



## Article

# Highlighting a Digital Platform to Assess Young People Needs: Reaching and Engaging Adolescents and Young Adults for Care Continuum in Health Project (REACH)

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**Abstract:** Young people (YP), defined as individuals aged between 10 and 24 years, are a vulnerable population. Leveraging digital platforms to reach YP is essential in identifying protective and risk behaviors among this population. The objectives of this study were to (1) examine the user-inclusive development process of a theory-based digital platform to reach YP, (2) describe aspects of the digital application prototype, and (3) provide preliminary findings from the utilization of the app. We present the five-step design process for building the app. The app, known as the REACH-AYA survey, consisted of 98 closed-ended questions with built-in skip-logic algorithms and took approximately 7 min to complete. The survey questions centered on behavioral, lifestyle, and psychosocial factors, which were adopted from different validated instruments, thereby addressing 10 different domains. During the pilot phase, participants utilized the app, critiqued its features, and provided iterative feedback. We used respondent-driven sampling to recruit participants in Nairobi, Kenya, the leading county in high-speed data connectivity. Once recruited, each participant completed the survey and later sent it to their peers until the desired sample size was achieved. The REACH-AYA app prototype was guided and developed by the design thinking approach with an initial pilot sample of 33 YP for pre-testing. The end-user pre-testing assessed for functionality, time, and adaptability. The app was then launched initially through social media, reaching 1101 YP, with approximately eighty percent ( $n = 887$ ) having completed the survey by the close of the study. The majority of the participants were male (59%), and approximately (69%) of the participants were aged between 15 and 24 years. This is one of the few studies that demonstrate user-centric methodologies of app development and real-life application in identifying protective and risk factors for the wellbeing of YP. Methodologies and lessons learned from this research may benefit other disciplines using digital technology to reach YP or other difficult-to-reach populations.

**Keywords:** REACH (Reaching and Engaging Adolescents and Young Adults for Care Continuum in Health); AYA (adolescents and young adults); YP (young people); prototype; digital app; screening

## 1. Introduction

Over 1.8 billion young people globally are aged between 10 and 24 years, 90 percent of whom live in developing countries [1]. Improving the general wellbeing of the young people (YP) in low- and middle-income countries (LMICs) is essential for the world to

achieve the United Nations Sustainable Development Goals and increase health promotion and disease prevention. Adolescents in Sub-Saharan Africa (SSA) account for over 25% of the population [2]. SSA accounts for most people living with human immunodeficiency virus (HIV), with YP living with HIV in SSA representing 85% of YP living with HIV worldwide, making this a population at risk [2–4].

YP's development is greatly affected by their social, physical, economic, cultural, and familial environments and personal characteristics [5–8]. Therefore, their health outcomes can strongly be influenced by the values and customs of individuals, peers, family, and community. In Kenya, programs and policies should address adolescent complexities to successfully reduce health disparities and health risk behaviors (HRB) among this population.

Therefore, designing impactful health and wellbeing programs that reach and engage YP facing health disparities in SSA is paramount [9–11]. It is also essential to understand health needs and challenges affecting the wellbeing of YP by soliciting this information from them [12]. YP has increasingly embraced technology in a world of constant technological advances, social media, and digital interfaces, especially in developing countries, making it easy to reach this target group through digital platforms [13,14].

HRB, a significant concern among YP, is often initiated or reinforced during adolescence [15,16]. The main risk behaviors include sexual behavior contributing to unintended pregnancy and sexually transmitted diseases, drug and substance use, unhealthy dietary habits, inadequate physical activity, and behavior that contributes to unintentional injury or violence [17,18]. Increased propensity for risk taking is also common during adolescence [19].

Despite the influx of studies on adolescent challenges, knowledge gaps still exist in the literature on the holistic assessment of protective and risk factors among YP in SSA. The gaps are mostly because adolescent issues continue to advance during this developmental stage. Studies have demonstrated disintegration and irregularities in YP service provision mostly because health care workers experience challenges in screening for adolescent issues [20,21]. Additionally, studies on adolescents are often combined with other age categories [22–24]. Therefore, there are little data on individual-level characteristics of YP that contribute to the risk behaviors and limited tools for the holistic assessment of risk and protective behaviors among YP [25]. Digital solutions (i.e., mobile applications) may help overcome these challenges. Mobile health (mHealth) solutions can provide valuable resources and improve access to care by soliciting and providing accurate, timely, and engaging information [26]. Mobile apps offer privacy compared to face-to-face meetings with healthcare providers and provide tailored, confidential health information without stigma or judgment [27]. Using technology to reach YP and improve health could also have some fiscal benefits [28]. YP are enthusiastic about the use of technology for health promotion [29], and cost analyses suggest that mobile app-centered health delivery (mHealth) program expenses are more cost-effective than other communication strategies [30]. A recent review of assessment tools available for use for 12–24-year-olds found that adolescents and young adults generally favored self-administered questionnaires over face-to-face interviews with a clinician or researcher. Studies indicate that most YP owning smartphones have used digital apps to download medical health apps, including disease prevention and mental health apps, and reported contentment with the digital services [31]. Several researchers have also recommended the design thinking method for intervention development studies based on flexibility, exactness, and limited chances of failure.

