		+	+	+
External influence				++			++	++

+ Indicates frequency of responses mentioned by the specific category of respondents.++ indicates the response was mentioned more than twice by the specific category of respondents. +++ indicates the response was mentioned more than three times by the specific category of respondents. ++++ indicates the response was mentioned more than four times by the specific category of respondents.

Parents supported the sentiments expressed by the boys. Fathers emphasized the high cost of purchasing the phone and the data bundles, given the high poverty levels. "*Phones are expensive and majority of families are poor, the cost of buying bundles to access information is very high*", explained a father. Mothers also added their voices to the conversation regarding the cost challenge. "*Young people have become more demanding for money to buy phone and bundles, which are expensive*", expressed a mother (FGD M20).

The CHVs agreed that poverty was a major challenge that would limit the use of phones by adolescents due to the cost of purchasing phones and bundles. "*The platform needs the use of money. For young people to get money, becomes a challenge because they are still in school. That can bring problems where they can even steal from their parents. Even if they don't*

steal from the parents, they might look for the money from friends who they think will give them money, so that they can get money to subscribe if the platforms are not free", explained a CHV (FGD C22).

Service providers, supported by teachers, emphasized the financial challenges involved in buying bundles.

"*Not all our adolescents can afford smart phones, and bundles to access internet*", said a reproductive health officer (KII H14). "*Like you know now phones are very expensive and a child cannot own one mostly the high school kids and the primary children they cannot own one. So it may lead them to taking your money to buy their own*", added a clinical officer (KII H18).

Teachers added, "*They can con someone so that they get their own. The boys can do fishing, you will find them in the lake looking for money to buy just a phone not even to pay school fees or buy uniform*".—School teacher (KII T07). Teachers further added that, "*Because of the desire to own a phone they may be tempted to collude with blackmailers to demand for ransom money. Phones encouraged stealing for example when they demand money for betting or for buying bundles when they are not given, they are tempted to steal*".—Deputy principal (KII T06).

The cost challenge was not expressed strongly by girls, who seemed to be more concerned about the cost of purchasing bundles, rather than phones. However, CHVs explained that the issue of the high cost of purchasing the phone could lead to young girls involving themselves in sexual relationships in order to receive money to buy one. "*The desire to own a mobile phone was overwhelming driven by peer influence to own a phone*", said a CHV (FGD C25).

3.3.2. Limited Access

The majority of adolescents, both boys and girls, said that access was a general challenge because of the lack of ownership of a mobile phone (Table 2). They said that they had to rely on their parents, relatives, or rich friends who owned a phone. In addition, most of the time when the adolescents were in school, especially those in boarding schools, phones were prohibited, which added to the challenge of access. "*we have the policy and they know it and when they come we search them thoroughly and we don't tolerate that, So the only time they would have access to phones is during the holidays*", explained a deputy school principal (KII T10).

The challenge of limited access was supported by all respondent categories. Mothers added the issue of low literacy levels in the rural areas. "*Not all adolescents will receive the information properly because not all of them have phones*", said a father respondent (FGD F15).

Therefore, using a mobile phone for SRH messaging would lead to discrimination against those who do not have access, leading to unhealthy competition and even stealing. Teachers added that most adolescents did not own phones but even those who had mobile phones would have limited access if they were not smart phones (analogue).

Adolescent boys and girls mentioned a lack of strong network services in the rural areas. "*The message might not reach the intended recipient since it requires a literate person who can read, sometimes our parents don't have phones that can Google so it will mean that you look for other ways to access a phone*", mentioned a female in school, aged 9–13 (FGD G07). Another issue mentioned was a lack of electricity to charge the phones at the right time. These logistical issues were supported by the fathers, CHVs, providers, and teachers. "*Some people do not even have electricity or solar to charge the phone, at all times*", said a father respondent (FGD F14). Teachers also mentioned losing the phone as an issue.

The adolescents, both boys and girls, were quick to mention that permission to use the phone was not easily granted by parents, especially when it was an expensive smart phone, while a few had different views, saying that permission could be granted depending on how adolescents used the phone. "*Parents don't agree because I might spoil it or block the phone so they deny me*", said a school-attending male, aged 9–13 (FGD B02). Both boys and girls expressed the fact that not all parents agreed to share their phones with them, making statements such as, "*They cannot allow because we can mishandle the phones*" (said a male in school, aged 9–13 (FGD B01)). "*They cannot agree because they fear that I would block the phone*

or spoil it", added a male in school, aged 14–18 (FGD B05). "*It may not be easy because most of the parents are against the use of mobile phones more so for students they see that they get distracted with their studies*", explained a female in school, aged 14–18 (FGD G09).

In general, mothers were the most hesitant respondent category, concerning the idea of young people accessing the mobile phones freely. According to them, the disadvantages outweighed the advantages.

"*Most parents may not understand the need of giving their phones to the children and so may not take it seriously, parents have not been adequately informed about the importance of SRH information so they will not give adolescents phones*", explained a mother (FGD M17). A CHV raised the issue that phone sharing could bring conflict between the parents and their children, a view supported by service providers.

3.3.3. Impact on School Performance

The impact on school performance was mentioned by all respondent categories except the fathers, Table 2. Both boys and girls mentioned the challenge of balancing school time and phone usage. "*You find that most adolescent have diverted their mind to betting than concentrating in school they took a lot of time knowing everything through WhatsApp than concentrating in their book*", said a male in school, aged 14–18 (FGD B05). "*Maybe one is school going, so they cannot get that time to be with the mobile phone; maybe there is a restriction that they should always be reading*", said female in school, aged 9–13 (FGD G06). Girls added that phone addiction would lead to poor performance in school, a lack of concentration in class, and a lack of time to use a phone for alternative purposes. "*When we are addicted to phone it can lead to us dropping out of school and even failing in the exams, once you are addicted you will not understand anything being taught in class because you will keep thinking about it all time*", added a female in school, aged 14–18 (FGD G10).

Mothers added to the concern of the disadvantages of phone use, such as distractions from studies and wasting their time betting instead of studying, adding that phones were not allowed in schools.

"*Children between the ages of 5–19 years are supposed to be in school and therefore should concentrate on their books, issues to do with the phone should be no*", said a mother (FGD M16) respondent, adding that mobile phone messaging posed a big challenge in interfering with adolescents' concentration in studies. These views were supported by CHVs, providers, and teachers.

3.3.4. Misuse

The misuse of mobile phones by adolescents was the most commonly cited challenge, which was highlighted by all groups of participants, see Table 2. Adolescents mentioned that they could misuse phones when given the opportunity by viewing bad photos such as pornography that can ruin their lives by spreading false information. Other issues raised were that watching pornographic movies could spread misleading information, promoting immoral behavior, early boy–girl relationships, the practice of early sex, and early marriages.

"*Sometime he sends you pornographic videos and he would wish that you do the same and this may result into pregnancies. Watching pornographic videos makes you horny*", explained a female in school, aged 14–18 (FGD G07). "*It can encourage someone also to engage in bad things like drug abuse or immorality especially with information from Facebook*", added another female in school, aged 14–18 (FGD G09). Girls said that the use of mobile phone was not good because it provided misleading and wrong information on matters such as abortion, especially from Facebook, which was a popular platform with the adolescent respondents.

Mothers were eager to mention the negative effects of the use of mobile phones by young people. "*Looking at very nasty things and encourages early sexual relationships, cheating and immoral behavior*", said a mother respondent (FGD M18). The boys also mentioned that mobile phones would encourage bad company. This was supported by the mothers, who explained that they facilitated connections with the wrong people (strangers) or with the

wrong friends through WhatsApp chats. Mothers expressed their anger on how phones were an instrument of destruction. "*The teachings they get are just negative*".—Mother (FGD M20). "*They get the opportunity to . . . at that time they are busy seducing one another through the phone, and it is very easy for them to start such behaviors when the phone is easily accessible in the house*".—Mother (FGD M17).

