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Methodological and Ethical Implications of Using Remote Data Collection Tools to Measure Sexual and Reproductive Health and Gender-Based Violence Outcomes among Women and Girls in Humanitarian and Fragile Settings: A Mixed Methods Systematic Review of Peer-Reviewed Research

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Abstract

Purpose: This systematic review investigates the methodological and ethical implications of using remote data collection tools to measure sexual/reproductive health (SRH) and gender-based violence (GBV) outcomes among women and girls in humanitarian and fragile settings. **Methods:** We included empirical studies of all design types that collected any self-reported primary data related to SRH/GBV using information and communication technology, in the absence of in-person interactions, from women and girls in humanitarian and fragile settings. The search was run in March 2021 without filters or limits in Ovid Medline, Embase, Web of Science, Clinicaltrials.gov, and Scopus. Quality was assessed using an adapted version of the MMAT tool. Two reviewers independently determined whether each full text source met the eligibility criteria, and conflicts were resolved through consensus. A-priori extraction fields concerned methodological rigor and ethical considerations. **Results:** 21 total studies were included. The majority of studies were quantitative descriptive, aiming to ascertain prevalence. Telephone interviews, online surveys, and mobile applications, SMS surveys, and online discussion forums were used as remote data collection tools. Key methodological considerations included the overuse of non-probability samples, lack of a defined sampling frame, the introduction of bias by making eligibility contingent on owning/accessing technology, and the lack of qualitative probing. Ethical consideration pertained to including persons with low literacy, participant safety, use of referral services, and the gender digital divide. **Conclusion:** Findings are intended to guide SRH/GBV researchers and academics in critically assessing methodological and ethical implications of using remote data collection tools to measure SRH and GBV in humanitarian and fragile settings.

Keywords

gender based violence, sexual reproductive health, humanitarian setting, fragile setting, measurement, remote data collection, ethics, systematic review

Introduction

Inadequate sexual and reproductive health (SRH) and heightened gender-based violence (GBV) pose considerable threats to public health and human rights (Glasier et al., 2006). The WHO's broad definition of SRH encompasses GBV: SRH is a state of physical, emotional, mental, and social wellbeing in relation to sexuality and the reproductive system, including the ability to have pleasurable and safe sexual experiences, free of discrimination, coercion, or violence (WHO, n.d.). GBV

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encompasses a variety of damaging acts perpetrated against someone based on their gender expression, gender identity, or perceived gender (IASC, 2015). Thus, SRH and GBV are interrelated: experiencing GBV has been associated with unintended pregnancy, complications during pregnancy, pain during sexual intercourse, reproductive tract infections, and sexually transmitted infections (STIs) (Jina & Thomas, 2013; Meinhart et al., 2021). Moreover, inadequate SRH services and education can magnify GBV harms and increase the risk of GBV perpetration (Igras et al., 2014; Kågesten et al., 2016).

Health disparities leading to differential SRH and GBV outcomes are influenced by gender inequality and thus disproportionately affect women and girls (Darmstadt et al., 2019). Moreover, risk factors for adverse SRH and GBV are heightened in humanitarian and fragile settings (IASC, 2019). Humanitarian and fragile settings are often associated with periods of chronic stress, poverty, conflict, forced displacement, strained social support networks, as well as the loss of medical and public health infrastructure which erode the provision of SRH care and exacerbate GBV (Classen et al., 2005; Logie et al., 2019). The COVID-19 pandemic has further increased women and girls' vulnerability to GBV and has led to disinvestment in lifesaving SRH services (Asi et al., 2022; Carter et al., 2020; Stark et al., 2020). This pattern of magnified GBV risk and reduced SRH service availability is particularly pronounced in humanitarian and fragile settings (Lokot & Avakyan, 2020; Tran et al., 2020).

Inequitable vaccine distribution to humanitarian and fragile settings heightens community transmission, contributes to COVID-19-related population morbidity and mortality, and accelerates the overcapacity of health and social services, all of which can yield negative consequences on GBV and SRH (Lobkowicz et al., 2021; Zard et al., 2021). Further, emerging literature from high income settings illustrates that the COVID-19 pandemic has magnified reported gender-based violence (Piquero et al., 2021) and that survivors of domestic violence are at an increased risk of COVID-19 diagnosis (Chandan et al., 2021). In low-income countries, the pandemic has negatively affected social determinants of health such as household income, unemployment, and food and food insecurity, known risk factors for GBV and adverse SRH (Bourgault et al., 2021). In humanitarian and fragile settings, school closures and lack of socioeconomic supports are particularly threatening for adolescent girls who face increased risk of sexual exploitation, transactional sex, and child marriage, all of which can negatively affect SRH through unintended pregnancy, STI, or gynecological trauma and may have life course and intergenerational health consequences (UNFPA, 2020; Yukich et al., 2021).

Researchers are increasingly interested in drawing on primary data collection in order to address the unintended gendered consequences of the COVID-19 pandemic in humanitarian and fragile settings. However, data collection in such settings is difficult in the best of times due to the instability inherent within natural disasters, low literacy, conflict, urban poverty, mass displacement, and civil unrest (Bennouna et al., 2017; Stark & Ager, 2011a). To further compound data collection difficulties, the pandemic context presents considerable methodological and ethical concerns, whereby risks may outweigh the potential benefits of primary data collection (WHO, 2020). For example, in-person primary data collection may increase the risk of community transmission considering the lack of COVID-19 vaccine equity in humanitarian and fragile settings (Y. Liu et al., 2020; Singh et al., 2020). In addition, stay-at-home orders increase the proximity of family members, thereby increasing the risk that research-related disclosures of sensitive information pertaining to GBV or SRH will be heard and that violence or stigmatization may ensue (Peterman et al., 2020; Seff et al., 2021).

A growing number of researchers are turning to digital and remote technologies to collect data on GBV and SRH during the pandemic. Promising remote data collection (RDC) tools include instant messaging platforms, phone interviews, online surveys, and mobile applications (Emezue, 2020; Hensen et al., 2021). While the deployment of such tools rapidly expanded during the COVID-19 pandemic, these modes of data collection pose their own methodological and ethical challenges (Seff et al., 2021). There is a considerable lack of research synthesis on the methodological and ethical consequences of RDC and this is especially true for RDC on SRH and GBV-related topics. Understanding best practices and pitfalls of RDC is critical to safeguarding the SRH rights and safety of women and girls. This systematic review is guided by the following research question: *What is the current peer-reviewed evidence on the use of remote data collection tools in humanitarian and fragile settings to collect primary data on women and girls' knowledge, attitudes, behaviors, and experiences related to SRH and GBV?* Specifically, within the context of humanitarian and fragile settings this systematic review seeks to identify: (i) modes of RDC used to capture SRH and GBV and (ii) primary concerns pertaining to upholding methodological rigor during data collection/measurement and ethical standards.

Methods

We conducted a mixed methods systematic review in March 2021 to identify qualitative, quantitative, and mixed methods studies conducted in humanitarian and fragile settings that collected data on women and girls' SRH and GBV using RDC tools. The methodology is guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses standards (Page et al., 2021).

Eligibility Criteria

Eligibility criteria were defined a-priori and included the following: (i) English, full text, and peer-reviewed sources; (ii) quantitative, qualitative, or mixed methods primary data collection; (iii) conducted in humanitarian or fragile settings; (iv) used RDC tools; and (v) measured women and girls' knowledge, attitudes, behaviors, and experiences related to SRH and

Table 1. Inclusion/Exclusion Criteria.

	Inclusion Criteria	Exclusion Criteria
Setting	Studies conducted in humanitarian/fragile settings, within low or middle-income countries, involving any of the following during periods of data collection: Refugees, internal displacement, armed conflict, natural disasters, civil unrest, poverty, or weak governance or infrastructure.	Studies conducted in high income countries. Studies conducted within university or post-secondary education settings. Studies conducted in locations that at the point of data collection were unaffected by the influx of refugees, internal displacement, armed conflict, natural disasters, civil unrest, poverty, or weak governance or infrastructure.
Method	Studies employing RDC: The use of methods/tools such as phone interviews, mobile applications, and online surveys to facilitate primary data collection in a way that replaces in-person interaction between participants and enumerators. RDC must have been employed for all aspects of data collection.	Studies wherein data were collected in-person between enumerators/research assistants and participants. Audio Computer Assisted Self Interviewing (ACASI) was excluded because this method requires on-site interaction and facilitation (Falb et al., 2017; Gutierrez & Torres-Pereda, 2009) (i.e., enumerators/research assistants physically hand the ACASI device to the participant).
Outcome	Studies that measured any self-reported sexual and reproductive health outcome(s), including GBV from women/girls. Inclusive of mixed-gender samples.	Studies that did not measure any outcomes related to sexual and reproductive health, including GBV. Studies that only collected data from persons other than affected women/girls (i.e., clinicians, policymakers, parents, teachers, or men/boys exclusively).
Publication Type	Peer-reviewed studies that collected primary empirical data and protocols (i.e., for forthcoming RCTs).	Letters, editorials, theoretical papers, commentaries, grey literature, review papers.
Language	English	Titles/abstracts or full texts in languages other than English

GBV (refer to Table 1). We did not include non-peer reviewed grey literature as this was beyond the scope of the present review and warrants a separate analysis and search strategy; we were primarily interested in synthesizing peer-reviewed literature on account of the generally more detailed, standardized, and robust methodological and ethical descriptions (Hossain & McAlpine, 2017). Further, in a previously conducted review focused on using RDC tools for intervention evaluation (Seff et al., 2021), we found that grey literature using RDC for all aspects of data collection was lacking and relevant sources (i.e., non-technical briefs) did not include the type of information we were interested in extracting.

Similar to other systematic reviews, humanitarian and fragile settings were defined as low- or middle-income countries involving any of the following: refugees, internal displacement, armed conflict, civil unrest, natural disasters, and poverty (Rubenstein et al., 2020; Stark et al., 2021; Stark & Ager, 2011b; Vu et al., 2014). Our operationalization of humanitarian and fragile settings was informed by definitions of (i) *humanitarian response to crises*: "range of situations including natural disasters, conflict, slow and rapid onset events, rural and urban environments, and complex political emergencies" (The Sphere Project, 2011, p. 9); (ii) *complex emergencies* where considerable breakdown of authority resulting from internal or external conflict requires an international response beyond the or capacity of a single agency (ELRHA, n.d.); and (iii) state fragility wherein governments cannot or will not deliver core functions of poverty reduction, safety and security, and capacity to manage public resources and basic services (Cammack et al., 2006).