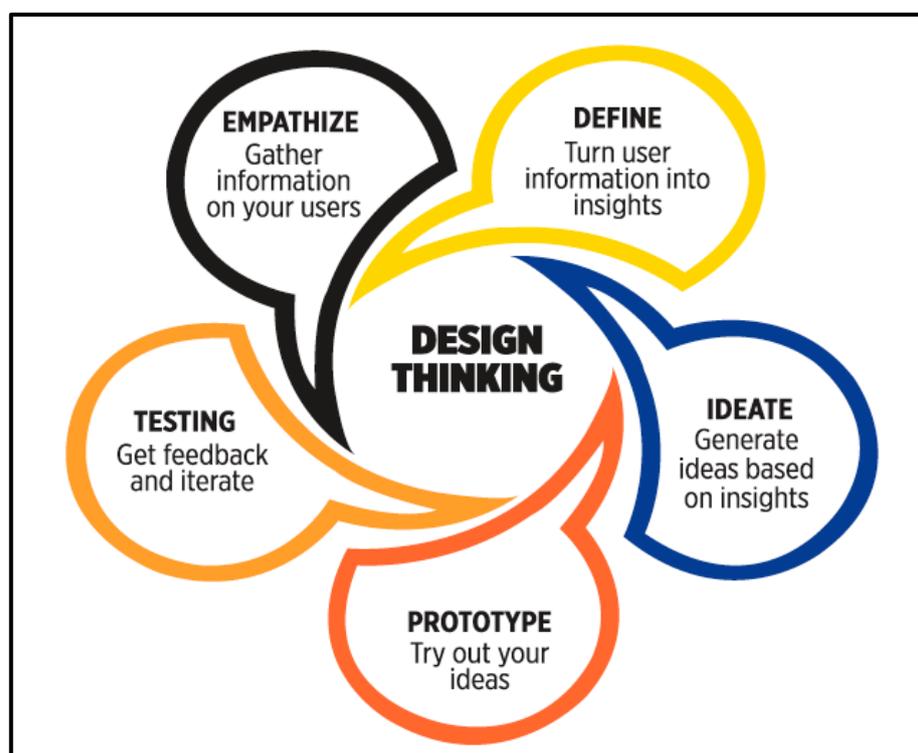
Much of the literature on factors influencing behaviors among young people in SSA comes from a demographic or health point of view. The study uses a comprehensive psychological, social, and developmental perspective covering a wide range of variables from YP's experience. This paper describes the REACH (Reaching and Engaging Adolescents and Young Adults for Care Continuum in Health)-AYA app developed using user-centric techniques. The REACH app is intended to aid in the holistic screening of health and risk behaviors of YP aged 10–24 years in Kenya. Community health workers can also be trained to use the tool while evaluating adolescent issues at the grass-root level. The app is intended to aid in the self-holistic screening of youth aged 10–24. The app then lists

available resources to the YP (outlined below). No screening apps of this nature and depth have been identified, positioning this app as both cutting-edge and innovative for future research endeavors.

## 2. Methods

### 2.1. Theoretical Approach

The REACH-AYA app was developed using the design thinking approach—a solution-based approach that incorporates the user experience to understand user needs. Design thinking is a non-linear research method mainly applied to comprehend users, question existing beliefs, reconceptualize setbacks, and develop inventive options that can be prototyped and tested. The method also uses a human-centered and iterative design process consisting of 5 steps: empathize, define, ideate, prototype, and test to enrich the user experience (Figure 1). Design thinking is heavily dependent on understanding user needs and has been extensively applied to establish solutions for complex challenges [32,33]. More information on the App and its domains from our study has been reported in a different manuscript [34].



**Figure 1.** Design thinking approach.

Below, we outline the process of developing the REACH-AYA app using the design thinking method.

### 2.2. The Theoretical Constructs

#### 2.2.1. Empathize

The first construct required the design team to empathize with potential users. To better understand the audience, their needs, and how the app would address the YP needs, the developers researched in the form of an environmental scan [35,36] and a rapid literature review. More specifically, concerned with “How to innovatively engage and solicit information from YP regarding their wellbeing?”. As part of the iterative process, the researchers also consulted with YP, adolescent champions, and different adolescent

experts, including mental health experts, clinical teams, social workers, community health workers, and other service providers in health care settings and stakeholders.