Fathers expressed the need for young people to be sensitized on the need to use their mobile phones resourcefully and not to misuse the opportunity by watching pornography and betting. They supported the views expressed by adolescents, such as that phones can be used to spread rumors and false information, the promotion of early sexual relations among young people, and encourage lying. They felt that the potential to misuse and abuse the mobile phone discouraged parents from giving adolescents the phone. "*As a parent I don't expect a child of that age bracket to have a phone. I view it in a different way and wonder where the child has gotten the phone from. I will therefore feel that she/he might get spoilt. Therefore I don't want them to use phones*", explained a father (FGD F15).

The health service providers and teachers supported the parents' sentiments. "*This can lead to the rise in adolescent relationships. It could be . . . because if you hear of lack of money . . . the adolescent can engage in some activities to get money so as to buy their own phone they must now have a phone because they will have heard of the advantages of owning one. That is one of the negative effects that can come about*", expressed a CHV (FGD C21). "*Phones expose them to pornography, early sexual relationships and influence from social media, and peer influence, by content presented to the adolescents, and language used*", said a clinical officer (KIIH16). "*The temptation to visit such sites is overwhelming. It is such an aid to accessing pornographic material . . . because of the embarrassment and restriction at the Cyber Cafés, the mobile phones have presented an opportunity for one-on-one interaction to visit the site through their mobile phone. Most of them have . . . a good number of them now have*", expressed a head teacher (KII T02).

Teachers expressed many concerns, and although there were positive and negative effects of mobile phones, the general feeling was that the mobile phone was a powerful learning tool if adolescents and parents were sensitized and educated on the importance of SRH messages delivered through phones; nonetheless, much caution was expressed: "*But they should not have it ruin their lives*".—Teacher (KII T08). "*The boys feel that they are now grownups like you and to some extent if you are not just strict then you may not control them*".—Deputy principal (KII T10). "*Like the young girls we have here, a man would lure them and give them a simple phone because this is a big favor now you see you must tow the line of this person so those who do not have might do all the plans to get a phone*".—Teacher (KII T07). Teachers added that phones encouraged cheating in exams and a betting addiction instead of focusing on beneficial and educative materials.

3.3.5. Relevance of Information, Privacy, and Stigma

The majority of the adolescent respondents, both boys and girls, noted the fact that some of the information could be irrelevant for their age, and that messages needed to be tailored to suit the adolescents. "*I think some may be relevant and some may not be relevant like the ways of preventing STIs, HIV I think those are relevant and others like watching pornographic movies I think those are not relevant, you get that the pornographic movies you watch you end up with occupied mind with movie you watch but they are of not good to you, you see you are a pupil or student you are watching pornographic movies I don't see the use of it, so some may be relevant and other may not*", explained a female in school, aged 14–18(FGD G08). This was supported by a teacher who said, "*They might receive information that is not relevant for them at their age*".—Head teacher (KII T02). Another concern raised was the use of simple language and ensuring that the content was captivating to the adolescents.

The issue of privacy was raised by boys and fathers. Boys believed that sharing with parents was not easy. "*It does not have privacy someone can access your communication easily and it can cause disagreement between you and your parent*", said male in school, aged 9–13 (FGD B02).

Fathers concurred that there was no privacy when a child could demand to access a parents' phone. The majority of respondents, both boys and girls, felt that owning a phone and accessing the SRH messages could lead to them being negatively judged by parents, peers, and society. Girls explained that parents often made very negative, discouraging remarks, such as, "*Those who have and access the messages through the phone are spoilt and stupid while the young people will make you feel like the odd one out*".—Father (FGD F12). These remarks were supported by CHVs and service providers: "*I think it can lead to stigma in the beginning, since anything new that comes must be stigmatized by people. So as it starts they will be stigmatized, but as it goes on they will continue learning, and more people will be receptive*", explained a CHV (FGD C24). Providers agreed that the stigma was from fellow young people and community members, explaining that, "*You hear comments like somebody's child nowadays is full of himself/herself I don't even know how they acquired the phone and they even sleep hungry You know that is stigmatizing irrespective of how you obtained the phone*".—Registered nurse respondent (KII H20).

3.3.6. Lack of Technical Knowhow

Girls, mothers, CHVs, providers, and teachers expressed concern about the ability of adolescents to use the phone to access SRH information. "*Not all young people know how to operate the phone*", said a mother respondent (FGD M16). CHVs added the issue of low literacy levels as a challenge, and that the use of technical scientific reproductive health (RH) language could be hard to understand. This was supported by service providers and teachers, who said that there was a need for the health workers to explain the information further. Teachers added that most parents did not take reproductive health seriously, because of the taboo surrounding it. Parents did not discuss SRH issues with their children, and as a result, the children were left on their own to experiment. "*And that's why you find that most of the youth are getting themselves into problems. They misinterpret the SRH information maybe what you intended for them they take it the other way round so you may not hit the significance of that . . . the information may not hit the point in that they may misuse that information otherwise they can change it around and use it as it suites them*", explained a deputy principal (KII T06).

Mothers opposed the idea of SRH mobile phone messaging; "*I don't see any benefits for bringing the teaching through the mobile phone*", and "*the teaching should not be brought through the mobile phones, let experts be brought from different fields and teach them like someone to talk to them on issues of family planning, be discussion can even be designed that girls and boys are taught separately, that could be better*", asserted several mothers (FGDs M17,M19, M20).

3.4. Addressing Challenges and Constraints

Participants suggested a variety of ways in which the identified challenges and constraints could be addressed. These included: availing resources to address logistic/infrastructure and cost/access challenges; ensuring the credibility and age appropriateness of the information; use of innovative channels/platforms for ASRH education; improving community knowledge/awareness and attitudes (especially parents) through training and sensitization; and improving adolescents' technical knowledge.

3.4.1. Inclusive Participation and Awareness to Improve Access and Use

Adolescent boys and girls advocated for the involvement of core stakeholders for the program, such as adolescents, parents, teachers, and service providers, in order to make the program more acceptable across society. For example, this could include involving the parents and explaining to them the importance of the SRH messages sent through the phone, which allow adolescents to access information; parents could also be involved in the development of appropriate SRH messages. They also suggested that the government should create awareness through advertisements on the advantages and disadvantages of the SRH messaging model.

Mothers emphasized that they should also be involved, saying, "*Bringing that information through the phone is just okay; but let the information be brought through the parents' phones so that the parents can read and tell them what they are supposed to do, but if it's the children by themselves then no.*".—Mother respondent (FGD M17). Fathers, providers, and teachers suggested the involvement of religious and opinion leaders. "*How I wish that the community, that is the parents and even the elders and even the churches come up with this forum, where the youth are advised, on reproductive health and the importance of it in their lives. Most of the time the youth are just discovering on their own through mobile phones or even through some . . . the television. Yeah. So nobody is there to guide them*", exclaimed a teacher (KII T03).

3.4.2. Sensitization and Raising of Awareness among Parents on the SRH Mobile Phone Messaging

Both adolescent boys and girls advocated for sensitization and the raising of awareness among parents on the SRH mobile phone messaging to encourage them to facilitate phone access for their children. All respondent categories supported the adolescents on this view, emphasizing that there was a need for education on the importance of the SRH messages (Table 3). A teacher explained the need, saying, "*We need to campaign and I think we've not adequately addressed the issue of sensitization. Sensitization of parents and teachers*".— Senior teacher (KII T01). They added the need to create awareness in schools and churches about the messaging program, targeting teachers, parents, and religious leaders (Table 3).

Table 3. Recommendations in mHealth design by respondent category.