Identified studies that met the definitions of humanitarian response, complex emergency, or fragile setting based on the setting description and the team's collective expertise were then cross-referenced using annual reports of humanitarian-related funding from Office for the Coordination of Humanitarian Affairs (OCHA), reports detailing influx of refugees from United Nations High Commissioner for Refugees (UNHCR), the presence of peacekeeping operations United Nations Security Council's Department for Peacekeeping, and the World Bank list of fragile states. RDC was operationalized as the use of technology to facilitate primary data collection in a way that replaces non-physically distanced in-person interaction between participants and enumerators (Hensen et al., 2021; Seff et al., 2021). Only studies that employed RDC tools across all stages of data collection were included because we were interested in synthesizing studies that primarily employed RDC tools and were designed a-priori to collect data remotely.

The outcome of interest was women and girls' SRH, inclusive of GBV. We used the WHO's broad definition of SRH that encompasses GBV, wherein SRH is a state of physical, emotional, mental and social wellbeing in relation to sexuality

and the reproductive system, including the ability to have pleasurable and safe sex experiences, free of discrimination, coercion, or violence (WHO, n.d.). GBV was conceptualized as violence perpetrated against someone based on their gender expression or identity, such as intimate partner violence (IPV), non-partner sexual violence, child marriage, sexual abuse and exploitation, and reproductive coercion, female genital cutting. Any outcome related to sexual health, reproductive health, and/or GBV was included so long as data were collected from women and girls about their own experiences. Studies that included mixed-gender samples were also considered.

Search Protocol and Study Selection

The published literature was searched using strategies created by a medical librarian. The search strategies were established using a combination of standardized terms and keywords. To identify humanitarian and fragile settings, keywords were combined with a list of countries from the Uppsala Conflict Data Program's publicly available datasets on settings experiencing armed conflict from 1989 to 2019 (UCDP, n.d.) and the International Refugee Commission's 2020 and 2021 emergency watchlist (International Rescue Commitee, 2020; International Rescue Committee, 2019). The search was run in March 2021 without filters or limits in the databases Ovid Medline 1946-, Embase 1947-, Web of Science 1900-, Clinicaltrials.gov, and Scopus 1960. Sources were exported to Endnote and duplicates were removed. Full electronic search strategies are provided in Appendix A.

The screening was conducted using Covidence (Covidence, 2021) and occurred in two stages: (i) title and abstract and (ii) full text review. A team of reviewers worked independently to review titles/abstracts (one reviewer per title/abstract) and the same team worked in duplicate to review full texts (two reviewers per full text). During the title/abstract phase, team consensus was sought if a team member was unsure about how to apply eligibility criteria. Sources where titles/abstracts met the inclusion criteria underwent full text review. During the full text screening, discordance between the reviewers was adjudicated by a third, independent reviewer.

Quality Assessment and Data Extraction

Data extraction and quality assessment were performed in duplicate using Google spreadsheets by the team of reviewers and disagreements were adjudicated by consensus. Appendix B contains the data extraction and quality assessment template in table form. Included studies were extracted and assessed by study design according to three main themes: general characteristics, methodological rigor, and ethics. Sources were first cataloged according to *general information*: authors, year of publication, country, purpose, study design, sample size, sample characteristics, participants' minimum age, RDC instrument employed, whether the study was conducted during the COVID-19 pandemic, and outcome measures.

Methodological quality and rigor were assessed by study design (qualitative, randomized controlled trials, quantitative non-randomized, quantitative descriptive, and mixed methods), using selected criteria from the Mixed Methods Assessment Tool (MMAT) that related specifically to data collection, measurement, and sampling considerations (Hong et al., 2018; Pace et al., 2012). We also further examined methodological rigor by extracting information on sampling and recruitment strategies, risk of selection bias for quantitative studies, discussion of saturation (qualitative studies), and noted limitations/challenges with RDC. These additional fields were incorporated to better address our research question of identifying primary concerns pertaining to data collection and measurement using RDC tools. External sources outlining best practices on RDC of sensitive information were consulted to develop data extraction fields pertaining to ethics (Bhatia et al., 2020; National Network to End Domestic Violence, n.d.; Peterman et al., 2020; Seff et al., 2021). Sources were reviewed based on procedures to obtain informed consent, inclusion of referral services, incorporation of measures to safeguard participant safety, discussion of adverse events, data security and confidentiality, participant literacy concerns, and the gender digital divide.

Results

Study Selection

A total of 5,772 citations were identified with the search strategy and exported to Endnote. 2857 duplicates were removed, resulting in a total of 2915 unique citations. The 2915 sources were screened in the title and abstract phase. In total, 424 sources were assessed for full-text eligibility based on the inclusion and exclusion criteria and 21 were included for extraction (refer to Figure 1 for the PRISMA flow diagram).

Study Characteristics

Full study characteristics are presented in Table 2. The 21 included studies cover wide geographical regions: Sub-Saharan Africa (n = 9), Asia (n = 5), Middle East (n = 5), and Latin America (n = 2). Among studies that employed only one RDC tool, online surveys (n = 10) were the most commonly employed, followed by mobile phone interviews/surveys (including interactive voice response via phone) (n = 5), mobile application-based data collection, including both WhatsApp and health-based applications, (n = 3), and SMS (n = 1). Only two studies employed more than one remote data collection tool: Vahdat et al. (2013) utilized both SMS and phone interviews and Ybarra et al. (2020) utilized phones, online surveys, online bulletin websites, and text-message

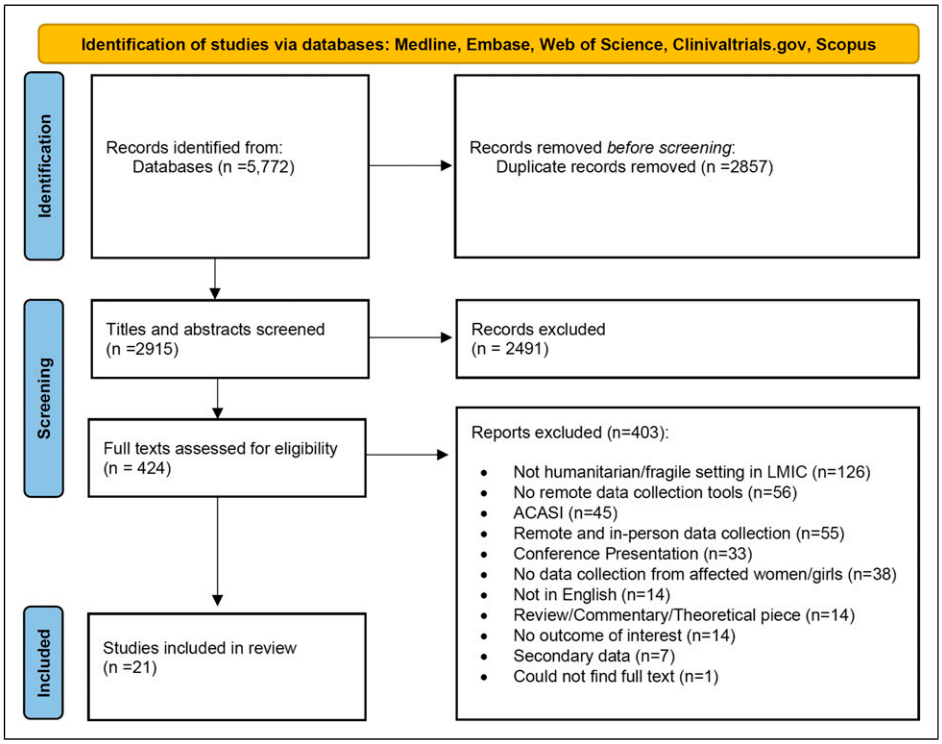

Figure 1. PRISMA flowchart of study selection process.

surveys. While most studies were comprised of adult samples, six studies included participants below the age of 18 (Doubova et al., 2017; Ko-Ko-Zaw et al., 2011; L'Engle et al., 2013; O. McCarthy, Leurent, et al., 2017; Memiah et al., 2020; Vahdat et al., 2013) and the youngest minimum age of inclusion was 14 (Doubova et al., 2017). Sample sizes ranged from 9 among the single qualitative study (Mbulayi et al., 2021) to 4817 among a mixed methods study assessing the use of a text message contraceptive information service (Mobile for Reproductive Health) (Vahdat et al., 2013). Among the quantitative descriptive studies, cross-sectional studies with online surveys administered via Google Forms, Qualtrics, and SurveyMonkey platforms were the most common. Lastly, four studies were conducted during the COVID-19 pandemic (Abuhammad, 2021a; Aolymat, 2021; Ghimire et al., 2020; Mahmood et al., 2021). Specific study characteristics are further presented in Table 2 by study design.

Qualitative Synthesis of Results

Full synthesis results for methodological rigor and ethics are presented for each source of evidence in Tables 3 and 4, respectively. The sections that follow present a summary of methodological challenges by study design type followed by ethical considerations across all designs.

Methodological Rigor: Quantitative Descriptive

Non-probability sampling using online surveys comprised the predominant form of sampling among the prevalence studies (Abuhammad, 2021b; Aolymat, 2021; Baloushah et al., 2019; Fakunmoju & Bammeke, 2013; Ghimire et al., 2020; González-Hernández et al., 2020; Maasoumi et al., 2019; Mahmood et al., 2021; Restar et al., 2020). However, given that most quantitative descriptive studies sought to estimate prevalence of GBV or SRH outcomes or assessed factors associated with GBV and SRH at a population level, the rigor of non-probability sampling is limited by the threat of overt and hidden selection biases which reduce confidence in prevalence estimates and the measures of association obtained. Online recruitment posed concerns for response rates, selection bias, and sample representation. Five of the nine studies that employed online surveying did not report response rates (Aolymat, 2021; Baloushah et al., 2019; Maasoumi et al., 2019; Mahmood et al., 2021; Restar et al., 2020). Even when reported, only one study made the distinction between how many potential participants received the study invitation, number of potential participants who engaged with the online survey link, the final number of participants who completed the survey, and the number of participants who were included in the study sample (González-Hernández et al., 2020). The lack of a well-

Table 2. Characteristics of Included Studies by Study Design.