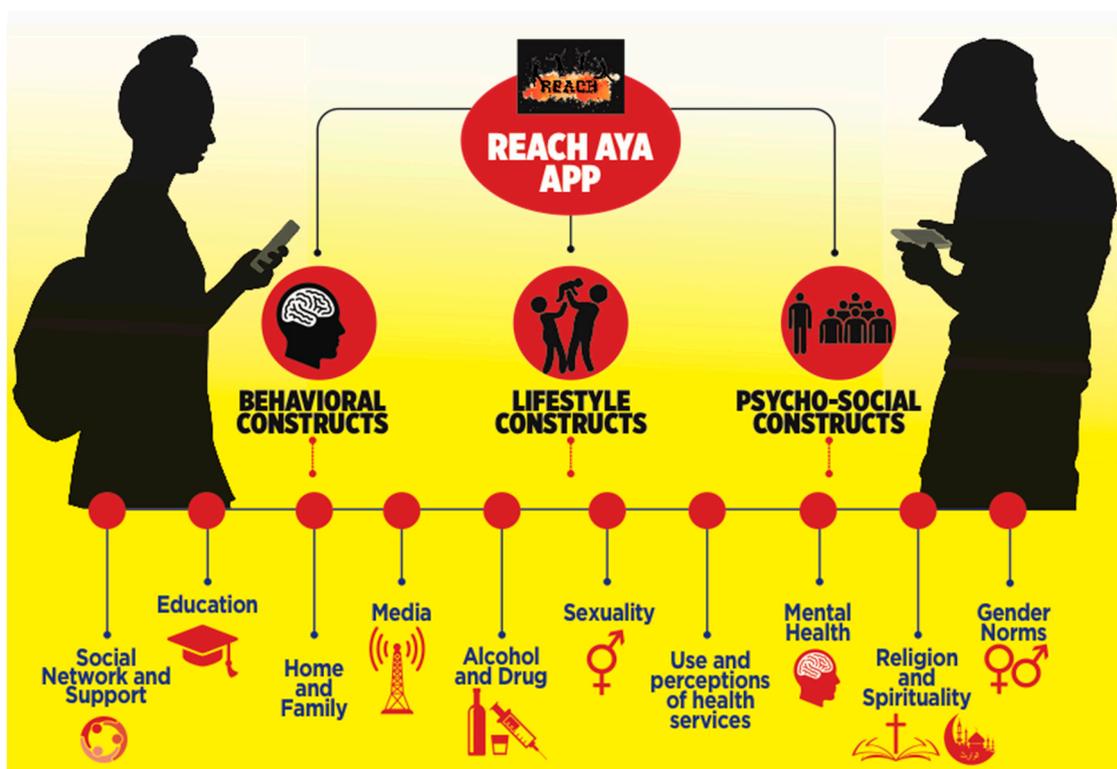
### 2.2.2. Define

During the second phase, the problem was defined using the information gathered in the initial step. Process mapping was used to outline research findings and identify considerable evidence that YP in SSA faced various health and wellbeing challenges through major themes outlined in the ideate step. The challenges identified from the first phase included the inability of the existing health structures to address YP's issues holistically and the lack of comprehensive screening tools for YP. The study researched and assessed the different survey instruments for collecting data from young people focusing on functionality, properties, and contextualization in the sub-Saharan context. The researchers identified the available survey tools for adolescents and explored different platforms to build the app from the existing data. The efforts supported the need for this research. In this process, the YP were individually engaged, while the adolescents' parents/caregivers and adolescent and youth health and medical experts were involved through established groups.

### 2.2.3. Ideate

This phase allowed the REACH-AYA developers to create ideas (brainstorm) and provide potential solutions based on user feedback and establish requirements for the app. In this process, the developers contextualized existing survey instruments for collecting data, reviewed the tools to suit Kenyan and SSA populations, and explored different platforms to develop the app.