To Include in mHealth Intervention Design	Boys	Girls	Mothers	Fathers	Providers	Teachers
Inclusive participation and co-creation	++	++	++	+	+++	+
Regulated content with trustworthy, informed sources of age appropriate messages and guidelines	+++	+++			++++	++
SRH application downloaded free, installed on phone, accessible platform at protected time and place	++++	+++	++	+	++++	++
Train all stakeholders on responsible phone use	+++	+++	+	+	+++	+++
Interactive presentation complementing counselling, dialogue	+	+	+	++		++
Make affordable, provide support, phones, bundles	++	+	++	+	+	
Sensitize, public, schools, churches	+++	+++				
Enhanced connectivity, use alt. energy				+	+	
Create a hotline, customer service		+			+	
Include school curricula						+

+ Indicates frequency of responses mentioned by the specific category of respondents. ++ indicates the response was mentioned more than twice by the specific category of respondents. +++ indicates the response was mentioned more than three times by the specific category of respondents. ++++ indicates the response was mentioned more than four times by the specific category of respondents.

3.4.3. Creating Protected Times and Spaces Supported by Counselling

Respondents suggested the development of SRH applications that can be downloaded and installed on mobile phones. Such a platform can be made available for adolescents at the protected times and places in schools and/or churches. These could be made interactive, and would be complemented with counselling (Table 3). Boys, girls, mothers, service providers, and teachers expressed the view that such activities could be undertaken at health clubs, where the SRH messages could be communicated to adolescents, free of charge, using shared phones, to make access to SRH messages more equitable. Teachers and adolescents were of the view that SRH education through mobile phones would work best if introduced as a school program, to make access possible for all adolescents in schools.

"*For everybody to access SRH information the information should be free of charge in schools*", suggested a female adolescent, aged 9–13 (FGD G06).

3.4.4. Relevance and Age-Appropriateness of Information

Both adolescent boys and girls stressed the importance of trustworthy sources of information, provided by people and organizations that are knowledgeable and with a good reputation, relaying correct SRH information (Table 3). They mentioned the need for sources to be reliable, such as the Ministry of Education, and messages to be channeled through schools, using champions to complement the education of adolescents. They also suggested the use of reputable media houses to advertise the importance of SRH mobile phone messaging. "*The danger is which source of information, if at all we could have a way in which the service providers could filter some information so that the youth cannot get those ones that are distracting to them, then it will be okay. Unfortunately, I believe there is no way they can filter that. Maybe through television, they can do that through the Communications Authority of Kenya, but through the mobile phone, you know, it's very difficult. How I wish they could come with a way of filtering this information that can assist us with the youth, then it can go on*", explained a teacher (KII T09).

Both adolescent girls and boys raised the issue of the age appropriateness of SRH messages sent through the phone. "*I think that the service providers, they should have a way of controlling the messages that get to the adolescent and limit the bad messages from being posted, appropriate and age specific SRH messages for the adolescents*", said a male in school, aged 14–18 (FGD B05). Girls mentioned the issue of false information on SRH and recommended the need for regulation by an approved organization, which can create an app with specialized SRH information for adolescents and educate the adolescents on how to use the phone and the application. The general view by both girls and boys was that a SRH source should be approved by the government and should limit SRH messages to reproductive health messages only. These views of adolescents were supported by parents, service providers, and teachers. Fathers added the need for guidelines to be developed on how to access the SRH information and restrictions should be put in place to restrict abuse. CHVs recommended that schools and the Ministry of Health should be the sources to disseminate the information because they are trusted and known by everyone.

Service providers added that messages should also be region specific, such as urban and rural regions. They proposed the formation of a technical committee for developing the information to address the issue of fear of the unknown of the parents regarding adolescent SRH information. Teachers added, "*I think we can tailor information that is towards that direction then phones can be of great help because you know our . . . the students of these ages are always on the phones they are always on the phone if they have such information then it would be easy for them to just read. We can tailor make the SRH messages to the adolescent sexual health and package it*". — Senior teacher (KII T01).

Girls added the need for adolescents to be truthful and straight forward when putting their request to their parents to use a phone. "*If we want to use phone to get information let us just be straight forward and go straight to get the information on health and return the phone so that next time when we ask for it then they will be giving us freely not asking themselves what we are going to do with the phone*", expressed a female in school, aged 14–18 (FGD G09). "*There are some parents who don't like their children to have phones so you can sit your parent down and explain to them the benefits you can get while using the phone and if they agree they would just give you chance to use it*", expressed a female in school, aged 9–13 (FGD G06).

3.4.5. Develop a Special Platform and Innovative Channels/Platforms for ASRH Education

All respondents recommended the development of a special SRH app that could be downloaded and installed on a mobile phone, for free access by adolescents. Mothers welcomed the idea of an SRH app, emphasizing the importance of creating a special program through the phone for SRH education. "*I think it can help because once the teachings*

are programmed in the mobile phones, then these people can just be taken for some workshop and be taught on the effective use they be taught on the effects of engaging in certain types of relationship at that age since that age of 10–19 they are school going and having a group discussion on some issues will greatly help them during that time they should also call issues the way they should; calling a spade a spade", explained a mother (FGD M16), who stressed that messaging should be packaged in a more attractive way. This was supported by fathers, CHVs, and providers. Providers stressed the need for creativity in developing SRH messages.

Other ways mentioned were to create links that could be shared through cloud messages; these links can be shared properly via trusted and known entities, such as Safaricom Citizen TV, NTV, Airtel, partners in collaboration with the Ministry of Health and Education or via centers for learning in detail the SRH messages sent. Teachers explained further, "*yes we have phones that are programmed then we even allow the parents to buy those phones just like we have text books that are recommended for students we can recommend such kind of phones that already are programmed. The engineers should add some apps that are containing health information facts. Involve I.C.T into it to make it innovative and the media people. It should be an interactive platform in which they are able to ask questions and they are answered*".—Deputy principal (KII T06). "*School can have a program, you log in and you had earlier said that the information needs to be packaged to suit different ages once you have the package then you can talk to ministry of education or the ministry of education can initiate it or is it something that can be initiated maybe at the county level, or in schools, at whatever level but it must be interaction between . . . it must be coordinated through the ministry of health and ministry of education Tailor made phones for the SRH messaging information, developed purely for age appropriate SRH educative materials*", explained a teacher (KII T03).

Providers added the creation of theatre groups, as well as a register of adolescents in the area for teaching and follow-up. Participants suggested the need for information to be disseminated through media channels such as radios or TV, which have a wider audience, are easily accessed, and reach wider geographical areas. "*For me I think the information can be relayed through the television since no one is hindered from watching the television*", explained a male in school, aged 9–13 (FGD B03). "*I think the idea for making the information reach the young people through the mobile phones could be reverted and the information could be passed through the TV or even the radio for it to reach many young people, because phone access can be a challenge to many young people so it could be relayed through the TV or radio*", explained a mother (FGD M18).

Respondents also mentioned dissemination through music concerts, use of theatre arts, videos, films, and holiday camps, as well as the distribution of educational materials and the teaching of SRH in churches. Health service providers added the use of champions to advocate the SRH messaging program, by organizing campaigns and holiday camps to teach about SRH issues. A teacher added, "*After the campaign, we register and map them. As we register them, then they network and have a call running. We know that so and so is a champion of formation of champions . . . for reproductive health . . . sexual and reproductive health . . . so and so. So they become our ambassadors wherever they go*".—Head teacher (KII T02).

3.4.6. Training Adolescents on Usage and Supporting Them

The training of young people in groups to learn about the SRH information relayed through the phone was mentioned by a majority of the respondents, who stressed the need to train young people on mobile phone usage and to teach adolescents about how to use the phone. Boys added the elements of guidance and counseling. They were supported by mothers, who added the need for free access to information and education on how to operate the phone. Fathers added seminars for adolescents on the importance of SRH mobile phone education. CHVs mentioned the need to use simple, understandable language in addition to training. Providers added that not only adolescents needed training but also teachers and service providers, in order for them to effectively influence utilization. "*Since phone use for SRH information is new, creation of awareness is very key*", remarked a reproductive health officer service provider (KII H15).