Quantitative Descriptive Studies										
First Author	Year	Country	Purpose	Study Design	N	Sample Characteristics	Min Age	RDC Tool	COVID-19*	Outcome Measure
Mahmood	2021	Kurdistan Region of Iraq	Determine prevalence of spousal violence in Kurdistan before and during COVID-19 lockdown.	Cross-sectional	346	Married Kurdish women	18	Online survey Google Platform	Yes	Spousal abuse
Abuhammad	2020	Jordan	Determine prevalence/correlates of violence against Jordanian women during COVID-19	Cross-sectional	697	Women living in any Jordanian city who had sixth grade literacy in Arabic	18	Online survey Qualtrics and SurveyMonkey	Yes	Violence against women
Aolymat	2021	Jordan	Compare prevalence of domestic violence, reproductive tract infections, menstrual irregularities, and contraceptive use before and during COVID-19.	Cross-sectional	200	Married Jordanian women	18	Online survey Google Forms	Yes	Domestic violence; menstrual disorders, genital tract infections prevalence; contraceptive use
Lebetkin	2014	Ghana	Examine whether the sale of injectable contraceptives in Ghanaian chemical shops was associated with better access and use of the method.	Cross-sectional & Longitudinal (3 months)	298	Women of reproductive age (18–49 years) who purchased injectable contraceptives and had access to a mobile phone	18	Phone Semi-Structured Interview	No	Contraceptive and family planning use
Gonzalez-Hernandez	2020	Colombia	Adapt the Condom Use Errors and Problems Survey for the Spanish language and determine prevalence of condom use errors among young Colombian adults.	Cross-sectional	775	Youth between 18 and 26 years who engaged in sexual intercourse using at least 3 condoms, 53% women	18	Online survey SurveyMonkey	No	Condom use errors
Memiah	2020	Kenya	Determine IPV prevalence/correlates among adolescents and young adults in Nairobi, Kenya.	Cross-sectional	887	Kenyan adolescents and young adults (15–24 years), 39.1% female	15	Mobile application: Reaching, Engaging Adolescents and Young Adults for Care Continuum in Health (REACH)	No	IPV
Maasoumi	2019	Palestine, Gaza Strip	Determine prevalence/correlates of female sexual dysfunction among women seeking reproductive services in Gaza.	Cross-sectional	385	Married Palestinian women	18	Online survey Google Forms	No	Female sexual dysfunction
Kocturk	2019	Turkey	Assess educational and career issues related to the experience of childhood sexual abuse.	Cross-sectional	100	Survivors of childhood sexual abuse that used Ankara Child Advocacy Centre, 93% female	16	Phone Interview	No	Childhood sexual abuse and related impacts on education and career
Restar	2020	Philippines	Assess PrEP awareness and determinants among Filipina women who identified as trans*.	Cross-sectional	139	Trans* Philipina women, who were sexually active, engaged in unprotected sex, lived in high HIV burden areas, had adequate English comprehension.	18	Online Questionnaire	No	Pre-exposure prophylaxis (PrEP) awareness and interest
L'Engle	2013	Tanzania	Assess the practicability, range, and behavioral impact of offering mobile-delivered family planning information to Tanzanians.	Cross-sectional	2870	Males and females of reproductive age; mobile for Reproductive Health (m4RH) program users, 56% female	19 and younger	m4RH: Mobile for Reproductive Health (interactive, menu-based SMS message service)	No	Family planning information

(continued)

Table 2. (continued)

Quantitative Descriptive Studies										
First Author	Year	Country	Purpose	Study Design	N	Sample Characteristics	Min Age	RDC* Tool	COVID-19*	Outcome Measure
Ghimire	2020	Nepal	Assess the prevalence of varying forms of interpersonal violence during the COVID-19 lockdown and association with sociodemographic factors, substance use, and overall mental wellbeing.	Cross-sectional	564	Victims and perpetrators of interpersonal violence, 48.7% female	18	Online questionnaire Google forms	Yes	Interpersonal violence during the COVID-19 lockdown
Baloushah	2019	Palestine, Gaza Strip	Determine IPV prevalence/associated factors among Palestinian women.	Cross-sectional	517	Currently married Palestinian women in Gaza strip	18	Online questionnaire Google forms	No	IPV
Fakunmoju	2013	Nigeria	Examine the propensity for maltreatment with respect to: types of abuse, gender differences, perception of abuse, exposure to childhood abuse.	Cross-sectional	376	Literate residents located in urban lefts in Lagos State, Nigeria, 42.4% female	Young adults (min age not stated)	Online questionnaire SurveyMonkey	No	Childhood sexual abuse and perpetration of sexual abuse.
Mixed Methods										
First Author	Year	Country	Purpose	Study Design	N	Sample Characteristics	Min Age	RDC* Tool	COVID-19*	Outcome Measure
Vahdat	2013	Kenya	Investigate use of a text message contraceptive information service (Mobile for Reproductive Health) among Kenyan youth.	Cross-sectional	4817	Youth who were users of the Mobile for Reproductive Health (m4RH) intervention; 61% female	<19	SMS via m4RH and Phone in-depth interview	No	Perceptions of the "m4RH" service; changes in contraceptive use and related access
Ko-Ko-Zaw	2011	Myanmar	Assess the feasibility of reproductive health information phone hotline in Myanmar.	Cross-sectional	743	Calls to the reproductive health hotline, 52% female	15	Phone Hotline	No	Participants' questions and perceptions of SRH
Ybarra	2020	Uganda	Develop an SMS HIV prevention mHealth platform (In This toGether) that targets young adults in Uganda.	Cross-sectional	FGDs: 202; Content Advisory Teams: 143, Beta Testing: 34	Young adults with access to a private mobile phone/ internet, able to read in English FGDs: 47%–50% female	18	Online survey; bulletin board website; text-message survey; phone.	No	Perceptions and opinions of HIV and sexual behavior
Quantitative Non-Randomized										
First Author	Year	Country	Purpose	Study Design	N	Sample Characteristics	Min Age	RDC* Tool	COVID-19*	Outcome Measure
Doubova	2017	Mexico	Evaluate internet-based intervention on STI and condom use among Mexican adolescents.	Differences in differences	246 (treatment) 210 (control)	Adolescents from the Iztapalapa Delegation, 14–15 years old, 53% female (treatment) and 58% female (control)	14	Internet-based survey via the study website	No	Knowledge of STI, Attitudes to condoms, self-efficacy toward condom use
Liu	2018	Nigeria	Examine the effect of differential counseling quality, side effects, and sociodemographic variables on the likelihood of obtaining a follow-up dose of DMPA-SC.	Longitudinal (3-month follow-up)	994	Urban Nigerian women obtaining DMPA-SC	18	Phone interview/survey	No	Introduction of DMPA-SC and influence of contraceptive counseling

(continued)

Table 2. (continued)

RCT										
First Author	Year	Country	Purpose	Study Design	N	Sample Characteristics	Min Age	RDC* Tool	COVID-19*	Outcome Measure
McCarthy	2017; 2018	Tajikistan	Protocol for RCT and RCT study to evaluate a mobile phone delivered contraception intervention.	RCT protocol	573	Men and women, between ages of 16–24, who owned Android mobile phone, lived in Tajikistan, and were literate. 47% women	16	Baseline: online or phone; Follow-up: mobile application or telephone	No	Use of effective contraception
Babalola	2019	Nigeria	Measure how efficacious a digital health tool (Smart Client) is on contraception and family planning ideation related behavior.	Cluster RCT (3-month follow-up)	565 women	Women aged 18–35 in Kaduna City not using non-barrier contraceptive method, owned/could access a mobile phone, and were fluent in Hausa.	18	Baseline and follow-up: prerecorded mobile phone calls with automated survey questions (Interactive Voice Response or IVR)	No	Contraception and family planning
Qualitative										
First Author	Year	Country	Purpose	Study Design	Sample Size	Sample Characteristics	Min Age	RDC* Tool	COVID-19*	Outcome Measure
Mbulayi	2020	Zimbabwe	Qualitatively investigate the psychosocial impact of COVID-19 among a chosen sample of Zimbabwe citizens.	Qualitative (single semi-structured interview)	20 recruited, 9 participants interviewed	First author's WhatsApp contact list, 44% female	18	WhatsApp	No	Domestic and sexual violence

* Conducted during the COVID-19 pandemic.
Note. RDC = remote data collection; *N* = sample size.

Table 3. Methodological Rigor by Study Design.

Methodological Rigor for Quantitative Descriptive Studies									
Study ID	RDC*	Sampling Strategy	Sampling Appropriateness	Participant Recruitment	Appropriateness of Measures**	Response Rate**	Risk of Selection Bias	Representativeness**	Limitations/Challenges
Mahmood, 2021	Online survey	Non-probability: Convenience Sample	Not appropriate for prevalence estimation	Dissemination among NGOs/governmental organizations. Social networking platforms used to share survey URL	No: Did not use validated instrument to measure outcome. Survey developed using previous literature/ research	Not reported	Reported: Under-representation of women without internet, low economic groups, and rural regions, all of which could be related to the outcome	No: Cannot be generalized to all married women in Kurdistan region of Iraq	Online and phone-based data collection excluded certain groups of women, such as those living in rural areas.
Abuhammad, 2021	Online survey	Non-probability: Convenience Sample	Not appropriate for prevalence estimation	Various channels employed: WhatsApp, messenger, email, social media	Yes: (1) Questioned were developed by the Violence Intake Centre. (2) Survey was translated and back translated and pilot testes among 15 participants. (3) Cronbach's alpha = 0.83.	Reported: About 70% surveys returned	Not reported: High risk of selection bias due to online recruitment and no clear sampling frame	No: Cannot be generalized to all Jordanian women.	(1) Online surveys have a low response rate so had to over sample participants. (2) Sampling strategy excluded women without access to social media or online communication tools.
Aolymat, 2021	Online survey	Non-probability: Convenience Sample	Not appropriate for prevalence estimation	Survey was posted on social media platforms	Partly: (1) Survey was pilot tested among 30 participants and subsequently validated; (2) Translated from English to Arabic, backtranslation not reported	Not reported	Not reported: No clear sampling frame	No: Cannot be generalized to all Jordanian women of reproductive age.	Not reported
Lebetkin, 2014	Phone	Non-probability: Purposeful sample	Appropriate to sample all women who purchased contraceptives from selected sellers	Recruited women who purchased contraceptives from chemical shops. Participant information collected biweekly from shop owners who recruited participate. Interviews were conducted with all eligible clients who used injectable contraceptives.	No: Did not report on how semi-structured interview guide used and how it was developed	Reported: 63% completed the follow-up interview at end line.	Reported: women without mobile phones could not participate and this could be related to the outcomes studied.	Yes: Representative of women who purchased injectable contraceptives from selected chemical sellers. Not representative of all women in Ghana who use injectable contraceptives.	Data collection occurred via mobile phone thus excluded women without access to a mobile phone, due to lower socioeconomic status or rural living.
Gonzalez-Hernandez, 2020	Online survey	Non-probability: Convenience Sample	Not appropriate because excluded persons not using Facebook	Survey was distributed via Facebook through directed posting to men and women 18–26 years of age.	Yes: Employed validated scales and instruments; Cronbach's alpha ranged from 0.72-0.83; Condom Use Errors/ Problems was adapted to Spanish by psychologists and translators; back translations not reported.	Reported: 4676 interacted with the post and 83% clicked on the link. 2325 surveys completed and 33% included.	Reported: Persons who were illiterate were excluded and this could be related to the outcomes being studied.	No: Cannot be generalized to all Colombian youth between 18 and 26 years. Only users of Facebook were included.	Impossible to ascertain how many persons who interacted with the post were eligible to participant but chose not to participate