The study team conducted various discussions with focus groups (the manuscript describing these results is under review for publication), and the developers utilized the information from discussions to better understand the needs and identified alternative solutions to meet the needs. The adolescents were recruited through the youth groups in Nairobi and were selected by age, gender, and location. For example, based on feedback, the app would include skip patterns and utilize logic algorithms to streamline the user experience. The developers ensured age-appropriate questions were linked in the skip logic for each age. Different app solutions popular with adolescents and young adults were identified. Questions for 10 different domains were mapped out based on the issues identified in the define stage. The 10 domains served as modules to cover the following topics: (1) social network and support, (2) education, (3) home and family, (4) media and Internet use, (5) alcohol and drugs, (6) sexuality, (7) use and perception of health services, (8) mental health (including questions regarding self-harm and suicidal behaviors), (9) gender and social norms, and (10) religion and spirituality (Figure 2). Several screening tools were integrated to ensure adequate screening of the sub-topics under the 10 key domains. The app can incorporate multiple-choice, free text, and numeric questions based on the question type. Market research was also conducted to identify trends to incorporate popular features with adolescents based on background research industry knowledge of modern mobile application features.



**Figure 2.** Domains of the REACH-AYA app.

#### 2.2.4. Prototype

After generating several possibilities, a web-based platform was developed as the prototype. This prototype provided the first iteration of a model that incorporated the inputs of the previous steps. The tool programming architecture was led and developed by the target age group. Members from the “empathize stage conducted an additional review of the survey.” The REACH-AYA interactive mobile app survey combined existing screening tools (Figure 3) adapted for joint use with YP and was contextualized for Kenya using a co-design process. The tools include (1) HEEADSSS (Home, Education/employment, Eating, Activities and peer relations, Drugs and alcohol, Sexuality, Suicide/depression, and Safety) assessment instrument [37], which is an interview instrument that explores various facets of adolescents’ lives; (2) CRAFFT (Car, Relax, Alone, Forget, Friends, Trouble) [38]; (3) RAST (Risk Assessment Screening Tool), which was adopted by the Kenya Ministry of Health and is a short clinical assessment tool designed to screen for substance-related risks and problems in adolescents [39]; (4) the World Health Organization’s (WHO) multi-country Gender-Based Violence (GBV) study screening tool that screens for GBV risk and occurrences [40]; and (5) PHQ-A, which is a PHQ-9 screening instrument for common mental health disorders, which was modified for adolescents [41].

## REACH-AYA MODULES

### 1

#### SOCIAL NETWORK & SUPPORT:

- Examples of Questions:
- How did they know about the survey?
- How many friends do you have? How many will you forward the survey to? Do you rely on the friends when you have serious problems?

### 2

#### EDUCATION

- Examples of Questions:
- Do you currently attend school?
- Level of education achieved?
- Who do you socialize with?
- School performance?
- Truancy?

### 3

#### HOME AND FAMILY

- Example of Questions:
- Do you get along with family?
- Whom?
- Is there any physical violence?
- Changes in your family?
- Missing meals?

### 4

#### MEDIA

- Example of questions
- Use of Media?
- Ever regretted an online activity?
- Mobile phone/ Computer use
- Access to pornographic material?

### 5

#### ALCOHOL AND DRUGS

- Examples of Questions
- Personal use? Do your friends use?
- CRAFT screening questions
- C**-Have you ever ridden in a CAR driven by someone (including yourself) who was “high” or had been using alcohol or drugs?
- R**-Do you ever use alcohol or drugs to RELAX, feel better about yourself, or fit in?
- A**-Do you ever use alcohol/drugs while you are by yourself, ALONE?
- F**-Do you ever FORGET things you did while using alcohol or drugs?
- F**-Do your family or FRIENDS ever tell you that you should cut down on your drinking or drug use?
- T**-Have you gotten into TROUBLE while you were using alcohol or drugs?

### 6

#### SEXUALITY

- Examples of Questions
- Gender identification?
- **WHO MULTICOUNTRY SCREENING TOOL FOR GBV**
- Sexual debut?
- Condom use?
- Sexual partners?
- HIV Knowledge?
- RAST screening questions?

### 7

#### USE AND PERCEPTIONS OF HEALTH SERVICES

- Examples of Questions
- HIV medication?
- Problems taking medication?

### 8

#### MENTAL HEALTH

- Examples of Questions
- Anger, feeling down depressed or hopeless?
- Trouble falling asleep, sleeping too much, Poor appetite?

### 9

#### GENDER NORMS

- Examples of Questions
- What do you identify yourself as (Gender Orientation)?
- I believe there is nothing wrong with unmarried boys and girls having sexual intercourse if they love each other?
- Most of my friends who have sex with someone use condoms regularly?
- I am confident that I can insist on condom use every time I have sex.
- I would refuse to have sex with someone who is not prepared to use a condom.
- A boy will not respect a girl who agrees to have sex with him.

### 10

#### RELIGION AND SPIRITUALITY

- Examples of Questions
- My faith shapes how I think and act every day.
- What do you say when someone has a different religious belief than you?