Teachers added several statements on preparing adolescents to use phones effectively for *SRH.*

> "*In schools we are trying because we have the health club, which talks to them about their health. We've even talked to them, we advise them at the assemblies, especially when they're closing school, that when they're going out, they're out of school, where we cannot monitor them, that they should be careful of their lives because any decision they make will have consequences*".—Senior teacher (KIIT01).

Teachers stressed the need to guide and counsel adolescents on the proper use of mobile phones for SRH educational purposes. They explained the need to talk to the adolescents about avoiding bad sites.

> "*We can control the usage of these phones at home we should also do some close supervision on what they are accessing. Guide and counsel them, give them the positive side and the negative side of using because everything has both sides*".—Head teacher (KII T02).

> "*We should advise them not to use them to see what they should not see at their ages. To do what they should not do at that age*", ahead teacher explained (KII T07).

> "*You don't just let them loose*", explained a deputy principal teacher (KII T10).

3.4.7. Addressing the Problem of Cost

Boys suggested the need for subsidized, cheap phones, or shared phones at SRH service centers.

"*Implementing agency should buy mobile phones for young people so that they can get the information more easily*" suggested a mother (FGD M19) or "*provide financial support for adolescents coming from poor households*", suggested a father. Regarding bundles, girls said it was good to request parents to buy them bundles or to borrow from someone such as a friend or family member to access relevant content. They could also request parents for their phones to access messages on WhatsApp.

These views were supported by CHVs and service providers. Providers suggested that the government should speed up the installation of fiber optic so that young people can access the SRH information, install free public WIFI in central areas where young people can access the internet, and that service providers should ensure strong internet connectivity. Respondents suggested alternative power sources, such as charging the phone using solar panels instead of electricity. Providers suggested the creation of a hotline dedicated to the adolescents for SRH help (Table 3).

4. Discussion

4.1. Phone Use by Adolescents: Acceptability, Accessibility, and Benefits

Findings show that mobile phone use was frequent among adolescents, mainly for calls and text messaging, but the majority relied on parents and friends to access the phones. The most popular use of mobile phones by adolescents was the short messaging service (SMS). This finding has been reported by other researchers. A survey conducted in 24 LMICs on mobile phone use revealed that the majority (78%) of cell phone users used SMS (Wike and Oates 2014; Poushter and Oates 2015). A study by Hampshire et al. (2015) reported similar results; 77% of adolescents aged 14–18 used cell phones for SMS, making it the most common method of communication among adolescents. SMS remains the most frequently used mobile phone communication format among youth in Sub-Saharan Africa (SSA), as reported also by several studies (Aranda-Jan et al. 2014; Raifman et al. 2014). Identifying the most preferred platform is critical to inform the design of future SRH mHealth interventions.

Concerning benefits, respondents reported that mobile phones could have fast and wide coverage of intended audiences to create awareness and enhance critical knowledge. All respondents felt that it was an effective and efficient way to communicate (SRH) information because adolescents were responsive and enthusiastic to use new innovative

technologies; moreover, because they can use mobile phones to access information, the phones resolve the critical barriers to receiving SRH information and services, as observed by Perry and colleagues (Perry et al. 2012). Diverse mHealth solutions have been used to connect adolescents to SRH information and services (Burns et al. 2016).

Respondents lauded the potential of mobile phones to promote the learning of useful SRH information among adolescents, to influence the formation, modification, and/or change of their behavior, such as the need to abstain from sex and the importance of using condoms to avoid pregnancy and sexually transmitted infections (STIs). Studies have shown that it is an appropriate approach to provide acceptable, safe, cost-effective, and accurate SRH information and services (Biddlecom et al. 2007; Kennedy et al. 2013; Bloomfield et al. 2014). The findings were also consistent with those of a study carried out by Kelly and colleagues (Kelly et al. 2016), indicating that mHealth programs can increase health knowledge and that such programs tend to be well-received by youth (Rokicki et al. 2017; Mitchell et al. 2011).

It was noted that phones can address adolescents' curiosity about the changes they are experiencing in their bodies and their desire to learn about new information. They would thus access accurate information and correct misconceptions (Kelly et al. 2016). It was noted that mobile phones addressed several barriers to SRH information and services for adolescents, such as the need for privacy and confidentiality in accessing sensitive information. Adolescents highlighted many barriers experienced by them when seeking SRH information and services, such as the stigma and discrimination by health care workers. Previous evidence has demonstrated that mobile phones can provide safe, accurate, cost-effective, and timely SRH information and services tailored to adolescents (Biddlecom et al. 2007). Other studies have proven that mobile phones offer privacy and convenience (Delany-Moretlwe et al. 2015), while highlighting the importance of including interactive features and feedback in the design of mHealth programs for adolescents. Our study also indicated that the use of games is popular among adolescents and could be incorporated into mHealth program designs.

4.2. Challenges and Constraints to SRH Information through Mobile Phones

The challenges/concerns to adolescent SRH information through mobile phones cited by respondents included: restricted access; cost; misuse, impact on school performance; and lack of technical knowledge.

4.2.1. Misuse

The respondents highlighted the fact that some adolescents could misuse phones, when given the opportunity, to view pornographic materials with misleading information, and others could use it for betting. Many of these challenges have been reported by other researchers (Ippoliti and L'Engle 2017; Aranda-Jan et al. 2014). A report by UNESCO urges caution, pointing out that anti-mobile phone sentiments and the banning of the use of mobile phones in school premises were among the most significant barriers to learning by using mobile phones (UNESCO 2012).

4.2.2. Cost

The adolescents and other respondents considered the high cost of buying phones and bundles as a barrier to accessing SRH information through mobile phones. Further respondents stressed that the strong desire to own a phone could lead to young girls involving themselves in sexual relationships in order to receive money to buy one, or boys stealing from their parents or turning to child labor. Related studies have identified the difficulties adolescents may experience in accessing cell phones due to cost or poor socio-economic status (Horst and Miller 2006; Mitchell et al. 2011), while others opined that mHealth programs do not reach vulnerable adolescent populations (Chen and Wellman 2004; Mitchell et al. 2011).

4.2.3. Impact on School Performance

The impact on school performance was mentioned by all respondent categories, noting that phone addiction would lead to poor performance in school, a lack of concentration in class, and a lack of time for schoolwork, all of which are well documented in the literature (Dong et al. 2016), suggesting that addictive phone use can lead to less academic engagement among adolescents (Robert et al. 2001). In addition, researchers have reported disturbed sleep patterns by frequent cheap night phone calls (Yu et al. 2013; Porter et al. 2016), and bullying, harassment, and exploitation, particularly of the female adolescents, given the minimal online child protection (UNICEF 2011) and widespread access to pornographic materials through mobile phones (Valkenburg and Peter 2011; Vallee and Ruglis 2013).

4.2.4. Limited Ownership of and Access to Mobile Phones

This study confirmed that the limitation of access to mobile phones among adolescents is an issue that must be adequately addressed for phones to be an effective means of SRH education among adolescents. A study in selected countries of sub-Saharan Africa(Ghana, Malawi, and South Africa) observed that mobile phone ownership among young people aged 14–18 years varied from a low 18% in Malawi to a high of 69% in South Africa (Hampshire et al. 2015). The variability in adolescent phone ownership is described by many researchers, such as Porter et al. (2016). A quantitative survey in Uganda by Wesolowski et al. (2012) reported that only 27% of 1503 secondary school students in Mbarara owned cell phones.

Hampshire et al. (2015) further observed that adolescents from disadvantaged groups generally had low rates of ownership, or had only limited access to shared household phones. This has been observed by other studies, which have highlighted that mHealth programs tend not to reach vulnerable adolescent populations (Mitchell et al. 2011). Disproportionately low ownership levels for phones were observed between rural versus urban sub counties. A study by Thirumurthy and Lester (2012) found similar results in Kenya. Other researchers have described pronounced differences in ownership between different socio-economic groups. For instance, Thirumurthy and Lester (2012) found that mobile phone owners had the higher mean monthly income than non-owners in Kenya. Thus, although adolescents could potentially benefit a lot from mHealth SRH information via text messaging, those at the highest risk due to the socioeconomic factors described by Mmari and Sabherwal (2013) may not be as able to access cell phones.

