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Design and field methods of the ARISE Network Adolescent Health Study

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Summary The ARISE Network Adolescent Health Study is an exploratory, community-based survey of 8075 adolescents aged 10–19 in 9 communities in 7 countries: Burkina Faso, Eswatini, Ethiopia, Ghana, Nigeria, Tanzania and Uganda. Communities were selected opportunistically and existing population cohorts maintained by health and demographic surveillance systems (HDSSs). The study is intended to serve as a first round of data collection for African adolescent cohorts, with the overarching goal of generating community-based data on health-related behaviours and associated risk factors in adolescents, to identify disease burdens and health intervention opportunities. Household-based sampling frames were used in each community to randomly select eligible adolescents (aged 10–19 years). Data were collected between July 2015 and December 2017. Consenting participants completed face-to-face interviews with trained research assistants using a standardised questionnaire, which covered physical activity, cigarette and tobacco use, substance and drug use, mental health, sexual behaviours and practices, sexually transmitted infections, pregnancy, food security and food diversity, teeth cleaning and hand washing, feelings and friendship, school and home activities, physical attacks and injuries, health care, health status assessment and life satisfaction, as well as media and cell phone use and socio-demographic and economic background characteristics. Results from this multi-community study serve to identify major adolescent health risks and disease burdens, as well as opportunities for interventions and improvements through policy changes.

keywords adolescent health, community-based survey, multi-country study, cohort study, sub-Saharan Africa

Sustainable Development Goals (SDGs): SDG 2 (zero hunger), SDG 3 (good health and well-being), SDG 4 (quality education), SDG 5 (gender equity), SDG 10 (reduced inequalities), SDG 17 (partnerships for the goals)

Introduction

Numbering 1.2 billion strong, adolescents comprise the largest generation in history [1]. The vast majority (90%) of them reside in low-and middle-income settings. Investing in the health of this age group has the potential to transform their lives and generate high economic and social returns for them and their future offspring. Population projections suggest that the number of individuals aged 10–24 in sub-Saharan Africa will increase to 436 million by 2025 and to 605 million by 2050.[2] Increased focus on the health risks they encounter during this

transitional stage is crucial to ensuring they are able to survive, thrive and lead.

Rationale for the study design

Filling the knowledge gap surrounding adolescent health has been identified as the first step in advancing the global health agenda within this important age group [3]. The African Research, Implementation Science and Education (ARISE) Network undertook an exploratory community-based cross-sectional survey on adolescent health across nine sites in seven sub-Saharan African countries with the goal of identifying priority areas for intervention, resource allocation and future research communities.

Much of the evidence pertaining to adolescent health used by decision makers has been obtained from school settings, such as the Global School-based Health Survey (GSHS) [4] and the Health Behaviour in School-Aged Children (HBSC) survey [5]. Although school-based approaches have many advantages, they systematically exclude adolescents who do not attend school. An estimated 89 million adolescents aged 12–24 are out of school in sub-Saharan Africa, comprising approximately half the population of this age group [6]. Adolescents excluded from educational opportunities may have different health behaviour patterns from those attending school and may be more likely to be disadvantaged, vulnerable and/or marginalized [7]. By implementing a household-based sampling design, ARISE sought to ensure that the study was all segments of the adolescent population that could benefit from the findings.

Although WHO defines adolescents as individuals in the 10–19 years age range, younger adolescents have not consistently been included in nationally representative health surveys. The Demographic and Health Survey (DHS) [8], used widely in sub-Saharan Africa, collects data from a large number of households (approximately 5000–30 000) on a range of demographic and health indicators, but the minimum age for participation is 15 years and the questionnaire is not specifically tailored to the adolescent experience. Early adolescents (ages 10–14 years) are typically considered to be a healthy population, even though many health behaviours become established during this transitional period [9]. To address gaps in our understanding of this phase, the ARISE Adolescent Health study enrolled adolescents starting at age 10 and used a questionnaire specifically developed for adolescents, who comprise a major proportion of the rapidly expanding youth population on the sub-Saharan African continent.