(continued)

Table 3. (continued)

Methodological Rigor for Quantitative Descriptive Studies									
Study ID	RDC*	Sampling Strategy	Sampling Appropriateness	Participant Recruitment	Appropriateness of Measures**	Response Rate**	Risk of Selection Bias	Representativeness**	Limitations/Challenges
Memiah, 2020	Mobile app	Non-probability: Respondent driven sampling	Partly: Respondent driven sampling can approximate probability sampling and incentives participation if all assumptions are met.	Study participants referred their friends. A Facebook page-initiated recruitment and was monitored by a website to ensure adequate representation of age groups.	Yes: Employed WHO multicounty gender-based violence study screening tool; Risk assessment screening tool; mobile application was pilot tested	Not reported	Reported: App was only accessible to persons who had a mobile phone, were technologically savvy, and able to download app from Google Play/ Apple Store. Such factors could be related to the outcome studies.	Yes: The application required participants to access location data, ensuring participants resided in Nairobi	Not all youth are comfortable with technology such that they could access the application
Maasoumi, 2020	Online survey	Non-probability: Convenience and Snowball sampling	Not appropriate for prevalence estimation	NGOs providing maternal/child health services were selected and snowball sampling was used to recruit female patients. Participants joined Facebook group to obtain link	Yes: Employed the validated Arabic version of the Female Sexual Function Index	Not reported	Reported: Low socioeconomic households without internet unable to participate. Selection was contingent upon nurses who identified participants. Thus, women who were not identified as potential participants were not approached.	No: Cannot be generalized to all women in Gaza Strip, particularly those of low socioeconomic status and those who do not or cannot access healthcare services at the selected NGOs.	Not all persons have access to the internet
Kocturk, 2018	Phone	Non-probability: Purposeful and Criterion Sampling	Partly: Appropriate to assess the childhood sexual abuse among survivors who received support from selected left. Did not report how the sample was obtained from client records.	Sampling occurred among persons seeking support for childhood sexual abuse from Ankara Child Advocacy Centre in 2012–2013. Phone numbers of the survivors and their parents were obtained from the registry.	No: validated instruments not used, no discussion of pilot testing or psychometric properties. Did not include how questions were developed: Phone survey consisted of 20 questions from a semi-structured interview containing open ended and closed ended questions	Reported: 100 childhood sexual abuse survivors contacted via phone. 26 changed their number and could not be reached. One parent did not consent. 73% participated	Not reported	No: Cannot be generalized to childhood sexual abuse survivors who did not seek services from selected left between 2012 and 2013. Also, only representative of certain forms of childhood sexual abuse, based on the type of service provision offered by the left (i.e., abuse related to touch and penetration).	Not reported
Restar, 2020	Online Survey	Non-probability: Purposeful and Criterion Sampling	Not Appropriate: Not representative of trans* Filipina women in metro Manilla or Central Visayas	Online recruitment via social media websites (Facebook/Twitter) and private online groups for the trans* community in the Philippines.	Yes: Used instruments that were adapted for the trans* community and provided reliability and validity metrics.	Not reported	Reported: Online convenience sampling may have excluded trans* persons who did not have access to internet or use social media groups/ websites.	No: not representative of broader trans* community in the Philippines	(1) Respondents had to meet a threshold of English comprehension and capacity to consent, assessed using Flesch-Kincaid Reading Level Test. (2) Survey completion may be performed by robots (include the challenge response test), (3) Survey may be completed more than once by same participant (allow only unique IP address).

(continued)

Table 3. (continued)

Methodological Rigor for Quantitative Descriptive Studies									
Study ID	RDC*	Sampling Strategy	Sampling Appropriateness	Participant Recruitment	Appropriateness of Measures**	Response Rate**	Risk of Selection Bias	Representativeness**	Limitations/Challenges
L'Engle, 2013	SMS message service	Non-probability: Availability sample	Not Appropriate: While all users of the m4RH mobile application were eligible for inclusion, the majority of participants did not respond to the follow-up survey questions and self-selected out of the study.	m4RH was promoted in family planning clinics via print advertisements and later by community health outreach workers. Users were eligible to enter into the study sample if they used the mobile application to ask a question. Every m4RH user was sent a series of four questions (in Swahili) via text message	Partly: Only 4 follow-up questions were included in the survey, of which 2 were basic demographics. No discussion of pilot testing and psychometric properties of the open-ended question on changes in family planning use. Responses may have been subject to social desirability bias.	Reported: About one third of participants (33%) responses to the follow-up multiple-choice survey questions, after using the m4RH mobile application. Response rate pertaining to the open-ended question was lower (18%).	Not reported: The low response rates indicate there may be systematic differences between m4RH users who responded to the follow-up questions, compared to those who did not. Authors did not comment on the effect of this selection bias.	No: There is no information on the non-respondents.	(1) Time between accessing the m4RH mobile application and being sent a follow-up ranged from 2–12 months and may have negatively affected response rates, (2) Users who were more active on the mobile application may have been more motivated to engage in family planning were more likely to respond to the follow-up survey questions. Social desirability may have overestimated measured use of contraception. (3) Stigma against unmarried adolescents engaging in sexual activity may have overestimated reported ages.
Ghimire, 2020	Online survey	Non-probability: Convenience Sampling	Not Appropriate: Persons at risk of spousal or interpersonal violence that did not have internet access/ social media accounts could not participate.	Survey link was distributed to social media groups using special accounts created for recruitment. To ensure participants were based in Nepal, respondents were asked to identify the city they resided in during the lockdown.	No: Outcomes not captured using pre-existing validated surveys. Domestic violence and substance abuse questions were designed by medical doctors and psychiatrists. Questions were added on the basis of face validity. Survey was piloted.	Partly: The survey completion rate among the participants who clicked on the survey link was 98.6%. No information on the number of potentially eligible respondents who had access to the survey link but did not participate.	Not reported: Recruitment strategy and online survey method pose serious risks for selection bias. The study was limited to internet users only and persons who used/ could access social media groups. Such factors could be related to the outcomes studied.	No: online surveys wherein recruitment is facilitated via social media can systematically exclude persons without internet access or social media accounts. The sample is not representative of all persons living in Nepal.	While participants were instructed to only fill out the study once, the investigators could not prevent participants from participating multiple times.
Baloushah, 2019	Online survey	Non-probability: Convenience sampling	Not Appropriate: the sampled women may not be reflective of all married Palestinian women living in the Gaza Strip because sampling was connected to use of community health institutes	Women who attended or were members of community health institutes in the Gaza Strip were eligible to be included in the study. Databases of women's contact information were obtained from the institutes. Participants were contacted via personal social media accounts.	Yes: Survey questions adapted from a previous study conducted in Saudi Arabia. Use of the HITS scale: Cronbach's alpha reported (0.892) with justification for IPV threshold.	Not reported	Reported: Recruitment strategy/online survey method posed serious risks for selection bias. More likely to exclude persons of low socioeconomic status. Study was also limited to women who accessed health institutes in the Gaza Strip. Healthcare access is predictor of reporting GBV, receiving related care, and disclosing violence.	No: online surveys can systematically exclude persons without internet access or internet privacy. Also, not all married Palestinian women access the health institutes or have social media accounts/ maintain regular access.	Reported: Low socioeconomic households and women could not be reached.

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Table 3. (continued)

Methodological Rigor for Quantitative Descriptive Studies									
Study ID	RDC*	Sampling Strategy	Sampling Appropriateness	Participant Recruitment	Appropriateness of Measures**	Response Rate**	Risk of Selection Bias	Representativeness**	Limitations/Challenges
Fakunmoju, 2013	Online survey	Non-probability: Convenience sampling	Not Appropriate: incomplete sampling strategy information recorded. Convenience sampling via online link distribution may not yield a representative sample.	Survey link forwarded to respondents and internet cafe operators helped to recruit participants without internet access.	Yes: Literature was consulted; Face/ content validity assessed through expert review; Questionnaires were pilot tested for cultural adaptation. Reliability and validity of maltreatment scale was reported in separate publication.	Reported 376 respondents were sampled but only 304 observations included in the analysis (80.9%). No information provided regarding why not all respondents were used in the analysis.	Reported: The experiences of rural residents are not included in the sample obtained. Findings may also differ with the inclusion of older and nonliterate respondents.	Not representative: Sample recruited consisted mainly of urban university students who were literate and living in Lagos State. However, the sampling frame and intended target sample are unclear.	Due to internet connectivity problems, some participants had to complete the survey over multiple attempts.