4.2.5. Limited Technical Capacity to Use Smart phones

Respondents expressed concern about the inability of adolescents to use the phone to access SRH information, due to low literacy levels, worsened by technical, scientific SRH language. In a study in Kenya and South Africa, UNICEF observed that inadequate mobile technology skills among parents increased the vulnerability of adolescents to exploitation and harassment, as well as misuse of the phones (Robert et al. 2001).

4.2.6. Logistical Challenges

Other barriers mentioned by adolescents, such as electricity and internet connectivity, have been reported by other researchers (Aranda-Jan et al. 2014; Ippoliti and L'Engle 2017; L'Engle et al. 2016).

4.3. Addressing Constraints in Local Context to Inform Design of mHealth Intervention for SSA

The participants suggested various ways of addressing the identified challenges in the local context. This study was motivated by our desire to gain an understanding from the key stakeholders of what was needed to design mHealth interventions that were likely to succeed in the local SSA context. Five principles emerged from this study's findings that are critical for success and should be included in the design of future interventions or could be used in assessing future proposals. The principles constitute a remarkable contribution to knowledge from the perspectives of six stakeholder categories involved

in this study (adolescent girls and boys, their mothers and fathers, their service providers, and their teachers). The principles resonate with a number of theories outlined in the literature, which should underpin the design of mHealth interventions. These principles include: inclusive participation of and co-creation with key stakeholders; a well-regulated, credible application, with messages from respected sources, targeting the most vulnerable adolescents; having protected, safe learning time and space for adolescents to listen to health promotion/risk prevention messages; complementing phone messages with counseling and dialogue; and training adolescents to ensure the capacity for appropriate phone use.

4.3.1. Inclusive Participation of Stakeholders in Intervention Design and Co-Creation

Respondents stressed the need for the inclusive participation of key stakeholders, such as adolescents, parents, teachers, and service providers, during the development and dissemination of the SRH messages, for the program to be acceptable across the society; this is an aspect not commonly identified by adolescent sexual reproductive health researchers. However, a number of workers have shown that it is critical to ensure that every stakeholder affected by a designed intervention is equitably represented in all activities in the design, determining actions, content, sources, timing, and roles are fair according to their needs, aspirations, and rights, as observed by Mason et al. (1991), as this enhances ownership and acceptability. Such participation can be enabled through formal and traditional networks and leadership systems caring for adolescents. Including and enabling such individuals and groups to participate in decisions, planning, and actions will enable every concerned stakeholder to influence the content and quality of the intervention (Kuokkanen and Leino-Kilpi (2000) and Burton (2014)), which will thus ensure that the intervention is more acceptable to both individuals and groups (Bose and Coccaro 2013).

Full and effective inclusion and participation means enabling all people, including adolescents, to fully take part in all aspects. It means removing barriers, to allow individuals to participate in all activities on an equal basis; this highlights the importance of this notion from the perspectives of the participants in this study, as underlined by the United Nations Convention on the Rights of the Child (United Nations Convention on the Rights of the Child 1989) and Cook et al. (2012), including their right to healthcare, education, social protection, and community participation, regardless of age, gender, ethnicity, poverty or impairment. Several studies have stressed that to have a successful mHealth intervention, no stakeholder should be discriminated against. However, there is often a reluctance to recognize the competence of adolescents to participate in decision-making about health, life skills, and important topics around the transition to adulthood, such as sexuality (Avison et al. 2007; Livingstone and Bulger 2013; Barnes 2011; Wesolowski et al. 2012; Alexy 2018; Porter et al. 2016; Kim 2018; Blumenstock and Eagle 2012).

Therefore, the design of successful mHealth interventions should display a culture which respects the 'right of access' to all stakeholders. It is important that young clients feel included and autonomous during health communication, as expressed by (Shulock et al. 2012). Another concept related to inclusive participation is co-creation, which is defined as the collaborative development of new concepts, solutions, products, and services together with experts and stakeholders (such as customers and suppliers, etc.). Galvagno and Dalli (2014), in their systematic review on co-creation, described it as a form of collaborative innovation, in which ideas are shared and improved together. UNESCO (2012) summarized the different theoretical perspectives in the co-creation literature and identified three: service science perspective, innovation and technology management perspective, and marketing and consumer research perspective. Co-creation allows and encourages active involvement by all stakeholders, to create a value-rich experience, as is desirable when designing adolescent mHealth interventions (Vandeyar 2013).

4.3.2. Develop Adolescent Specific, Well Regulated ARH Information from Authoritative Sources

The aim was to develop a well-regulated, adolescent-specific application, targeting the most disadvantaged groups in the program design. The adolescents stressed the need for high quality, regulated, age-appropriate SRH information, from trustworthy sources such as the Ministry of Education and/or Health. Efforts should be made to target disadvantaged adolescents. Age and education are the most important predictors of mobile phone ownership among adolescents (Wesolowski et al. 2012). Our quantitative findings in this study showed that phone ownership among the adolescents was less than 20%. This has also been described by other researchers, such as Porter et al. (2010), who noted that while mobile phone ownership and usage had greatly expanded among young people in many LMIC settings, adolescents from disadvantaged groups generally tended to have low rates of ownership, or may only have limited access to a shared household phone (Blumenstock and Eagle 2012; Thirumurthy and Lester 2012). Suggested solutions to make access to phones more equitable included introducing them through school programs and providing freely accessible phones and information at SRH service centers. The increasing availability of cell phones, along with the capability for the devices to carry and transfer data, suggest that phones will reach more people than computers and the Internet in coming years, across different socioeconomic backgrounds (Kelly et al. 2016).

4.3.3. Downloadable Application for Discussion at Protected Safe Space and Time

Respondents suggested the development of a special SRH application that could be downloaded and installed on a mobile phone. This, respondents explained, would require a dedicated safe space and time for accessing SRH information from a shared phone. The term safe space generally means "*a place or environment in which a person or category of people can feel confident that they will not be exposed to discrimination, criticism, harassment or any other emotional or physical harm*." A judgment-free zone where you can let your guard down and truly be yourself (Oxford Dictionary 2020). A safe space is a place—physical or virtual—you can go to relax and recharge. Creating "safe spaces" for adolescents would promote healthy and productive transitions to adulthood. Adolescence is a time of many transitions and a time to acquire the skills for adult life. Adolescence is a time to lay a foundation of education, financial skills, positive health behaviors including SRH, and critical thinking. In an often intolerant world, having a safe space to go to is incredibly important for maintaining good mental health.

Researchers have described the virtual safe space model as designed to facilitate access to information and services in a way that is safe, culturally appropriate, and accessible to adolescents, particularly those who face higher levels of marginalization. Examples of locations that can be used are community halls, dedicated program space, schools, and youth centers (Hallman and Roca 2011). There are two main ways that people think about safe spaces: ideologically or as a physical space that allows for the physical safety of members. A safe space is typically meant for marginalized populations to have a space that is conducive to their physical well-being. It can also be used to voice common narratives throughout the group. It should be a place where young people feel physically and emotionally secure (Brady et al. 2005). These routes are critical ways of strengthening children and young people's life skills, which are crucial for preventing sexual, reproductive, and gender-based violence (SRGBV). School-based clubs and other types of safe spaces can be a useful entry point for addressing SRGBV. Most interventions have engaged girls separately from boys to give both boys and girls their own space to speak freely, gain confidence, and improve their knowledge, attitudes, and practices in managing violence and inequality. In a safe space, young people feel free to openly express themselves in a confidential environment, and to ask sensitive questions without fear of judgment (Brady et al. 2005; Austrian and Ghati 2010; Parkes et al. 2013; McAslan Fraser 2014; Kim 2018).