Setting and study population

The ARISE Adolescent Health Study was conducted at nine communities in seven sub-Saharan African countries. It was performed in partnership between Africa Academy of Public Health (Tanzania), the Centre de Recherche en Santé de Nouna (Burkina Faso), Haramaya University (Ethiopia), Addis Continental Institute of Public Health (Ethiopia), Muhimbili University of Health and Allied Sciences (Tanzania), the University of Dodoma (Tanzania), the University of Ghana, the University of Ibadan (Nigeria) and the University of Swaziland (Eswatini). Site participation was based on the following factors: budgetary constraints, existing data collection infrastructure, research team capacity and willingness of a site leader. sites in South, West and East Africa.

Study communities were selected opportunistically by investigators at each individual site. To allow for potential future long-term follow-up and for selection of representative samples, the research team purposefully selected communities within existing Health and Demographic Surveillance Systems (HDSSs) where possible six of the nine sites. Where no HDSS existed, site leaders selected communities based on various factors such as available and reliable population-level data for sampling frames, accessibility and proximity to the research institution, community buy-in and approval for carrying out the research and demographic characteristics such as urbanicity and population size.

Three of the study communities were in urban areas: Dar es Salaam, Tanzania; Harar, Ethiopia and Ibadan, Nigeria; the other six were in rural areas: Dodoma, Tanzania; Iganga/Mayuge, Uganda; Kersa, Ethiopia; Lubombo/Manzini, eSwatini; Ningo Prampram, Ghana; and Nouna, Burkina Faso (Figure 1). In all communities, male and female residents aged 10–19 years were recruited for the study through household-based sampling. In Burkina Faso, both communities in Ethiopia, both communities in Tanzania and Uganda, the study was nested within existing Health and Demographic Surveillance Sites (HDSS). Adolescents who refused to participate, were too sick to be interviewed, or were absent at the time of data collection were excluded. Married adolescents were additionally excluded at the Ethiopian communities. According to the 2016 Demographic and Health Survey (DHS) from Ethiopia, 78.1% of females and 98.3% of males aged 15–19 reported never being married. Demographic characteristics of participants enrolled in each community are shown in Table 1.

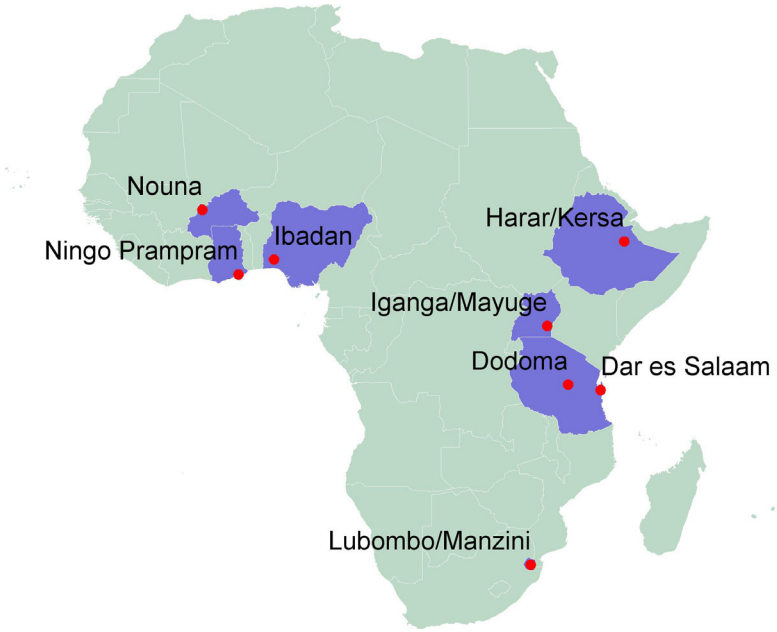

Figure 1 Map of ARISE Network Adolescent Health Study communities.