Methodological Rigor: Mixed Methods Studies										
Study ID	RDC*	Sampling Strategy	Recruitment Strategy	Appropriateness Of Measures**	Response Rate**	Risk Of Selection Bias	Sample Representativeness**	Adequacy Of Qualitative Data Collection Methods**	Appropriateness of Qualitative Approach**	Mixed Methods Rationale**	Limitations/ Challenges
Vahdat, 2013	SMS and Phone in-depth interview	Availability sample. Partly: Majority of participants did not respond to follow-up questions. Persons who did not already use the platform could not be included.	Recruited all existing users. Service was promoted in clinics and via radio; Users who asked an SMS question and answered the demographic questions were sent a phone interview invitation.	No: Use of mobile intervention was automatically captured by mobile app; 3 questions automatically sent to participant when they asked an SMS question; In-depth interview guide development was not reported	1155 users were asked survey questions; 457 reported contraceptive use, 26 interviewed	Not reported: Not clear whether sample of users who interacted and responded to the SMS service were different from Kenyan youth	Not representative: Sample of respondents who self-selected into the intervention may be different from those who the intervention is intended for	No: Only a quarter of users responded to questions and a minority agreed to the phone interview. 30-minute in-depth phone interviews using structured guide collected qualitative data on basic perceptions rather than in depth probing.	Yes: Qualitative description was well suited for research aim.	Partly: Qualitative description was sufficient to gain basic perceptions of Mobile Reproductive Health in addition to the quantitative metrics. However, authors do not describe the purpose of mixing data.	Only a quarter of users responded to questions and a minority agreed to the in-depth phone interview. Delay between SMS receipt and questions lowered response rates.
Ko-Ko-Zaw, 2011	Phone Hotline	Availability sample. Appropriate: all users of the SRH hotline were included.	The hotline was publicized in health magazines and newspapers.	No: Collected basic information: demographics and question posed to the hotline	Not reported	Not reported: Persons without phone access could not participate and this could be related to the outcomes.	Representative of all persons who called the hotline during a particular time frame.	Partly: Data collection occurred while the participant was seeking help from the hotline via phone. Limited opportunity for probing.	Partly: Content analysis was well suited for the research aim however no rationale given for why not all recordings were analyzed.	No: Content analysis was performed by randomly sampling the recordings. No rationale for why not all recordings were analyzed. Purpose of mixing data not described.	Not reported

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Table 3. (continued)

Methodological Rigor: Mixed Methods Studies											
Study ID	RDC*	Sampling Strategy	Recruitment Strategy	Appropriateness Of Measures**	Response Rate**	Risk Of Selection Bias	Sample Representativeness**	Adequacy Of Qualitative Data Collection Methods**	Appropriateness of Qualitative Approach**	Mixed Methods Rationale**	Limitations/ Challenges
Ybarra, 2020	Bulletin board website; online survey; SMS; phone	Convenience and maximum variability sampling Partly: Authors noted they were unable to recruit a diverse sample for FGDs.	Facebook/Instagram advertisements directed to Ugandans (18–22 years) who set language preferences to English. Participants were screened online to determine demographic characteristics to ensure sample diversity.	Partly: FGD questions included relevant domains related to understanding sexual decision making and preferred features of the intervention being developed. Beta testing included Likert style questions. Did not explain how Likert questions were developed.	FGD: 22% completed the FGDs, 79% completed baseline and end line assessment	Participants randomized to receive the intervention or an attention-matched control during beta testing, so selection bias was not a concern.	Not representative: samples obtained are not representative of Ugandan youth who do not have access to mobile phones/ internet and did not use texting for at 6 months or more. Unrepresentative of lower socioeconomic status youth given that attrition was related to working or affording mobile data.	Partly: FGDs facilitated via bulletin board websites enabled participation across Uganda, at convenient times, respondents could openly share opinions. Beta testing questions related to user experiences with the intervention, including open ended text responses. Little opportunity for probing.	Yes: Qualitative description was used. The FGDs and open-ended text questions were well suited to the research objective to develop the HIV prevention program	Partly: Authors do not provide an explicit rationale for mixing data. However, FGDs directly informed the creation of the HIV prevention program, which was then beta tested using qualitative and quantitative methods. Thus, both qualitative and quantitative methods were needed to develop the program.	(1) Recruiting 18–19-year-olds was more difficult than recruiting persons in their early 20s, (2) Multiple phone calls/SMS were needed to encourage participation/ resolve tech issues. Some phones were unable to open the survey link, webpages were too slow to load, unstable mobile network may have resulted in program messages being received late and in a rapid cascade.

Methodological Rigor: Quantitative Nonrandomized								
Study ID	RDC*	Sampling Strategy Appropriateness	Sample Representativeness**	Recruitment Strategy	Appropriateness of Measures**	Response Rate**	Risk of Selection Bias	Limitations/Challenges
Doubova, 2017	Internet-based questionnaire (website)	Probability: simple random sampling of public secondary schools Appropriate	Yes: Representative of adolescents in Iztapalapa Delegation (high poverty area)	School based recruitment	Yes: (1) 23-item scale of STI knowledge validated among Mexican adolescents; (2) UCLA Multidimensional condom attitudes scale previously validated in Mexico; (3) Self efficacy toward consistent condom use translated to Mexican Spanish; (4) Also measured the effect of social desirability bias using the "Lie Scale," which was validated among the study population,	99% in the treatment group and 98% in the control group	Reported: Treatment and control group different at baseline with respect to parental communication about SRH and school performance. In addition, there were multiple significant differences with respect to baseline knowledge of STI, condom use efficacy, and sexual relationships.	Internet-based self-administered survey is subject to social desirability bias

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Table 3. (continued)

Methodological Rigor: Quantitative Nonrandomized								
Study ID	RDC*	Sampling Strategy Appropriateness	Sample Representativeness**	Recruitment Strategy	Appropriateness of Measures**	Response Rate**	Risk of Selection Bias	Limitations/Challenges
Liu, 2018	Phone interview/ survey	Non-probability: Purposeful and Criterion Sampling Appropriate to obtain sample of women using DMPA-SC.	No: Not representative of Nigerian women of reproductive age, public sector providers of DMPA-SC, or all users of DMPA-SC. Sample obtained was predominantly urban, from Southwest States (higher wealth and education).	Recruited healthcare providers using a list of private sector providers obtained from the DMPA-SC distributor.	Partly: (1) Quality measure: based previous literature. (2) Questions pilot tested with DMPA-SC users to assess comprehension, time to completion, and response fatigue. (3) Rationale provided for creating the composite continuous summary measure of quality and creating the dichotomous indicator of quality. (4) Authors commented on lack of heterogeneity in the quality experiences recorded and use of a "Western" quality framework, indicating potential issues with the use of the quality measures in the Nigerian context	(1) 316 healthcare providers were contacted, of which 205 (64.9%) were included in the study, (2) 1179 women purchased DMPA-SC. Of the 944 women consented to be contacted, 541 completed the first phone survey (57.3%) and 342 completed the second follow-up survey (63.2%) and 311 provided complete item information (90.9%).	Reported: (1) Only included private sector providers, (2) A proportion of participants who agreed to participate could not be reached by phone. Reasons for non-response may be related to study variables, (3) Urban regions of southwest states have higher socioeconomic status compared to national counterparts, (4) Participants who completed the follow-up interview and had complete variable information were more likely to be older and married and experienced higher quality encounters, (5) Providers may recruit women who had positive experiences.	A portion of participants who consented to be contacted could not be reached via phone; Low quality phone connection resulted in reduced comprehension and research fatigue, so questions were adapted to yes/no responses (binary choices). Authors mentioned social desirability bias given responses may have been monitored by or sent to their providers.

Methodological Rigor: RCT								
Study ID	RDC*	Randomization Appropriateness**	Exchangeability of Comparator Groups**	Recruitment Strategy	Appropriateness of Measures**	Response Rate**	Sample Representativeness**	Limitations/Challenges to RDC
McCarthy, 2017; 2018	Baseline: online or phone Follow-up: mobile application	Yes: Randomization by computer software, investigators unaware of the allocation assignment. Participants could not be blinded to allocation and analysis occurred blinded to allocation.	No: Contamination between intervention and control group occurred. The application for the control group included intervention content. Also, control participants reported other participants read messaged from their application. Baseline characteristics may have been unbalanced by current pregnancy intention and education	RCT advertised through flyers, Tajik Family Planning Association and affiliated website, youth organizations, and social media.	Partly: Could not use validated measure of contraceptive acceptability in the setting (Tajikistan). Outcome measure developed and pilot tested for face validity.	Reported: 83% retention in the intervention group and 82% retention in the control group. If follow-up was not completed, research staff contacted the participant by phone to collect data.	No: Since eligibility criteria are contingent on owning an Android phone, sample does not represent all sociodemographic groups.	Persons without personal Android phones or unwilling to download the mobile phone application and receive messages about contraception through the application were excluded. Authors noted that ownership and access to a mobile phone may be related to attitudes toward contraception. Telephonic data collection with research assistant was linked to more risk of social desirability bias, compared to application-based questions completed independently.

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Table 3. (continued)

Methodological Rigor: RCT								
Study ID	RDC*	Randomization Appropriateness**	Exchangeability of Comparator Groups**	Recruitment Strategy	Appropriateness of Measures**	Response Rate**	Sample Representativeness**	Limitations/Challenges to RDC
Babalola, 2019	Baseline and Follow-up: prerecorded mobile phone calls	Partly: 12 city wards (clusters) randomly and equally assigned to the intervention (Smart Client digital health tool) and control arm (nothing). Randomly selected 6 wards from 2 local Kadunan government areas.	No: At baseline, there was an imbalance in religion. Analysis adjusted for religion, inter alia, when creating the estimation models.	Field research assistants, who were female and fluent in Hausa, recruited women in the randomized intervention wards by traveling foot to door. Consenting and eligible women were then registered to receive the "Smart Client" calls.	Partly: (1) Outcomes of interest pertained to ideation and behaviors regarding contraception: desired family size, self-efficacy for communicating with a family planning provider, spousal communication on family size, spousal communication about contraceptive methods, misinformation rejection, current use of modern contraceptives. (2) No information provided about pilot testing, reliability/validity.	Reported: (1) High attrition. From those recruited, a large proportion did not engage/dropped out. Initiation rate was higher among control (86.3%), versus treatment (55.1%). Complete data collection from baseline to post-intervention: 41.6% in the intervention group and 46.7% in the control group. (2) Women who were Muslim and had greater levels education, were more likely to complete the intervention. No sociodemographic differences noted among the control group regarding the study sample and participants who dropped out of the sample.	No: Eligibility criteria were contingent on owning a phone/being able to access one. Participants also had to be literate in Hausa. The results cannot be generalized to women who cannot access mobile phones or who are illiterate or fluent in a separate language.	(1) Attrition was a major concern for the intervention group due to the higher demand of calls, (2) Delays between recruitment and beginning the intervention surveys contributed to attrition. Survey calls also sounded like telemarketers. Technical issues with the intervention platform and phone were also demotivating. (3) Recruitment of participants was labor intensive as it was based on eligibility criteria of committing to multiple calls, staying in the intervention for 3 months, and adequate literacy skills. Field research assistants may not have applied eligibility criteria appropriately.