4.3.4. Complementary Technical, Interactive Dialogue and Counselling Support to Phone Messages

Respondents stressed the importance of counselling and technical dialogue to complement the phone messages, which could be offered by teachers, service providers, champions, and/or parents. This was emphasized by Livingstone and Bulger (2013), who demonstrated the need to teach adolescents the importance of informed choice in virtual environments that are free to access by adolescents. The platform should include in the design innovative features such as interaction and feedback, as described by (Chen and Wellman 2004).

4.3.5. Training of Adolescents and Key Stakeholders on Their Roles in Appropriate Phone Use

Respondents suggested that adolescents should be trained and supported by accompanying phone messaging with guidance and counselling. Findings by UNICEF (2013) suggest the need to train and educate parents and teachers on mobile phone use in addition to training adolescents themselves. UNESCO advocates for promoting responsible mobile phone use rather than banning (UNESCO 2012). This view is supported by our findings as well as research evidence from other studies (Vandeyar 2013; Kim 2018). The training of all stakeholders in their respective roles is important, making their inclusive participation effective and efficient. Goldberg and Bryant (2012) propose a conceptual framework to provide a structured approach to designing, coordinating, and evaluating the complex processes inherent in training, arguing that it is critical to plan the training of multiple stakeholders to enhance the initiatives' sustainability and its responsiveness to clients. The widely cited framework developed by Cooke (2005) is particularly relevant to capacity building within LMICs because it can help shift the power dynamics and subsequently the control over decisions to more vulnerable participants (Goldberg and Bryant 2012).

5. Conclusions

There is great potential for mobile phones to promote the learning of useful SRH information among adolescents, which could influence their health behaviors, such as reducing the risk of unplanned pregnancy and sexually transmitted infections (STIs). There is a need for mobile phone-supported SRH interventions because they can provide safe, confidential, accurate, and timely information and services to adolescents. This study indicated widespread support for such mHealth approaches from parents, teachers, and healthcare professionals. Adolescents face many barriers to accessing SRH information and services that must be addressed if progress towards SDGs is to be realized. This study provides key recommendations to overcoming these barriers, which could enhance the effectiveness of mHealth SRH-focused interventions. Future research should investigate how to coproduce mHealth approaches to deliver SRH interventions to maximize their reach and reduce health inequalities due to the social determinants of health.

6. Limitations

Being a qualitative study, the extent to which our findings can be generalized is limited. However, the participants in the qualitative interviews were drawn from the sampling process undertaken for the quantitative part of the study. This should have improved the representativeness of the sample interviewed, and thus the views of the participants may represent the views of adolescents, parents, service providers, and teachers, at least in Western Kenya; the views are also consistent with those of other researchers, while also adding views on techniques to expand the reach of mHealth in the Kenyan context.

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Informed Consent Statement: All participants provided written informed consent to participate in the study. For adolescent minors below the age of 18 years, parents provided informed consent by signing a consent form on behalf of the students, and students were asked for assent to participate in the study. All students above the age of 18 provided written consent to participate.

Data Availability Statement: Availability of data and materials, The datasets used and/or analyzed during the current study are available from the corresponding author on request.

Conflicts of Interest: The authors declare no conflict of interest.

Abbreviations

ASRH	Adolescent Sexual Reproductive Health
LMIC	Low Middle Income Countries
MHealth	Mobile Health
NACOSTI	National Commission for Science, Technology and Innovation
SRH	Sexual and Reproductive Health
STI	Sexually Transmitted Infections
UNESCO	United Nation Education Organization
UNICEF	United Nations Children's Fund

Appendix A. Characteristics of FGD Participants

Sub County/School	Participant Type	FGD CODE #	Number of Participants	Gender	Age Range	Characteristics of Participants
Asego	Boys	FGD B01	9	Male	9–13	Adolescent in primary school
Wagwe	Boys	FGD B02	10	Male	9–13	Adolescent in primary school
Kamenya	Boys	FGD B03	12	Male	9–13	Adolescent in primary school
Kanyango	Boys	FGD B04	12	Male	14–18	Adolescent in high school
Othoro	Boys	FGD B05	11	Male	14–18	Adolescent in high school
Asego	Girls	FGD G06	10	Female	9–13	Adolescent in primary school
Kamenya	Girls	FGD G07	10	Female	9–13	Adolescent in primary school
Kanyango	Girls	FGD G08	8	Female	14–18	Adolescent in high school
Othoro	Girls	FGD G09	11	Female	14–18	Adolescent in high school
Wagwe	Girls	FGD G10	12	Female	14–18	Adolescent in high school

Sub County/School	Participant Type	FGD CODE #	Number of Participants	Gender	Age Range	Characteristics of Participants
Kisaku	Fathers	FGD F11	10	Male	30–55	Fathers to the adolescents
Kamenya	Fathers	FGD F12	8	Male	30–55	Fathers to the adolescents
Asego	Fathers	FGD F13	10	Male	30–55	Fathers to the adolescents
Kamenya	Fathers	FGD F14	11	Male	30–55	Fathers to the adolescents
Wagwe	Fathers	FGD F15	9	Male	30–55	Fathers to the adolescents
Kamenya	Mothers	FGD M16	12	Female	30–55	Mothers to the adolescents
Wariga	Mothers	FGD M17	11	Female	30–55	Mothers to the adolescents
Asego	Mothers	FGD M18	12	Female	30–55	Mothers to the adolescents
Kamenya	Mothers	FGD M19	8	Female	30–55	Mothers to the adolescents
Wagwe	Mothers	FGD M20	10	Female	30–55	Mothers to the adolescents
Ogongo	Community Health Volunteers	FGD C21	12	Female	30–55	Health volunteers in communities working in Homabay County
Kisaku		FGD C22	8	Female	30–55	
Kamenya		FGD C23	10	Male	30–55	
Kanyango		FGD C24	9	Male	30–55	
Wagwe		FGD C25	12	Female	30–55	

Indicate transcript unique identification code.

Appendix B. Summary of KII Participants

School/Hospital	Participant Type	KII CODE #	Gender	Age Range	Occupation/Designation
Rangwe Primary	Senior teacher	KII T01	Female	30–55	Teaching
Gendia Primary	Head teacher	KII T02	Female	30–55	Teaching
Lianda Primary	Teacher	KII T03	Female	30–55	Teaching
Life central	Teacher	KII T04	Female	30–55	Teaching
Gendia Boys	Head teacher	KII T05	Male	30–55	Teaching
Migori boys	Deputy principal	KII T06	Male	30–55	Teaching
Ogande girls	Teacher	KII T07	Female	30–55	Teaching
Rangwe girls	Teacher	KII T08	Female	30–55	Teaching
Sindo Girls	Teacher	KII T09	Female	30–55	Teaching
Mbita boys	Deputy principal	KII T10	Male	30–55	Teaching
Rachuonyo	Nurse	KII H11	Female	30–55	Service delivery
Makongeni	Medical superintendent	KII H12	Male	30–55	Service delivery
Kabondo	Reproductive health officer	KII H13	Male	30–55	Service delivery
Magunga	Reproductive health officer	KII H14	Male	30–55	Service delivery
Ogongo	Clinical officer	KII H15	Male	30–55	Service delivery
Rangwe	Clinical officer	KII H16	Male	30–55	Service delivery
Waware	Clinical officer	KII H17	Male	30–55	Service delivery
Wagwe	Clinical officer	KII H18	Male	30–55	Service delivery
Pala	Registered nurse	KII H19	Female	30–55	Service delivery

Indicate transcript unique identification code.

References

Akinfaderin-Agarau, Fadekem, Manre Chirtau, Sylvia Ekponimo, and Samantha Power. 2012. Opportunities and limitations for using new media and mobile phones to expand access to sexual and reproductive health information and services for adolescent girls and young women in six Nigerian states. *Africa Journal of Reproductive Health* 16: 219–30.

Alexy, Valet. 2018. About inclusive participation in sport: Cultural desirability and technical obstacles. *Sport in Society* 21: 137–51.