Table 1 Demographic characteristics of participants enrolled at each community in the ARISE Network Adolescent Health Study

		Gender		Age		In School	
Community	*N*	Male	Female	10–14	15–19	Yes	No
Nouna, Burkina Faso	1629	687 (42.2)	942 (57.8)	742 (45.5)	88.7 (54.5)	817 (50.2)	812 (49.8)
Lubombo/Manzini, eSwatini	412	161 (39.1)	251 (60.9)	124 (30.1)	288 (69.9)	303 (73.5)	109 (26.5)
Harar, Ethiopia	1059	500 (47.2)	559 (52.8)	562 (53.1)	497 (46.9)	1001 (94.5)	58 (5.5)
Kersa, Ethiopia	951	528 (55.5)	423 (44.5)	667 (70.1)	284 (29.9)	540 (56.8)	411 (43.2)
Ningo prampram, Ghana	625	281 (45.0)	344 (55.0)	339 (54.2)	286 (48.8)	496 (79.4)	129 (20.6)
Ibadan, Nigeria	750	339 (45.2)	411 (54.8)	298 (39.7)	452 (60.3)	560 (75.6)	181 (24.4)
Dar es Salaam, Tanzania	825	376 (45.6)	449 (54.4)	266 (32.3)	558 (67.7)	577 (71.3)	232 (28.7)
Dodoma, Tanzania	1226	548 (44.7)	678 (55.3)	818 (66.7)	408 (33.3)	898 (73.2)	328 (26.8)
Iganga/Mayuge, Uganda	598	312 (52.2)	286 (47.8)	320 (53.6)	277 (46.4)	521 (87.1)	77 (12.9)

Communities and sampling procedures

Neither the communities included in the study nor samples of adolescents selected from each community were selected to be representative of the larger national or regional populations. As described below, however, each site employed sampling methods aimed at obtaining a sample of adolescents that represented the individual community. Age-eligible potential participants in all communities were randomly selected from household and household member sampling frames derived from HDSSs or other recent census records. Households with at least one adolescent resident were randomly selected from the sampling frame. When two or more adolescents were listed in one household, one was selected randomly for interview. All sampled adolescents were sought for interview at each community. Face-to face interviews were carried out at various times between July 2015 and December 2017 by trained research assistants with prior data collection experience and good knowledge of the local language. Both male and female research collected data. In all communities, research assistants underwent at least one day of intensive training on how to conduct the survey. Each individual community is described below.

Nouna, Burkina Faso

Nouna is a semi-urban town in the north-west of Burkina Faso. It serves as the administrative centre of Kossi province. The Nouna HDSS, located in the town of Nouna and surrounding villages, was established in 1992. Its catchment area corresponds to an area of 7464 km^2 and an estimated population of 320 232 [10]. Trained field staff visit all households within the HDSS boundaries every four months to record births, deaths and in- and out-migration. The Nouna community utilised a two-part stratified sampling procedure aimed at ensuring community representativeness with respect to ethnicity (and thus roughly religion) and urbanicity, since health practices differ systematically by these variables. First, a sample of 10 (of a total of 59) villages within the HDSS census area was selected to ensure inclusion of all five main ethnicities. All children in these 10 villages who had been enumerated in the 2015 HDSS census and were between the ages of 12–19 years on 1 October 2017 were classified by ethnicity. A total of 1795 individuals were then sampled proportionally to the population size within each ethnicity stratum. Second, a simple random sample of 749 age-eligible adolescents was selected from all those in one sector of Nouna town. This ratio of semi-urban to rural individuals matched the ratio seen in the overall HDSS. Data were collected during the dry season in November and December 2017.

Harar and Kersa, Ethiopia

Harar is located in eastern Ethiopia, 510 km from the capital city of Addis Ababa. The Harar HDSS, which began in 2011 and is managed by Haramaya University, covers a 19.5 km^2 area inhabited by approximately 60 000 individuals that encompasses 12 of the 19 sub-districts (*kebeles*) in Harar City [11]. Trained field staff visit the more than 9000 households under surveillance at six-monthly intervals to ascertain vital events, socio-economic characteristics and physical characteristics of the dwellings. The Kersa HDSS, located in the east Hararaghe zone of the Oromia region, was established in 2007. It is an open cohort of all individuals permanently living in 24 of the 35 rural sub-districts of Kersa (population approximately 129 000) that is also managed by Haramaya University [12]. Approximately 63 000 individuals are currently under surveillance. Censuses of the Kersa HDSS are conducted at six-monthly intervals to record births, deaths and in- and out-migration. Other information, including changes in marital status, pregnancy outcomes, health status and economic status, is collected at longer intervals.