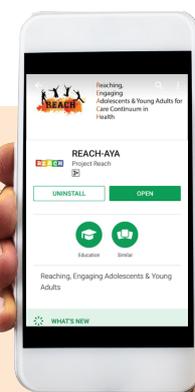
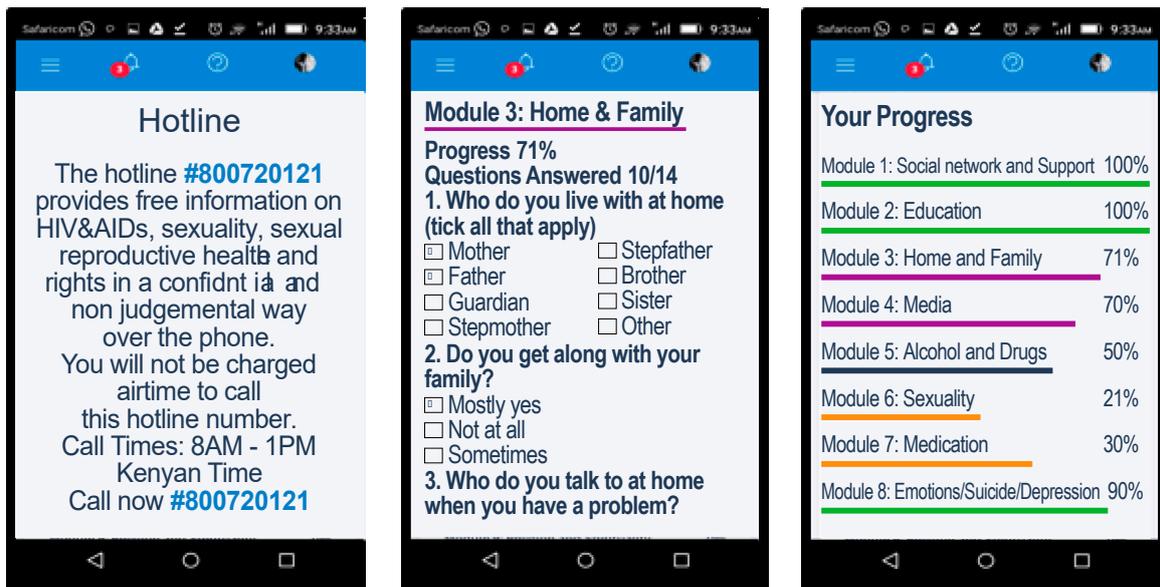


Figure 3. Examples of questions and topics included in the REACH-AYA app.

Questions from these existing tools were integrated into the 10 domains to develop a holistic survey tool. Examples include questions focusing on aggression, sleeping, and eating patterns under the “mental health” domain, screening for physical violence, family relationships, and adjustments under the “home and family” domain. Due to its robust nature, the comprehensive survey tool was incorporated into an app format defined as the digital platform. The REACH-AYA app was designed to use low-cost general packet radio services (GPRS). GPRS allowed YP to track the progress of their survey until completion. It also permitted participants to pause and still resume from where they stopped communicating with the REACH web application until the survey was completed. Data were then synchronized over the mobile network to the hosting server. Participants did not have to complete the questions all at once and could change responses as needed.

In addition, health-related resources, including access to a free hotline number dedicated to the health and behavioral needs of YP, were provided within the app. The topics addressed by the app include HIV/AIDS, sexuality, and sexual and reproductive health and rights, which are provided to the YP in a confidential and non-judgmental approach over the phone. The YP can access the hotline services between 8.00 a.m. and 1.00 a.m. (Kenyan time) now operates as 24-hour hotlines (Figure 4). Plans to include a downloadable game to the app-The iREACH game is underway. The game is designed to promote self-awareness and self-empowerment among girls aged 15–24 years by allowing them to perceive themselves through different characters in various life situations while playing.



**Figure 4.** Example of REACH-AYA prototype displays.

#### 2.2.5. Test

The prototype was tested with potential users gaining a sense of the app's functionality and the need for improvements. The prototype utilized a natural language processing (NLP) platform and logical process content flow to make REACH-AYA more intelligent in her interaction with users. For example, if someone answered they have never had sex, they would not be asked a question about if they used a condom during their last sexual experience.

Testing assessed three constructs: (1) functionality, (2) time, and (3) adaptability. As part of the iterative process, it was further vetted amongst 33 YP who provided helpful feedback on specific questions. Once the technical and business requirements were met, the app was ready for launch and beta testing among a broader group of YP. The app required geographic location access to ensure participants resided within Nairobi. Data were then synchronized over the mobile network to the hosting server. Skip patterns programmed in the prototype were also tested during this phase. The app was downloaded from the Google Play or Apple store and could work offline, only communicating with the REACH web application once the survey was completed.