Aranda-Jan, Clara B., Neo Mohutsiwa-Dibe, and Svetla Loukanova. 2014. Systematic review on what works, what does not work and why of implementation of mobile health (m-health) projects in Africa. *BMC Public Health* 14: 188. [CrossRef] [PubMed]

Austrian, Karen, and Dennitah Ghati. 2010. *Girl Centered Program Design: A Toolkit to Develop, Strengthen and Expand Adolescent Girls Programs*. Nairobi: Population Council.

Avison, William R., Jane D. McLeod, and Bernice A. Pescosolido. 2007. *Mental Health, Social Mirror*. London: Springer. [CrossRef]

Barnes, Colin. 2011. Understanding Disability and the Importance of Design for all. *Journal of Accessibility and Design for All-JACCES* 1: 55–80.

Biddlecom, Ann E., Susheela Singh, and Alister Munthali. 2007. Adolescents' views of and preferences for sexual and reproductive health services in Burkina Faso, Ghana, Malawi and Uganda. *Africa Journal of Reproductive Health* 11: 99–110. [CrossRef]
Bloomfield, Gerald S., Rajesh Vedanthan, Lavanya Vasudevan, Anne Kithei, Martin Were, and Eric J. Velazquez. 2014. Mobile health for non-communicable diseases in Sub-Saharan Africa: A systematic review of the literature and strategic framework for research. *Global Health* 10: 49. [CrossRef] [PubMed]
Blumenstock, Joshua Evan, and Nathan Eagle. 2012. Divided we call: Disparities in access and use of mobile phones in Rwanda. *Information Technology International Development* 8: 1.
Bose, Anjali, and Robert Coccaro. 2013. *Understanding African Children's Use of Information and Communication Technologies: A Youth—Led Survey to Prevent Sexual Exploitation Online*. Bangkok: ECPAT International.
Brady, Michael K., Gary A. Knight, Joseph Cronin Jr., Hult M. Tomas, and Bruce D. Keillor. 2005. Removing the Contextual Lens: A Multinational, MultI-setting Comparison of Service Evaluation Models. *Journal of Retailing* 81: 215–30. [CrossRef]
Burns, Kara, Patrick Keating, and Caroline Free. 2016. A systematic review of randomized control trials of sexual health interventions delivered by mobile technologies. *BMC Public Health* 16: 778. [CrossRef]
Burton, Patrick. 2014. Submission by the Centre for Justice and Crime Prevention [CJCP], South Africa to UN Commission on the rights of the child: Day of general discussion. *Digital Media and Children's Rights* 12: 1–4.
Chen, Wenhong, and Barry Wellman. 2004. The global digital divide–within and between countries. *IT Society* 1: 39–45.
Cook, Philip H., Cheryl Heykoop, Athapol Anuntavoraskul, and Jutarat Vibulphol. 2012. Action research exploring information communication technologies [ICT] and child protection in Thailand. *Development in Practice* 22: 574–87. [CrossRef]
Cooke, Jo. 2005. A framework to evaluate research capacity building in health care. *BMC Family Practice* 6: 44. [CrossRef] [PubMed]
Davis, Kevin. 1995. The Phenomenology of Research: The Construction of Meaning in Composition Research. *A Journal of Composition Theory* 15: 121–29.
Delany-Moretlwe, Sinead, Frances M. Cowan, Joanna Busza, Carolyn Bolton-Moore, Karen Kelley, and Lee Fairlie. 2015. Providing comprehensive health services for young key populations: Needs, barriers and gaps. *Journal of International AIDS Society* 18: 19833. [CrossRef]
Dick, Bruce, and Jane Ferguson. 2015. Health for the World's Adolescents: A Second Chance in the Second Decade. *Journal of Adolescent Health* 56: 3–6. [CrossRef]
Dong, Seo Gi, Yujeong Park, Min Kyung Kim, and Jaekook Park. 2016. Mobile phone dependency and its impacts on adolescents' social and academic behaviors. *Journal of Science* 63: 282–92.
Feroz, Anam, Farina Abrejo, Sumera Aziz Ali, Rozina Nuruddin, and Sarah Saleem. 2019. *Using Mobile Phones to Improve Young People's Sexual and Reproductive Health in Low- and Middle-Income Countries: A Systematic Review Protocol to Identify Barriers, Facilitators and Reported Interventions*. Karachi: Department of Community Health Sciences, The Aga Khan University Pakistan.
Galvagno, Marco, and Daniele Dalli. 2014. Theory of value co-creation: A systematic literature review. *Managing Service Quality: An International Journal* 24: 643–83. [CrossRef]
Goldberg, Jessica, and Malcolm Bryant. 2012. Country ownership and capacity building. *BMC Public Health* 12: 531. [CrossRef]
Gonsalves, Lianne, Kelly L. L'Engle, Tigest Tamrat, Kate F. Plourde, Emily R. Mangone, Smisha Agarwal, Lale Say, and Michelle J. Hindin. 2015. Adolescent/youth reproductive mobile access and delivery initiative for love and life outcomes (ARMADILLO) study: Formative protocol for mHealth platform development and piloting. *Reproductive Health* 12: 67. [CrossRef]
Hallman, Kelly, and Eva Roca. 2011. *Building Economic, Health, and Social Capabilities among Highly Vulnerable Adolescents in KwaZulu-Natal, South Africa*. Nairobi: Population Council.
Hampshire, Kate, Gina Porter, Samuel Asiedu Owusu, Simon Mariwah, Albert Abane, Elsbeth Robson, Alister Munthali, Ariane DeLannoy, Andisiwe Bango, Nwabisa Gunguluza, and et al. 2015. Informal m-health: How are young people using mobile phones to bridge healthcare gaps in sub-Saharan Africa? *Social Sciences and Medicine* 142: 90–99. [CrossRef] [PubMed]
Hindin, Michelle J., and Adesegun O. Fatusi. 2009. Adolescent sexual and reproductive health in developing countries: An overview of trends and interventions. *International Perspectives on Sexual and Reproductive Health* 35: 58–62. [CrossRef] [PubMed]
Horst, Heather, and Daniel Miller. 2006. *The Cell Phone: Anthropology of Communication*. Oxford: Berg Publishers Incorporated.
Ippoliti, Nicole B., and Kelly L'Engle. 2017. Meet us on the phone: Mobile phone programs for adolescent sexual and reproductive health in low-to-middle income countries. *Journal of Reproductive Health* 14: 11. [CrossRef] [PubMed]
ITU. 2019. Available online: https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2019.pdf (accessed on 7 January 2022).
Kay, Misha, Jonathan Santos, and Marina Takane. 2011. mHealth: New horizons for health through mobile technologies. *World Health Organization* 64: 66–71.
Kelly, Engle, Emily R. Mangone, and Angela M. Parcesepe. 2016. Mobile phones interventions for adolescents sexual and reproductive health A systematic Literature Review. *Pediatrics Journal* 138: 21.
Kennedy, Elissa C., Siula Bulu, Jennifer Harris, David Humphreys, Jayline Malverus, and Natalie J. Gray. 2013. "Be kind to young people so they feel at home": A qualitative study of adolescents' and service providers' perceptions of youth-friendly sexual and reproductive health services in Vanuatu. *BMC Health Services Research* 13: 455. [CrossRef]
Kenya National Bureau of Statistics (KNBS). 2015. *Kenya Demographic and Health Survey2014*. Rockville: ICF Macro.
Kim, Bora. 2018. How Can Health Professionals Enhance Interpersonal Communication Interpersonal Skills with Adolescents? Available online: https://www.tandfonline.com (accessed on 7 January 2022).