Ningo Prampram, Ghana

The Ghanaian study community is located in the Ningo Prampram district within the greater Accra region in coastal southern Ghana. The population of the district was estimated at approximately 70 000 by the 2010 census [13]. In this community, a two-stage sampling technique was used. First, 25 enumeration areas (EAs), as defined by the 2010 census, were randomly selected. The selection probability was proportional to EA size. All housing units were then documented within each EA to form the sampling frame for the selection of adolescents in the second stage. In this stage, 25 households with at least one adolescent resident were randomly selected from each EA. When two or more adolescents were listed in one household, one was chosen randomly for interview. Data were collected during the rainy season in June and July 2016.

Ibadan, Nigeria

The Nigerian study community is located in Ibadan, the capital and most populous city of Oyo State in south-western Nigeria. The population of Ibadan has been estimated at over 3 million. There are 11 Local Government Areas (LGAs) in Ibadan Metropolitan area: five within the city and six semi-urban ones. In this community, a two-stage sampling design was used. First, two LGAs (Ibadan North and Ibadan South-West) within the Ibadan Metropolitan area were randomly selected for inclusion in the study. Households with at least one adolescent resident were then randomly selected from each LGA proportionally to the population size of the LGA. When two or more adolescents were listed in one household, one was selected randomly for interview. Data were collected during the dry season in March 2017.

Lumboo and Manzini, Eswatini

In Eswatini, data collection took place in the eastern region of Lubombo and the central-western region of Manzini. Both regions are mostly rural, though the Manzini region also includes the city of Manzini, Eswatini's second largest urban area. At the time of the last census in 2007, the populations of Lubombo and Manzini were estimated at 220 000 and 350 000, respectively [14]. In this community, a two-stage stratified cluster random sampling was used. Strata were region (Lubombo, Manzini) and urbanicity (rural, urban). In the first stage, 50 EAs in each of the two regions were selected. In both regions, 37 of the selected areas were classified as rural and 13 were classified as urban by the Eswatini Statistics Office. In the second stage, 20 households in each EA were selected using systematic random sampling. If no

adult household member was available at the time of visit, the household was replaced with another randomly selected household. Data collection took place during the dry season in July and August 2015.

Dar es Salaam and Dodoma, Tanzania

The Tanzanian study communities were located in Dar es Salaam and Dodoma, Tanzania. Dar es Salaam lies along the Indian Ocean coast and is the financial capital of Tanzania. The Dar es Salaam HDSS, known as the Dar es Salaam Urban Cohort Study (DUCS), was established in 2011 for the purposes of longitudinally monitoring of demographic events and conducting nested epidemiologic surveys. DUCS covers the Ukonga and Gongo la Mboto wards of the Ilala region [15]. It encompasses seven administrative streets (Gongo la Mboto, Guluka kwa lala, Mwembe Madafu, Markaz, Mazizini, Mongo la Ndege and Ulongoni), which span a 9.91 km^2 area about 20 km from the city centre. All households within this area are visited twice per year, and any household member considered as having the primary dwelling within the household and having lived in the household for the previous 3 months preceding the census was eligible for inclusion. Over 100 000 individuals living in 21 000 households have been enumerated through 30 June 2015. At the time of the study, 14 920 adolescents had been registered. Births, deaths, changes in marital status and residency status data are recorded during every update. Household information is updated every other year. Ten trained research assistants with prior data collection experience within DUCS carried out the ARISE survey between February and September 2016, a period that spans both the long rainy season and the dry season. Dodoma is situated in the central plateau of Tanzania. The Dodoma HDSS was launched in 2016 and is based in the rural district of Chamwino. At the time of the study, the Dodoma HDSS has enumerated 23 785 individuals residing in 5266 households across the five villages of the Mlowa barbarani and Makang'wa wards. Household members who have lived continuously in the project area for 4 months or longer are eligible for inclusion. Adolescents were randomly selected from the sampling frame of all households containing one or more adolescent. Only one adolescent was selected per household. Data collection took place from April to June 2017, a period that includes both rainy and dry months.