Methodological Rigor: Qualitative							
Study ID	RDC*	Limitations or Challenges with Form of Data Collection?	Type of Sampling Employed and Appropriateness	Recruitment Strategy	Are the Data Collection Methods Adequate to Address the Research Question? **	Is the Qualitative Approach Appropriate to Answer the Research Question?**	Was Saturation Discussed or Reached?
Mbulayi, 2020	WhatsApp	(1) 20 participants were selected, of which 17 accepted the invitation and only 9 actually participated. (2) Participants were connected directly to the social network of the investigator and may be more homogeneous to each other than if sampled across social networks or WhatsApp contact lists.	Convenience and maximum variability sample. Participants selected from first author's WhatsApp contacts. Participants sampled for diversity in gender, social, professional, cultural, geographical, and economic background. Partly appropriate: Some demographic characteristics were not as variable as the authors may have originally intended.	The selected persons (n = 20) were contacted via phone to participate in the study.	No. The method of data collection was limited to WhatsApp-based in-depth interviews; other forms of data such as documents, records, and observation not considered as part of the case study design. In terms of interviewing, participants were instructed to record voice audio clips (voice notes) and were sent the voice note and written text of each interview question and probe. Participants responded through text or voice note. The depth of probing, quality of responses, development of interview guide, positionality of interviewers not discussed.	Partly: Qualitative approach was thematic analysis. Thematic analysis may not be appropriate for the case study design. While the question being investigated is clear (the psychological impacts of COVID-19 among sample of Zimbabweans), the use of a case study design and thematic analysis is less clear.	No discussion of saturation.

* RDC = remote data collection; ** Items from the MMAT tool; *** RCT protocol.

Table 4. Ethical Considerations by Study Design.

Ethics: Quantitative Descriptive Studies								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related Measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
Mahmood, 2021	Online survey	Informed consent was obtained electronically prior to beginning the survey, within the introductory section of the online survey	Yes: Helpline from UN Population Fund and General Directorate for Combatting Violence Against Women in Kurdistan Region of Iraq	Information pertaining to recruitment was worded generally in case husband saw information	Not reported	Data were anonymous	Via phone, researchers filled out the online questionnaire for participants with low literacy	For women with no internet access, researchers contacted participants by phone and filled out the survey; Phone and online support services were made available
Abuhammad, 2021	Online survey	Informed consent was obtained electronically: women who responded to the call for participation were sent the consent forms electronically. Participants could select the "agree" button if willing to participate.	No	Forced responses were not used as some items could elicit negative feelings or distress.	Not reported	Qualtrics was password protected and only accessible by the author. Questionnaire was anonymous and no identifying information was collected.	Eligibility criteria was contingent upon sixth grade literacy level in Arabic	No
Aolymat, 2021	Online survey	Informed consent was obtained online, on the first page of the questionnaire	No	No	Not reported	Data were anonymous	No	No
Lebetkin, 2014	Phone	Not reported	No	No	Not reported	Not reported	N/A (phone interview)	No
Gonzalez-Hernandez, 2020	Online survey	Informed consent was collected online	No	No	Not reported	Not reported	Excluded participants who were unable to write or read	No

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Table 4. (continued)

Ethics: Quantitative Descriptive Studies								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related Measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
Memiah, 2020	Mobile app	Not reported	No	Participants were permitted to stop and start the study as needed (did not have to complete the survey all in one attempt) and were allowed to go back and change their answers.	Not reported	Data captured in Excel with an interphase to the application-based questionnaire. Participants given an ID once they consented	No	No
Maasoumi, 2020	Online survey	Informed consent was obtained online prior to beginning the survey	No	No	Not reported	Responses received in Excel. Anonymous data were collected	No	No
Kocturk, 2018	Phone	Via phone, verbal consent of the non-offending parent of the childhood sexual abuse survivor was obtained first. Then, survivors were contacted, and verbal consent was obtained via phone from them. This two-stage process considered secondary trauma and cultural sensitivity.	Yes: phone interviews were conducted by the first author, who was a psychological counselor at the Ankara Child Advocacy Centre. As a psychologist, psychological care was provided by the first author, as needed.	Yes: only research team members who were employees of the Ankara Child Advocacy Centre could conduct interviews	A non-offending parent who refused participation had a negative emotional response after being contacted by the research team.	Not reported: Participants' telephonic responses were written on a form and eventually transferred electronically. No mention of data protection and anonymity. Research team had access to phone numbers and identity of the non-offending parent; no information on how this information was kept private.	No	No

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Table 4. (continued)

Ethics: Quantitative Descriptive Studies								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related Measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
Restar, 2020	Online Survey	Consent obtained electronically. Participants completed a cognitive screening form to assess comprehension of the consent form and capacity to consent.	No	No	Not reported	Not reported	Questionnaire was at a 6th grade level of readability and comprehension.	No
L'Engle, 2013	SMS message service	An introductory text message was sent to each user before sending more questions. This introductory text provided basic elements of the informed consent	Not reported	No	Not reported	Each query (related to the use of the application) was entered into a database and phone numbers managed as unique users. After all 4 survey questions were answered, they were merged by phone number in the database. No discussion of how to keep phone number information protected.	No	No
Ghimire, 2020	Online survey	Informed consent was obtained online from a Google Form- the same Google Form used to implement the survey.	Not reported	No	Not reported	Researchers stored data on a password-protected Google Drive that had limited access from non-investigators. No personal identifiers were stored.	No	No

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Table 4. (continued)

Ethics: Quantitative Descriptive Studies								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related Measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
Baloushah, 2019	Online survey	Informed consent obtained through the online survey before beginning the questionnaire.	Not reported	Women initially contacted for study participation via social media rather than phone/email. The participants could stop the study at any time.	Not reported	Data remained anonymous	No	No
Fakunmoju, 2013	Online survey	Not reported	Not reported	Not reported	Not reported	Data collected using SurveyMonkey but no mention of how data were stored.	No	No

Ethics: Mixed Methods Studies								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
Vahdat, 2013	SMS and phone in-depth interview	Informed consent obtained via SMS: introductory SMS included the essential elements of informed consent. Informed consent was obtained verbally via phone for the 26 phone interviews.	No	No	Not reported	User data and responses to questions were merged into a database and matched to the mobile phone number. No measures to protect participant information or were not reported	Not reported	Not reported
Ko-Ko-Zaw, 2011	Phone Hotline	Informed consent obtained via phone with clinicians who staffed the hotline	Referral list for health services given to the medical hotline responders	No	Not reported	Recordings were kept confidential and were only accessible by the principal investigator	n/a	Not reported

(continued)

Table 4. (continued)

Ethics: Mixed Methods Studies								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
Ybarra, 2020	Social Media, Phone, Online Survey, Online bulletin SMS Text	Informed consent was obtained via a phone call with study research staff after the participant was screened for eligibility using an online survey.	No	Eligibility was contingent on participants owning and accessing a personal mobile phone that was not shared with others.	Participants were fearful that others might see sex-related words on their phones and assume they had HIV, view pornography, or otherwise engaging in "bad" sexual behaviors.	The online bulletin through which focus groups were conducted was password protected. Researchers tried to use aliases for participants, but this was culturally resisted, and participants wanted to use their real names. Use of an alias was made an eligibility criterion.	Participants were excluded from the study if they could not read in English.	Females were more difficult to recruit than males. Female participants did not have sufficient mobile data to carry out study activities. Women asked to receive the study incentive prior to beginning the baseline survey in beta testing so they could buy mobile phone credit. Online survey was compressed to use less data. SMS components were recommended over online components due to the higher cost of mobile internet. Online activities required higher incentives for participation due to internet costs.

Ethics: Quantitative Non-Randomized								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related Measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
Doubova, 2017	Internet-based questionnaire (website)	Parental and adolescent consent collected within the participating schools.	No	Not reported	Not reported	Study materials available on website with email and password log in.	No	No

(continued)

Table 4. (continued)

Ethics: Quantitative Non-Randomized								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related Measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
Liu, 2018	Phone interview/ survey	Consent for initial phone survey obtained by DMPA-SC providers. Consent for follow-up phone survey was obtained verbally during the first phone call. Consent was reaffirmed verbally during the second phone survey.	No	No	No	Not reported	Not reported	No

Ethics: RCT								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related Measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
McCarthy, 2017; 2018	Baseline: online or phone Follow-up: mobile application	Informed consent collected via secure online trial database. Option for paper-based consent form also provided.	Yes: For female participants, At the beginning of the trial message on support services will be provided in case sensitive messages are read by others or they feel unsafe due to messages being read	Instructions provided on how to keep intervention messages private/ how to delete messages. Collected outcomes related to physical violence since participating in the study. Participants had to own their own a mobile Android device to download an application and had to be willing to download the application.	Information on whether participants experienced physical violence while being in the study was collected. Less than 1% of participants reported physical violence.	Participant personal information stored in secure server following upload. Personally identifiable information extracted from database and stored in a separate location from anonymized data. Mobile numbers stored in platform to facilitate intervention messages.	Eligibility contingent on being able to read or write in Tajik or Russian.	Internet will be provided if necessary

(continued)

Table 4. (continued)

Ethics: RCT								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related Measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
Babalola, 2019	Baseline and Follow-up: prerecorded mobile phone calls using interactive voice response platform (IVR).	Obtained verbally and in-person by trained female field agents who spoke Hausa and traveled door to door within the sample wards selected.	No	Participants had to state whether they shared a phone with anyone. If the call came at an inconvenient time, participants had the option of relistening to it at a later time. Participants could also select a nickname to provide the researchers.	Not reported	Data were recorded and analytics were collected using IVR. Phone numbers were the unique identifiers. No description of how phone numbers were kept secure.	Eligibility criteria was contingent on being fluent in Hausa	No. Authors mentioned that the respondents stopped participating in the intervention and listening to the skits because of their husband's disapproval. This alludes to differential access and acceptability of women/girls using mobile phones independently for contraception information (or as they desire).

Ethics: Qualitative								
Study ID	RDC*	Informed Consent	Referral Services for Participants	Safety-Related Measures	Adverse Events	Data Confidentiality/ Security	Literacy Concerns	Efforts Taken to Mitigate Gender Digital Divide
Mbulayi, 2020	WhatsApp	The participant was called and asked to be part of the study. They were told the purpose, potential hazards, implications, and their rights as a means of security their voluntary and informed consent.	Not reported	Participants were able to choose to participate in the study at a time that was convenient for them.	Not reported	No	No	No

* RDC = remote data collection.

defined sampling frame is the main methodological challenge with online surveys disseminated though social media/networking websites and SMS platforms. Consequently, it is unclear to what extent estimates are generalizable to the population of interest or are affected by overestimation, underestimation, or attenuation. Moreover, many studies noted that online surveys systematically exclude women and girls without internet access, who are not active on social media, or do not use messaging platforms.