#### 2.3. Study Recruitment

Each study participant was compensated with KES 300 (USD 3) upon completion of the survey and an additional KES 100 (USD 1) of airtime (phone data) for each friend that was referred and completed the survey (maximum of 5 friends). All payments and transactions were automated via the mobile platform to minimize human interaction and promote confidentiality. The Facebook page (REACH-AYA) was used to initiate recruitment, and the uptake was monitored through the project website reach.aya.com to ensure representation of all age groups. Recruitment and sampling worked jointly. Respondent-driven sampling (RDS) enabled recruitment to continue until the targeted sample size of 561 was achieved.

#### 2.4. Sampling

The research was a cross-sectional survey design, and the RDS method [42] was used, in which YP were asked to refer to up to 5 people with whom they have the most frequent contact. The elaborate study procedures have been described in our published manuscript. Contact was defined as an in-person interaction on social network services and via instant messaging. This sampling method was both timely and cost-efficient to achieve the desired sample size within a relatively short time. The process has been understood as a preferred recruitment approach among hard-to-reach populations [43,44]. RDS not only enhanced participation but also served as a way to identify social network patterns.

#### 2.5. Data Collection

Data collected in the app-based survey interface were exported in a Microsoft Excel spreadsheet. Several strategies were used to protect participant confidentiality. A participant ID uniquely identified all consenting participants in Excel to protect personally identifiable information (PII) and ensure confidentiality. A network ID additionally linked participants within a social network to ensure no respondent identifiers were used. Completed surveys were automatically uploaded to the host server. If there was no mobile network coverage, completed surveys were stored locally on the phone. Once a signal was found, completed surveys would be automatically uploaded.

All survey data were encrypted, thus maintaining the confidentiality of responses. Communication between the browser and the server was encrypted using the secure sockets layer (SSL). Servers hosting the system were secured by firewalls to prevent unauthorized access and distributed denial of service attacks (DDOS). At the same time, data were protected from spam and virus threats using imunify360 security technology. Passwords were used to protect access to the web interface. In the current study, access to the data was restricted to the investigators and the web administrator. Data were stored on a secure system and de-identified before being analyzed by the study investigators via secure networks. The study posed no more than minimal risks to the participants. We further introduced a series of safeguards and protections for potential risks to privacy and confidentiality and possible distress caused by asking for sensitive information, such as a direct link to a helpline counselor for participants completing the survey.

### 3. Results

The REACH-AYA prototype app was successfully developed using the design thinking approach with an initial sample of 33 YPs. The app was then launched through social media platforms (Facebook), and participants were recruited for the pilot study. The sample size needed for the pilot was 561 participants [45]; however, the pilot test was received with enthusiasm and yielded 1101 users, with the majority being male (59%) and fewer females (41%). The survey's overall percent completion was 80.5%, where 19.5% of the participants downloaded the app but could not complete the survey by the close of the study. Most (69%) of the YP engaged in this pilot study were 15 years of age or older, while 41% accounted for the age brackets 10–13 and 14–15 years. The data from the pilot study are under evaluation and will be published upon completion.

The results are illustrated in the dashboard below (Figure 5).