Uganda

The Iganga-Mayuge Health & Demographic Surveillance Site (IMHDSS) was established by Makerere University in 2004 and is located in the two eastern Uganda districts of Iganga and Mayuge, about 120 km east of the capital city of Kampala. The 63 villages that comprise the predominantly rural IMHDSS contain a total population of approximately 74 000 residing in approximately 16 000 households. The approximately 25 000 registered adolescents aged 10-19 make up one-third of the total population. Twice per year, trained field workers record births, deaths, pregnancies and in- and out-migrations [16]. IMHDSS records were used to select a random sample of adolescents stratified by urbanicity. Peri-urban residents comprised 20% of the sample and rural residents comprised 80% of the sample. Adolescents were eligible for selection if they had resided in their household for at least one year. When the selected adolescent could not be contacted, traced or declined to participate in the study, he or she was replaced by another adolescent from the nearest household. Data collection in this community took place in February and March 2016, a period that spans the dry season and beginning of the rainy season.

Informed consent

In all communities, field staff visited households selected by the sampling procedures to recruit potential participants. Participants and their parents were first informed of the purpose and nature of the study and informed that their participation was voluntary. Written informed consent was obtained from all adolescents aged 18 and 19 years. Written parental consent and adolescent assent were obtained from adolescents younger than 18 years of age. Interviews were held in private settings within the household or compound.

Questionnaire

Face-to-face interviews were conducted by trained interviewers with all consenting participants using a standardised questionnaire translated into the local language. The questionnaire was adapted from the widely used GSHS [4], which has been extensively validated and applied in 22 countries across sub-Saharan Africa including Ethiopia, Ghana, Nigeria, Tanzania, Eswatini and Uganda. Burkina Faso was the only country in the current study that did not participate in the GHSS.

Because the GSHS was designed for use among in-school adolescents only, our research study team members reviewed the content to ensure its appropriateness for both in- and out-of-school adolescents. The ARISE Adolescent Health Study team includes experts across the domains covered in the research, including nutrition, mental health, reproductive health, substance use, HIV/

AIDS and other areas. These experts also provided important local expertise on context and culture in each community included in the research.

At an ARISE Network meeting in Dar es Salaam, Tanzania, in 2015, the GSHS tool was reviewed in detail. Our team of experts recommended minimal revisions to existing questions and addition of other validated instruments where needed. A consensus vetting of changes was then carried out, and a draft instrument was circulated to all research team members for comment. The final instrument was agreed upon by the multidisciplinary team of research scientists. Modules covered by the questionnaire included socio-demography, socio-economy, food security, food diversity, teeth cleaning and hand washing, feelings and friendship, physical activity, school and home activities, physical attacks, injuries, health care, health status assessment, life satisfaction, cigarette and tobacco use, substance use, drug use, sexual practice, pregnancy, media use and sexually transmitted infection. As dictated by the GSHS tool, insertions were made to certain questions by each site to capture site-specific types of foods, physical activity, alcohol and illicit substances and site-specific slang words used to describe certain issues. Revisions were made to the GSHS question on bicycle riding for physical activity to encompass out-of-school adolescents: "During the past 7 days, on how many days did you walk or ride a bicycle to or from school?" was changed to "During the past 7 days, on how many days did you walk or ride a bicycle to or from school, work, store or other location?"

Other validated and previously used instruments were included for additional information on topics of importance. The GSHS core module includes four questions on HIV that are school-specific and does not include other sexually transmitted diseases. Therefore, ARISE used the WHO "Asking young people about sexual and reproductive behaviours" [17] questions for HIV and STIs as well as pregnancy.