Other studies recruited participants through existing contraception providers via purposeful sampling (Lebetkin et al., 2014), leveraged participants' social networks though respondent driven sampling (Memiah et al., 2020), employed purposeful sampling to select participants who experienced childhood sexual abuse (criteria of interest) and accessed a child advocacy center (Koçtürk et al., 2019) and included all available users of the mobile for Reproductive Health (m4RH) program within the sample (L'Engle et al., 2013). We deemed sampling as being affected by bias when it was solely contingent on access to a RDC tool and excluded users who could not be reached or did not respond to survey questions after providing consent. Systematic differences between participants who self-select out of the study due to no response or inability to be contacted pose risks for selection bias. In terms of measurement, four studies were deemed to be affected by measurement bias given these studies did not: use validated survey instruments, report measures of reliability/validity (Ghimire et al., 2020; Mahmood et al., 2021), pilot test survey instruments (Koçtürk et al., 2019), or detail how interview guides were developed (Lebetkin et al., 2014). The use of SMS also limited the number and depth of survey questions posted to participants (L'Engle et al., 2013).

Methodological Rigor: Mixed Methods

Two of the three mixed methods studies (Ko-Ko-Zaw et al., 2011; Vahdat et al., 2013) employed availability sampling; this was deemed sufficient given the primary goal was to assess the feasibility, use, and perceptions of SRH services/resources among existing users. However, even among users and hotline, adequate response rates were not guaranteed: some participants were users of the service/resource but did not respond to the survey. Ybarra et al. (2020) employed mixed methods (FGDs, open text responses, Likert responses) to develop and pilot an HIV prevention program for Ugandan youth and recruited participants through social media advertisements. To increase the likelihood of obtaining a diverse sample by gender, education, income, and sexual experience, interested participants were first screened for demographic characteristics.

We noted declining participant retention between the quantitative and qualitative components of data collection in Vahdat et al.'s (2013) study. The authors noted that delays between user interaction with the SRH service and participation in research reduced retention. Qualitative data capture was also limited to simple description, as opposed to in-depth probing and contextualization; quantitative data was limited to basic demographic questions and questions on perceptions/experiences that could be collected via SMS (Vahdat et al., 2013). Ybarra et al. (2020) noted positive aspects of online bulletin board facilitated FGDs; however, there was no discussion of probing participants for more information. Moreover, multiple phone calls/SMS were needed to encourage participation and resolve technology issues, some phones were unable to open the survey, and SMS was preferred over online surveys due to higher internet costs. Overall, the measures used were not validated or relied on service use data (Ko-Ko-Zaw et al., 2011; Vahdat et al., 2013; Ybarra et al., 2020).

Methodological Rigor: Quantitative Non-Randomized Evaluations

Two quantitative non-randomized evaluations were identified. The only study to collect a probability sample was conducted by Doubova et al. (2017). A simple random sample of public secondary schools from a defined geographical location in the Iztapalapa Delegation of Mexico was obtained, and students were selected from within the respective schools. The authors tried to quantify and correct for the potential effect of social desirability bias due to self-report by employing the "Lie Scale" of the Eysenck Personality Questionnaire, which measures attempts to respond in socially desirable ways using 20 dichotomous questions (Eysenck & Lara-Cantú, 1992). The second quantitative non-randomized evaluation utilized purposeful and criterion sampling to recruit chemical contraceptive (DMPA-SC) providers in Nigeria who then identified potential participants (J. J. Liu et al., 2018). The authors noted that the quality measure employed may not have been suitable for the Nigerian context and opted for binary response choices for telephonic interview due to low quality phone connection and research fatigue.

Methodological Rigor: RCT

For the RCT protocol (O. L. McCarthy, Osorio et al., 2017) and later completed RCT (O. O. McCarthy et al., 2018) and cluster RCT (Babalola et al., 2019), eligibility was contingent on having access to or owning a phone. McCarthy et al. (2017) further limited eligibility to Android phones. Given that RCTs collect data at baseline and follow-up periods, different RDC tools can be used: researchers offered a choice between online/phone for baseline and mobile application for end line (2017, 2018). The Babalola et al. (2019) RCT was negatively affected by high and unbalanced attrition rates. This was attributed to the research team not using an attention-matched control group; there were a greater number of calls received by the intervention group compared to the control group. Babalola et al. (2019) also noted that survey calls sounded like telemarketing calls and technical issues further demotivated participation.

Methodological Rigor: Qualitative

The single qualitative study identified recruited participants from the first author's WhatsApp list using maximum variation sampling (Mbulayi et al., 2021). WhatsApp was also used to facilitate semi-structured interviews using the voice notes feature with question prompts sent over text/voice notes. However, given the authors did not detail the limitations of WhatsApp-based interview facilitation, it is not clear how this WhatsApp-based qualitative interviewing method may affect data quality.

Ethics

Ethics were assessed both in terms of procedural ethics (mandated requirements such as informed consent and referral services) and issues concerning the equity and inclusion of marginalized groups in research. Across the design types, the process of obtaining informed consent was enacted through the type of RDC tool employed. Two studies employed additional mechanisms through which to collect informed consent and assess capacity to consent including, a secure online database (O. McCarthy et al., 2017) and an online cognitive screening form to assess comprehension (Restar et al., 2020). Two studies collected informed consent in-person even though data collection occurred remotely (Babalola et al., 2019; Doubova et al., 2017). Generally, the sources did not report how participants could ask questions during the consent process when relying on SMS, online surveys, or mobile applications to collect data (although this could be reflective of space limitations rather than gaps in the consent protocols). However, Ybarra et al. (2020) did contact interested participants by phone to further explain the research and obtain informed consent, thereby offering an opportunity to answer questions. Also, no sources reported on how information on data security and privacy were communicated to participants, particularly when personal information (geolocation and phone numbers) were collected and given that data were automatically received in survey platforms via processes that may be foreign to participants. In terms of data confidentiality/security, studies employed password protected data storage. When personally identifiable information was collected, separate databases storage was utilized (O. McCarthy et al., 2017).

17 studies did not report offering referral services (at minimum, contact information for services that could be accessed, such as mental health hotlines) to participants, which is contrary to best ethical practice, particularly when measuring GBV (Ko-Ko-Zaw et al., 2011; Koçtürk et al., 2019; Mahmood et al., 2021; O. McCarthy et al., 2017). The lack of service referrals may have been a direct consequence of studies conducted during the COVID-19 pandemic when referral services were difficult to access or unavailable. Secondly, O. McCarthy et al. (2018) offered referral services only to female participants because collecting data on women's contraceptive use in Tajikistan was deemed to be potentially sensitive, leading to compromised safety if women's partners or parents were made aware. Support service information was not provided to male participants as the Tajik Family Planning Association advised it was not culturally realistic for males to feel unsafe after answering questions about contraception.

Studies that detailed the use of safety-related research practices were in the minority. However, when mentioned, practices were innovative. For example, Mahmood et al.'s (2021) GBV study mentioned that recruitment information was worded using general terms, in case abusive husbands saw the information or monitored internet access. Moreover, Abuhammah (2021a) did not force responses within their GBV survey in an effort to protect participants from negative feelings/distress. McCarthy's (2017) SRH study incorporated instruction on how to delete or keep messages from the research team private. To monitor safety, the study also collected outcomes related to participants' experiences of physical violence since enrolling in the study. Less than 1% of respondents had reported experiencing physical violence while being in the study (O. McCarthy et al., 2017, 2018). Other safety-related measures included asking participants if they shared a phone, reestablishing a different call back time, providing a nickname or alias, and choosing a time for participation that was convenient for them (Babalola et al., 2019; Mbulayi et al., 2021).

Seven studies explicitly mentioned participant literacy levels and only one study implemented measures to assist illiterate persons in participating (Mahmood et al., 2021). Researchers contacted illiterate or low literacy participants by phone and manually filled out the online questionnaire on their behalf. In other studies, inadequate literacy was noted as an exclusion criterion (Abuhammad, 2021a; Babalola et al., 2019; González-Hernández et al., 2020; O. McCarthy et al., 2017; Restar et al., 2020; Ybarra et al., 2020) and no reported measures were implemented to reduce participation barriers. While literacy levels may be less of a concern regarding telephonic data collection, illiteracy or low literacy may affect recruitment efforts that are contingent upon participants reading study information and opting in.

Lastly, considerations given to gender digital divide were not a predominant theme across the studies. Three studies (Mahmood et al., 2021; O. McCarthy et al., 2017; Ybarra et al., 2020) highlighted women's more limited access to the internet and discussed strategies for mitigation. Women's access to the internet also included affordability concerns for mobile data (Ybarra et al., 2020). To mitigate the gender digital divide, telephonic data collection was offered in lieu of the online survey (Mahmood et al., 2021), internet access was provided when unavailable (O. McCarthy et al., 2017), online surveys were compressed to reduce mobile data usage, and SMS surveys were used in lieu of online surveys (Ybarra et al., 2020). Lastly, Babalola et al. (2019) noted that husbands' disapproval limited interactions with interventions intended to improve access to information about contraception.

Discussion

Scholarship that predates the pandemic has detailed the ethical and methodological challenges to conducting GBV and SRH research in humanitarian and fragile settings, thereby cautioning primary data collection in such contexts (Contreras-Urbina et al., 2019; Hossain & McAlpine, 2017; WHO, 2016). Accordingly, research on SRH and GBV does not always reflect the diversity of experiences for women and girls across the globe. For example, compared to stable settings in middle- and high-income countries, empirical research related to GBV and SRH is lacking in humanitarian and fragile settings, particularly within a pandemic context. The COVID-19 pandemic has magnified vulnerability to GBV and adverse SRH and reinforced context-specific existing challenges to conducting primary research pertaining to women and girls' SRH and GBV in humanitarian and fragile settings. Researchers and practitioners collecting primary data on GBV and SRH within such settings mobilize data collection against a backdrop of environmental, social, and political insecurity, necessitating methodological adaptations and special considerations for safety and ethics (Tables 5 and 6).

The present review synthesized empirical, peer-reviewed research using RDC to measure any outcomes related to GBV and SRH in humanitarian and fragile settings for the purpose of better understanding and addressing methodological and ethical considerations of primary data collection concerning in a pandemic context. By improving methodological and ethical parameters of data collection related to GBV and SRH in these settings, we hope to ultimately expand the understanding of women and girls' diverse experiences of violence and health. Overall, our synthesis indicates that conducting such research using RDC tools can maintain appropriate rigor and uphold ethical best practices under certain conditions. The rigorous and ethical application of RDC to collect sensitive information on SRH and GBV in humanitarian and fragile settings should be guided by best ethical and safety practices (Contreras-

Table 5. Critical Findings.