Kuokkanen, Liisa, and Helena Leino-Kilpi. 2000. Power and empowerment in nursing: Three theoretical approaches. *Journal of Advanced Nursing* 31: 235–41. [CrossRef]
L'Engle, Kelly L., Emily R. Mangone, Angela M. Parcesepe, and Smisha Agarwal. 2016. Ippoliti NBETM PIfAS. *Reproductive Health ASR Pediatric* 138: 3.
L'Engle, Kelly L., Heather L. Vahdat, Elizabeth Ndakidemi, Christine Lasway, and Trinity Zan. 2013. Evaluating feasibility, reach and potential impact of a text message family planning information service in Tanzania. *Contraception* 87: 251–60. [CrossRef]
Livingstone, Sonia, and Monica E. Bulger. 2013. *A Global Agenda for Children's Rights in the Digital Age: Recommendations for Developing UNICEF's Research Strategy*. New York: LSE/UNICEF Office of Research.
Mason, Diana J., Barbara A. Backer, and Catherine Alicia Georges. 1991. Toward a feminist model for the political empowerment of nurses. *Image Journal of Nursing School* 23: 72–77. [CrossRef]
McAslan Fraser, Erika. 2014. *Addressing Violence against Women and Girls in Education Programming: DFID Guidance Note Part A*. London: VAWG Helpdesk.
Mitchell, Kimberly J., Sheana Bull, Julius Kiwanuka, and Michele L. Ybarra. 2011. Cell phone usage among adolescents in Uganda: Acceptability for relaying health information. *Health Education Research* 26: 770–81. [CrossRef] [PubMed]
Mmari, Kristin, and Simran Sabherwal. 2013. Review of risk and protective factors for adolescent sexual and reproductive health in developing countries: An update. *Journal of Adolescent Health* 53: 562–72. [CrossRef] [PubMed]
Oxford Dictionary. 2020. Available online: https://diversity.ncsu.edu (accessed on 7 January 2022).
Parkes, Jenny, Jo Heslop, Samwel Oando, Susan Sabaa, Francisco Januario, and Asmara Figue. 2013. Conceptualising gender and violence in research: Insights from studies in schools and communities in Kenya, Ghana and Mozambique. *International Journal of Educational Development* 33: 546–56. [CrossRef]
Perry, Raymond C. W., Karen C. Kayekjian, Rebecca A. Braun, Michelle Cantu, Bhupendra Sheoran, and Paul J. Chung. 2012. Adolescents' perspectives on the use of a text messaging service for preventive sexual health promotion. *Journal of Adolescent Health* 51: 220–25. [CrossRef] [PubMed]
Porter, Gina, Kate Hampshire, Albert Abane, Elsbeth Robson, Alister Munthali, Mac Mashiri, and Augustine Tanle. 2010. Moving young lives: Mobility, immobility and inter-generational tensions in urban Africa. *Geoforum* 41: 796–804. [CrossRef]
Porter, Gina, Kate Hampshire, James Milner, Alister Munthali, Elsbeth Robson, Ariane De Lannoy, and Andisiwe Bango. 2016. Mobile phones and education in sub-Saharan Africa: From youth practice to public policy. *Journal of International Development* 28: 22–39. [CrossRef]
Poushter, Jacob, and Russ Oates. 2015. *Cell Phones in Africa: Communication Lifeline*. Washington: Pew Research Centre.
Raifman, Julia R. G., Heather E. Lanthorn, Slawa Rokicki, and Günther Fink. 2014. The Impact of Text Message Reminders on Adherence to Antimalarial Treatment in Northern Ghana: A Randomized Trial. *PLoS ONE* 9: e109032. [CrossRef]
Robert, Kubey W., Michael J. Lavin, and John R. Barrows. 2001. Internet Use and Collegiate Academic Performance Decrements: Early Findings. *Journal of Communication* 51: 366–82.
Rokicki, Slawa, and Günther Fink. 2017. Assessing the reach of effectiveness of mHealth: Evidence from reproductive health program in adolescent girls in Ghana. *BMC PUBLIC Health* 17: 969. [CrossRef]
Rokicki, Slawa, Jessica Cohen, Joshua A. Salomon, and Günther Fink. 2017. Impact of a text-messaging program on adolescent reproductive health: A cluster–randomized trial in Ghana. *American Journal of Public Health* 107: 298–305. [CrossRef]
Shulock, Katherine, Kristin Beima-Sofie, Haris Apriyanto, Irene Njuguna, Caren Mburu, Cyrus Mugo, Janet Itindi, Alvin Onyango, Dalton Wamalwa, Grace John-Stewart, and et al. 2012. It's about making adolescents in charge of their health": Policy-makers' perspectives on optimizing the health care transition among adolescents living with HIV in Kenya. *AIDS Care* 6: 1–8. [CrossRef] [PubMed]
Strassberg, Donald S., Jordan E. Rullo, and Julia E. Mackaronis. 2014. The sending and receiving of sexually explicit cell phone photos ("sexting") while in high school: One college student's retrospective reports. *Computers in Human Behaviour* 41: 177–83. [CrossRef]
Sundler, Annelie J., Elisabeth Lindberg, Christina Nilsson, and Lina Palmér. 2019. Qualitative thematic analysis based on descriptive phenomenology. *Nursing Open* 6: 733–39. [CrossRef] [PubMed]
Thirumurthy, Harsha, and Richard T. Lester. 2012. M-health for health behaviour change in resource-limited settings: Applications to HIV care and beyond. Bulletin. *World Health Organization* 90: 390–92. [CrossRef]
UNESCO. 2012. *Turning on Mobile Learning in Africa and the Middle East: Illustrative Initiatives and Policy Implications*. UNESCO Working Paper. Paris: UNESCO.
Unger, Jennifer A. Unger. 2019. An mHealth SMS intervention on postpartum contraceptive use among women and couples in Kenya: A randomized controlled trial. *American Journal of Public Health* 109: 934–41.
UNICEF. 2011. *From 'What's Your ASLR' to 'Do You Wanna GO PRIVATE?* New York: UNICEF.
UNICEF. 2013. *Intermedia: A (Private) Public Space: Examining the Use and Impact of Digital and Social Media among Adolescents in Kenya*. Washington: UNICEF.
United Nations Convention on the Rights of the Child. 1989. *Rio Declaration*. New York: United Nations Convention on the Rights of the Child.
Vahdat, Heather L., Kelly L. L'Engle, Kate F. Plourde, Loice Magaria, and Alice Olawo. 2013. There are some questions you may not ask in a clinic: Providing contraception information to young people in Kenya using SMS. *Interantional Journal of Gynecol Obstetricts* 123: e2–e6. [CrossRef]

Vaismoradi, Mojtaba, Hannele Turunen, and Terese Bondas. 2013. Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing and Health Sciences* 15: 398–405. [CrossRef]

Valkenburg, Patti M., and Jochen Peter. 2011. Online communication among adolescents. An integrated model of its attractions, opportunities, and risks. *Journal of Adolescent Health* 48: 121–27. [CrossRef]

Vallee, Danel Joseph Lavoie, and Jessica Ruglis. 2013. *Around the Clock: Technology and Adolescent Sleep Patterns*. Montreal: World Social Science Forum.

Vandeyar, Thirusellvan. 2013. Practice as policy in ICT for education: Catalysing communities of practice in education in South Africa. *Technology in Society* 35: 248. [CrossRef]

Wesolowski, Amy, Nathan Eagle, Abdisalan M. Noor, Robert W. Snow, and Caroline O. Buckee. 2012. Heterogeneous mobile phone ownership and usage patterns in Kenya. *PLoS ONE* 7: e35319. [CrossRef]

WHO. 2011. Available online: https://www.who.int/goe/publications/goe_mhealth_web.pdf (accessed on 7 January 2022).

Wike, Richard, and Russ Oates. 2014. *Emerging Nations Embrace Internet, Mobile Technology: Cell Phones Nearly Ubiquitous in Many Countries*. Washington: Pew Research Center.

Yu, JeongJin, Hyeonyee Kim, and Ian Hay. 2013. Understanding adolescents' problematic internet use from a social/cognitive and addition research framework. *Computers in Human Behaviour* 29: 2682–89. [CrossRef]