Self-rated health was measured using the following validated instruments: Kutcher Adolescent Depression Scale (KADS-6) [18], health-related quality of life (HRQOL) [19], the Health Behaviour in school-aged Children' (HBSC) symptom checklist [20], and questions on sexual assault adapted from Life Events Checklist (LEC) for DSM-5 [21]. Life satisfaction was assessed using two measures: Cantril's Ladder [22] and the Student's Life Satisfaction Scale (SLSS) [23]. Dietary diversity was ascertained via 24-hour recall of food categories from a standard 16-item food category list [24].

Where the GSHS collects self-reported height and weight, the ARISE instrument added measured height,

Table 2 Modules included in the ARISE Network Adolescent Health Study questionnaire

Domain	Subtopic	Items
Socio-demographics	Demographics	• Age • Sex • Educational status • Parental vital status • Parental age • Parental education • Parental occupation • Household composition
	Household socio-economic status	• Drinking water quality • Toilet facilities • Cooking fuel use • Assets • Food security
Nutrition and physical activity	Diet	• Food group consumption within previous 24 hours • Frequency of fruit, vegetable, carbonated beverage and fast food consumption • Height • Weight • Arm circumference
	Physical activity	• Frequency of physical activity • Frequency of walking/biking for transport • Sedentary behaviour
Hygiene	Dental hygiene	• Frequency of tooth brushing • Frequency of dental visits
	Hand hygiene	• Frequency of hand washing: • Before eating • After using the toilet • With soap

Table 2 (*Continued*)

Domain	Subtopic	Items
Reproductive health	Menstruation	• Knowledge of menstruation • Menarche status • Menstrual hygiene • Menstruation-related school absences
	Sexual behaviour	• Sexual activity status • Age at sexual initiation • Contraceptive use • Sexting behaviour • Sexually explicit media exposure
	Pregnancy	• Ever been/made someone pregnant • Pregnancy wantedness • Pregnancy outcome
Socio-emotional health		• Experiences of: • Loneliness • Anxiety-related insomnia • Low mood • Anxiousness • Depression symptoms • Suicidal ideation • Suicidal attempts • Social relationships • School absences • Parental connection • Parental regulation • Self-rated health status • Self-reported physical symptoms • Life satisfaction
Injury/Violence	Violence	• 12-month history of physical attacks • 12-month history of physical fights • Bullying history • History of sexual violence
	Injury	• 12-month injury history • Type(s) of injury experienced
Substance use	Tobacco	• Ever use of tobacco products • 30-day use of tobacco products • Passive exposure to tobacco products
	Alcohol	• Ever use of alcohol • 30-day use of alcohol • Source of alcohol • Alcohol-related impairment
	Drugs	• Use of: • Marijuana • Cocaine • Amphetamines • Inhalants • Khat (Ethiopia and Uganda)
Health care utilisation		• Type of health service accessed within the past 12 months: • Hospital admissions • Primary care visits • Traditional healer visits • Reason for accessing service • Cost of service • Satisfaction with service • Use of Internet to seek health information

weight and mid-upper arm circumference. Detailed descriptions of each model are provided in Table 2.

Piloting was necessary despite the fact that the vast majority of questions in the survey were from the GSHS, which has been conducted and vetted previously in 97 countries. Pilot testing of the ARISE instrument took place in Ethiopian communities, allowing for feedback from both a rural and urban community (two of the nine sites were in Ethiopia).

Data management

Data were recorded on paper and entered electronically into Epi-data version 3.1. Identifiable information was confidentially maintained in secure databases with access restricted to key study personnel. Standardised variable names were used across communities. Data collection progress was monitored internally by each community and reviewed at interim meetings of the ARISE Network. Data from all communities were pooled and cleaned centrally using SAS v. 9.4 (SAS Institute).

Limitations

This study has three main limitations. First, as stated above, the adolescents sampled at each site are not representative of the general population of adolescents within the seven countries or sub-Saharan Africa as a whole. Survey results therefore cannot be generalised beyond the individual communities included in the study. Nevertheless, we believe that meaningful inferences can be drawn from the cross-community comparison of results across these 9 sites that can be applied to communities with similar geographic and socio-demographic characteristics in the region.