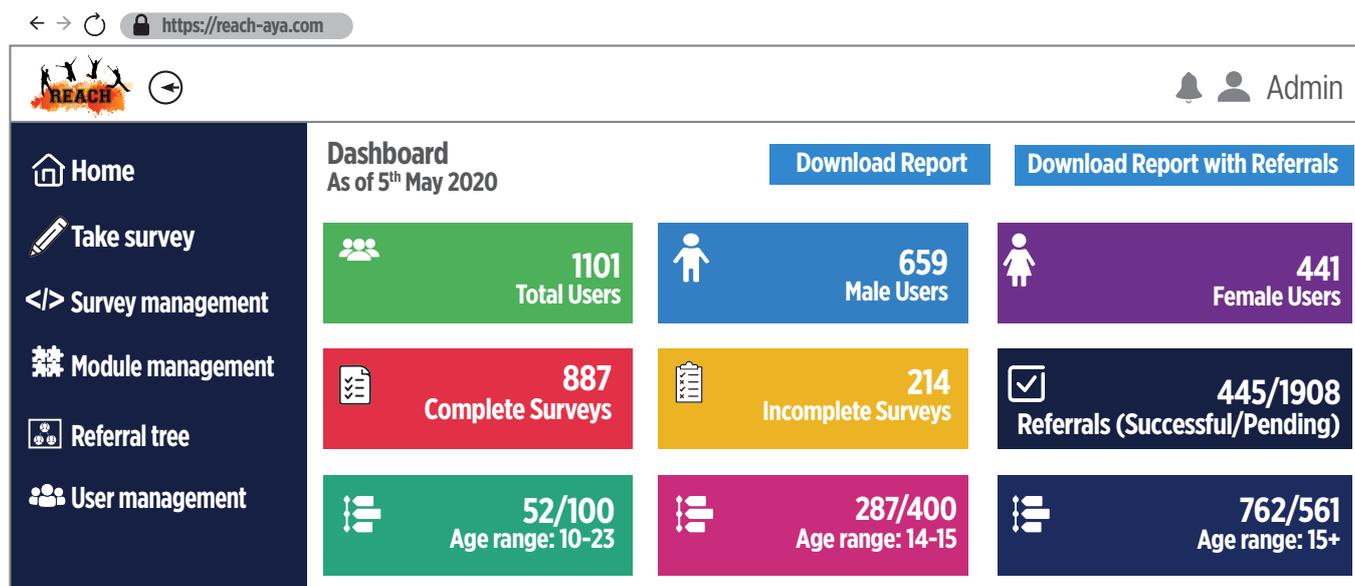


Figure 5. REACH dashboard display.

#### 4. Discussion

The REACH-AYA app is an evolving youth-based platform designed through a human-centered and iterative process coupled with user-centric techniques. The app is vital to understanding risk and protective factors related to behavioral, lifestyle, and psychosocial issues among young people aged 10–24 years in Nairobi, Kenya, the leading county in YP smartphone users [46]. The platform comes at a shortage of knowledge regarding assessing and addressing the challenges among YP in SSA using digital technology [47]. In addition, this app has become more relevant in a climate of physical distancing due to the COVID-19 pandemic and the increased need to utilize telehealth to meet clinical and health promotion or training needs.

The REACH app design and implementation introduced an innovative way to solicit information from YP using technology [48]. Innovation was driven through technology to address three main themes: (1) the incorporation of ongoing user feedback, (2) the ability to engage a hard-to-reach population better, and (3) the utilization of technology to address health promotion and disease prevention.

##### 4.1. Incorporating Ongoing User-Driven Solutions Using the Design Thinking Approach

The developers adopted the design thinking approach because of its logical flow in digital app design, the user focus, and success in previous use within health domains such as chronic and infectious diseases [49]. This approach fits well with the objective to identify risk and protective factors among YP that may ultimately inform interventions. The design-thinking system also enhances iterative engagement with the user to provide more rapid, contextualized, and user-driven solutions [50].

This study aimed to develop a prototype for continuity of care records with context-specific links to electronic health information resources. The developers concluded that integrating context-specific links enhanced the prototype's usability [51]. To ensure the content designed in the app was relevant to the context, we engaged YP and relevant stakeholders in the design and evaluation of the app. The tools used to design the survey combined existing and new screening tools contextualized for Kenyans through a co-design process.

Design recommendations from domain and design experts of a study on expanding a mobile intervention for tuberculosis treatment reported the need to meet end users' needs as a critical factor that enhanced utilization of their app [52]. The study further highlighted that engaging end-users rather than using hypothetical scenarios is a better

way of improving any prototype. The iterative process allowed the developers to improve the app with user expectations in mind and provided an opportunity to address the issues raised by addressing them one at a time and incorporating additional features highlighted by the users while testing its use.

#### *4.2. Addressing the Needs of Hard-to-Reach Populations*

Priority populations are often hard-to-reach populations. Literature has shown digital platforms (apps) that are more focused on priority or hard-to-reach populations, such as adolescents or non-cisgender persons, have improved health awareness, education, and outcomes [53,54]. The REACH-AYA app addresses the needs of priority subpopulations regardless of gender or sexual orientation. Existing studies also echo the importance of reaching priority communities that are sometimes hard to improve health outcomes. The REACH-AYA app's ability to assess information and possibly respond to risky behaviors spans a broader population of YP. Such digital platforms that cater to YP can improve surveillance to formulate primary and secondary prevention efforts [55,56].

Empowering priority populations in meeting their needs using agile modalities that are easy to navigate and accommodating is essential. Although it may be hard to engage YP, the technological savviness and propensity to use cell phones make health apps using this modality beneficial [57,58]. A 2011 study by Riley noted that many mobile app theories are one-way, and the use of dynamic theoretical frameworks and applications is critical [59]. The iterative experience is essential to ensure contextually relevant content and materials are included when designing the app. It is also ideal for tracking mobile context to characterize situations and strategically identify gaps or promising trends. Further, mHealth apps and interventions have been found to bridge critical gaps to enable universal access to information and education and curb risky behaviors in potentially hard-to-reach YP [60].