Second, this study collected solely quantitative data. A mixed-methods design would have provided richer information about attitudes and behaviours and their cultural context, but was neither feasible or preferable at this exploratory stage. Collecting quantitative data through the use of a structured questionnaire allowed for standardisation of data collection across 9 diverse sites. These data can also be used as baseline measures for tracking progress towards quantitative goals in future rounds of the survey. Furthermore, the quantitative results can inform future qualitative work. For example, since the results of the survey suggest that many adolescents have an unmet need for health services, qualitative data collection can be targeted towards understanding the types of barriers to healthcare access that adolescents face.Lastly, only one site pilot-tested the instrument prior to field implementation. The instrument was, however, largely based on a repeatedly validated instrument developed by WHO that has been widely used around the globe with the addition of other previously validated instruments.

Challenges encountered in adolescent survey research

We wish to comment on challenges encountered when conducting household-based survey research in an adolescent population. From an ethical perspective, particular care must be taken by field interviewers to ensure privacy from potential intrusions by family members or neighbours. In addition, some participants may experience discomfort when asked sensitive information. To minimise this discomfort, some communities matched interviewers to participants by sex. For adolescents under the age of 18, parental involvement in the informed consent process is crucial in order to ensure their protection from research-related harms. Folayan et al. [25] note that a potential trade-off for this involvement, however, is that it may hinder the autonomous decision-making of the adolescent and compromise confidential information about them.

Managing social desirability bias around sensitive topics is another challenge particular to conducting face-to-face interviews with adolescents. Prevalence estimates for sexual behaviour and substance use do suggest that some underreporting may have occurred in this study [26]. The interviewer-administered survey nevertheless remains the principal data collection tool for surveys in resource-limited settings, and no consensus has been reached regarding alternative data collection methods that may enhance data quality in sub-Saharan Africa.

Audio computer-assisted self-interview (ACASI) is the preferred method for collecting data on sensitive behaviours in the United States, but Mensch et al. [27] have suggested that its usefulness and applicability in Africa may be dependent on the local context. This observation is supported by the results of a systematic review of 15 datasets from low-and middle-income countries, most of which compared ACASI methods to face-to-face interviews (FTFI) for reporting HIV risk behaviours [28]. The review concluded that non-FTFI methods were not consistently associated with a significant increase in the reporting of all outcomes.

Non-verbal response cards (NVRC) were developed by Lindstrom et al. [29] as an affordable, user friendly alternative to ACASI. In rural Tanzania, this data collection method was associated with greater reporting of sexual activity, HIV testing, a larger number of lifetime sexual partners and younger ages at first sex among young women [30]. While potentially a promising technique for collecting sensitive data among sub-Saharan African adolescents, more research is needed to determine its feasibility and acceptability in different local contexts within this region. At the Burkina Faso community of the ARISE Adolescent Health Study, a module for pilot testing this method was included in the questionnaire, which may provide additional insight regarding its ability to enhance data quality in this setting.

Mobile phones are an adolescent-friendly technology that may provide another means of collecting sensitive data. They have been used for phone-based surveillance

projects on a small scale in sub-Saharan Africa [31] and shown to increase reporting of sexual activity among young women in South Africa [32]. Several concerns have been identified regarding their use in this population, however, including lack of airtime with which to respond, device loss, swapping of phone subscriber identity module cards, deletion of the survey application by participants, low confidence about understanding the questions being asked and concerns about confidentiality of responses [33]. More refinement of this method may be needed before it becomes widely adopted for survey research in this setting.

Future directions

The ARISE Network is currently collaborating on the development of integrated multi-community studies to test the effectiveness and impact of interventions and policies to address adolescent health needs identified in the Adolescent Health Study. In addition, the Network is working on additional rounds of longitudinal data collection in order to evaluate trends in adolescent health indicators over time and age. Future rounds will incorporate qualitative data collection, innovative methods for collecting data to minimise reporting and social desirability biases as well as biomarker and anthropometric metrics of health risk factors and outcomes.

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