#### *4.3. Utilizing Technology for Health Promotion and Disease Prevention*

The rapid increase in the utilization of digital apps has necessitated design processes that lead to robust, usable, and practical apps that support healthy behaviors among consumers. Technology is revolutionizing how communities address and assess health outcomes and behaviors through telehealth. In the age of technology and COVID-19, utilizing mHealth to raise awareness, access health status, and improve health outcomes is essential. This study leverages the accessibility of smartphones and acceptance of their use among YP to provide valuable and user-friendly services that benefit YP and health professionals. It also extends previous research that examines the most effective designs, testing procedures, and implementation of mHealth to assess health behaviors and outcomes among YP [60–62].

#### *4.4. Strengths and Limitations*

The iterative process allowed feedback from the users, promoting the continued quality improvement of the app throughout the design process. This more dynamic, user-led process served as a significant strength and is more successful. This novel approach to accessing data for researchers and valuable resources for users was mutually beneficial. With limited information on health risk and protective behavior (and no app of this kind to our knowledge used elsewhere), this app is a potential tool for use not only in generating data but also as an avenue to educate YP on key preventive measures within their situational contexts. Incorporating a hotline within the tool was an added feature that acted as a valuable resource and strength for users who needed further information. In addition, the transfer of information through mobile applications proved to be ideal in an age group and geographic area where frequent cell phone use is commonplace.

RDS is limited as a sampling method; however, for our study, it also served as a strength for recruitment and increased the study's power. RDS allowed users to recruit others within their social circles and enabled this study to benefit from a larger sample size in a short amount of time. RDS used in the recruitment of participants potentially reduced

non-response bias since those who would ordinarily not participate for various reasons may do so as a favor to a friend. The ability to offer a financial incentive was also a plus. Using social media (i.e., Facebook) to recruit the participants engaged in implementation was an added advantage as this brought together perspectives from YP with different characteristics embedded in a network. Therefore, engaging end-users better ensured that the app met the desired objectives and was more readily utilized by YP.

Additional strengths include the robust number of individuals who can use the data from this app—from health care providers in the clinic setting to mental health providers, teachers, parents, policymakers, researchers, religious and local leaders, etc.

Some limitations can be noted. While design thinking has its advantages, the heightened engagement can also compromise the researcher's autonomy, which should be carefully managed. Having a diverse team in the development process was instrumental in curbing this bias [63]. Although the RDS method allowed us to include hard-to-reach populations, we cannot ignore that this is not a random sampling, and generalization should be used with caution. Usability was also dependent on internet connectivity, which could be a barrier in poor or low-connectivity areas. However, Nairobi is one of the leading cities in high wireless speeds.

## 5. Conclusions

This study is one of the few demonstrating a YP-centered app's development and implementation process to assess risky behaviors in hard-to-reach populations. The REACH-AYA app provides guidance and suggests methodologies that could be adopted when developing digital technology to reach, engage, and prioritize needs in this critical subpopulation. The iterative design thinking approach, inclusive feedback, and opinions from end-users and experts show promise, especially among AYA populations. Future recommendations include app development and implementation processes with the end users' needs in mind, particularly for vulnerable populations. The REACH-AYA app provides valuable findings and paves the way for future rigorous development and evaluation of health apps for real-time surveillance of adolescents' conditions.

**Author Contributions:** P.M. conceived the study, performed data interpretation, drafted the manuscript, and critically reviewed the manuscript. P.M., L.O., Y.O. and S.M. managed the study, data collection, and critical manuscript review. P.M. and Y.O. contributed and reviewed the methodology section for the manuscript. P.M., Y.O. helped in preparing the first draft of the manuscript. M.L.-D., L.O., A.K. and N.G.-K. critically reviewed the manuscript and met journal specifications. All authors have read and agreed to the published version of the manuscript. All authors participated in the critical appraisal and revision of the manuscript.

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**Institutional Review Board Statement:** Our research involved human participants and was performed in accordance with the Declaration of Helsinki, undergoing approval by an appropriate ethics committee. Approval for this study was obtained from both the Amref Health Africa Ethics and Scientific Review Committee and the University of West Florida Institutional Review Board. All ethical procedures were conducted and maintained throughout the study period. Informed consent was obtained from the participants. For participants who were less than 18 years, assent was obtained with additional consent from the parent/guardian. The YP above 18 years provided informed consent as part of the recruitment process. All consent/assent procedures during the implementation of the survey were conducted electronically.

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**Disclaimer:** The views, findings, and conclusions represented in this article are those of the authors and do not necessarily represent the official views of the affiliated institutions.

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