	Methodological Rigor
1	Prevalence estimation using online surveys distributed via social media pose serious methodological implications: (i) lack of a defined sampling frame, (ii) making participation contingent on having access to select technology, and (iii) high non-response/attrition.
2	To obtain rich data, mixed methods and qualitative research conducted using RDC tools such as WhatsApp voice memos and online focus group discussion forums should integrate mechanisms to probe participants on their responses/reflections.
3	Evaluation studies that aim to assess the effectiveness of SRH/GBV services could develop a sampling frame by recruiting active users of the service. However, it is important to apply measures that will bolster participant retention, including measures that maintain balanced attrition rates between comparator groups, if included.
	Ethics
4	The mapping out and inclusion of referral services in case of psychological distress, risk of violence, or other adverse events is critical for RDC because researchers have less control over the study implementation environment.
5	RDC has the potential to exclude women/girls that cannot access technology and the internet due to prohibitive costs, male gatekeepers, or harmful social norms that discourage their independent use of technology.
6	The exclusion of persons with low or no literacy levels was common among studies employing RDC and is a barrier to fostering an inclusive research environment and diversifying the samples and data obtained.

Table 6. Implications for Practice, Policy, and Research.

1	Practitioners, policymakers, scholars, and research ethics boards should critically consider how the methodological and ethical implications described might negatively impact the safety, data, and evidence they are trying to collect.
2	Promising practices to enhance rigor include the following: (i) Implementing strategies to define the sampling frame by using geo-located data, existing service users (in the case of service evaluation), and a pre-screening survey to aid in frequency sampling by key demographics; (ii) Collecting information on non-respondents or participants lost to follow-up and implementing measures to prevent harmful attrition; (iii) Using short, validated instruments to capture SRH/GBV outcomes and testing their applicability to RDC tools such as SMS; (iv) Actively probing participants during qualitative interviews via WhatsApp/online focus group discussions.
3	Promising practices to enhance ethics include the following: (i) Maintaining updated lists of referral services; (ii) Compensating participants for data/internet use costs upfront and providing tech support for participants with reduced digital skills/comfort; (iii) Giving participants the flexibility to choose the form of technology they are most comfortable using/can maintain safe access to; (iv) Making contingency plans of how to include participants with low or no literacy (i.e., additional phone surveys)
4	However, given contextual nuances, RDC of SRH/GBV in humanitarian/fragile settings may not always be feasible particularly if the safety can be reasonably compromised and if remote data collection and related sampling issues cannot address the research goal.

Urbina et al., 2019; Hossain & McAlpine, 2017; WHO, 2016) and may not always be appropriate in relation to the specified research goal.

Gap in the Evidence Base: Qualitative Research Using RDC Tools

Most of the studies included in this review utilized quantitative methods, indicating that the use of RDC tools to conduct qualitative research on GBV and SRH in fragile and humanitarian settings is even more limited in a pandemic context. The lack of qualitative research may pose epistemic challenges to collecting rich lived experiences from women and girls in humanitarian and fragile settings. Further, the ability to conduct realist evaluations of programs that incorporate qualitative data and triangulate methods may also be limited (Hossain & McAlpine, 2017).

Sampling and Response Rate Considerations

In humanitarian and fragile settings, it may not be financially or logistically viable to collect probability samples (Hossain & McAlpine, 2017), especially if the phenomenon under study is stigmatized. In such cases, researchers may use RDC tools (i.e., SMS, survey links) to facilitate peer-recruitment through respondent driven sampling. Moreover, while the use of online surveys disseminated through social media to collect prevalence data are popular, we advocate for a critical and thoughtful consideration of whether an appropriate sampling frame can be obtained. While prevalence data can help to prioritize needs, prevalence estimates are useful for planning if appropriate sampling strategies are used; otherwise, figures may over- or underestimate the true population prevalence parameter. Specifically, prevalence estimates using RDC tools may systematically exclude women and girls on the basis of inadequate internet access/affordability, low socioeconomic status, and suboptimal literacy. Accordingly, we reaffirm existing guidance for conducting research in humanitarian/fragile settings that prevalence data is not necessary for program development and can be considered a later-stage priority, particularly during periods of insecurity and infectious disease outbreaks (Hossain & McAlpine, 2017).

Regarding research specifically seeking to assess the feasibility or scalability of SRH or GBV services, promising ways to develop a sampling frame may include employing availability samples wherein all existing users of an application are invited to participate, using geo-located smart phone data, and screening potential respondents by demographic characteristics prior to accepting enrollment.

However, low response rates to survey questions disseminated among existing users of an SMS service or mobile application can introduce sampling bias if non-respondents are systematically different from respondents with respect to key variables. Thus, it is important to employ strategies that maximize participant retention such as disseminating survey questions immediately after users interact with the SMS service or mobile application, sending reminder messages using multiple modalities (SMS, instant message, email, phone call, etc.), and providing respondents with choice regarding amenable RDC tools.

Considerations for Measurement

Further, researchers must strive to incorporate validated and reliable SRH or GBV measures within RDC tools, taking into consideration that tools will need to be translated to the language of origin and back translated to ensure accuracy, pilot tested to assess psychometric properties, and adapted to the RDC tool selected. For instance, surveys delivered via SMS or instant messaging platforms could be simplified by using short versions of survey tools/scales/instruments. Further research is needed to develop and test publicly available short and reliable tools for measuring GBV and SRH that are intended for SMS or instant messaging platforms and appropriately normed among women and girls living in humanitarian settings. Such tools can be used in a pandemic context without sacrificing measurement quality. We also advocate for researchers to transparently report sample retention rates and make efforts to identify characteristics associated with non-response. This is of particular relevance among online surveys that are disseminated widely through social networking websites, thereby reaching persons who are eligible to participate but opt out. Given this review's focus on primary data collection, all outcomes related to GBV and SRH were self-reported, and subject to social desirability bias, particularly if respondents were under perceived surveillance of family/friends.

Ethical Considerations

Regarding ethics, it is widely known that providing referral services is a well-established ethical best practice (World Health Organization, 2016). Researchers have a duty of care, particularly when conducting sensitive research in humanitarian and fragile settings wherein participants face unique vulnerabilities with respect to stigma, elevated stress, gender discrimination, and lack of legal protection from gender discrimination (Hossain & McAlpine, 2017). Thus, a prerequisite step to the use of RDC tools in humanitarian and fragile settings ought to be a grounded understanding of social socio-political norms pertaining to gender, SRH, and GBV in order to assess what referral services may be needed as well as acceptable and mapping out such services. Creating a community steering committee by using participatory approaches or collaborating and co-partnering with local Feminist organizations or advocacy groups can help provide valuable contextual insights into the social, cultural, safety and legal situation prior to and during data collection, particularly if the level of insecurity changes as the research is being implemented (Contreras-Urbina et al., 2019; Hossain & McAlpine, 2017; Lokot, 2019). Secondly, low literacy in

combination with the gender digital divide may be of particular concern in fragile and humanitarian settings. Thus, researchers must incorporate strategies that mitigate barriers to participation among women/girls with low literacy and those affected by the gender digital divide, understanding that both may act concurrently to magnify barriers to participation in research employing RDC tools.

To advance research inclusion, it is imperative that participants be given different RDC tool options, depending on their literacy level and access to and familiarity with technology. Giving participants choice allows for greater freedom and opportunity to engage in research. However, the inclusion of women and girls in research by offering choice of RDC tool may come at a cost to measurement rigor; certain tools may introduce bias (i.e., social desirability bias may be greater threat in phone interviews compared to anonymous online surveys). Accordingly, researchers should collect data on what RDC tool was used and why in order to perform analytic control in regression analysis, sensitivity analysis, or hypothesize the direction of bias. Offering technological support is another strategy to mitigate participation barriers. Furthermore, of particular concern within humanitarian and fragile settings are inadequate internet infrastructure, affordability, and lack of compatible device ownership which can negatively affect respondent retention and participation; researchers should consider condensing internet-bases surveys for minimal data usage, using SMS for simple survey questions, and compensating participants for mobile data/internet charges.

The gender digital divide may manifest differently in terms of access, acceptability, digital literacy and internet access across humanitarian and fragile settings (Antonio & Tuffley, 2014). In humanitarian and fragile settings, normative barriers to women's adoption of information and communication technologies include the perceived lack of relevance/need, negative perceptions of cost (particularly among male gatekeepers), fear of women and girls' engagement in illicit relationships, infidelity, and exploitation, reputational damage, and beliefs that use of digital tools are a poor use of their time (Tyers et al., 2021; USAID, 2020). Thus, in collaboration with local groups, a context specific examination of the gender digital divide prior to data collection is prudent and appropriate measures must be incorporated to maximize women and girls' participation in RDC.

The exclusion of participants who do not have adequate access to RDC tools can also introduce bias. For instance, research has shown that household ownership of computers, phones (fixed and mobile), and radio was associated with women rejecting patriarchal justifications of physical intimate partner violence (Cardoso & Sorenson, 2017). Computer ownership and increasing the number of owned information and communication technologies showed the strongest associations (Cardoso & Sorenson, 2017). Thus, by conditioning eligibility on technology access/ownership, studies investigating GBV may inadvertently be underestimating the true measures of association and prevalence.

Researchers may also consider incorporating specific safety features within RDC, such as asking participants if they have a safe phone number or email, establishing with participants a safe time to be contacted by research staff, introducing or describing the research purpose in broad terms (i.e., women's health study), instructing participants to clear browser history or delete applications following study completion, and incorporating "quick escape" buttons (Seff et al., 2021).

Limitations

This systematic review has some limitations. First, due to the need for rapid evidence generation and synthesis, we could not accommodate two reviewers per title/abstract screened. Consequently, it is possible that the title/abstract screening yielded false negatives. We also did not consider non-English sources, which may have limited the sources considered for inclusion. Further, only considering peer-reviewed literature has the potential to omit relevant research conducted by monitoring and evaluation teams in humanitarian and fragile settings. Similarly, given the rapid expansion of remote data collection during the COVID-19 pandemic, it is possible that additional eligible studies were published between the database extractions and publication. However, we are confident that the range of included studies allowed for saturation of key methodological and ethical themes and best practice implications. Finally, we acknowledge that studies may have incorporated additional information related to our data extraction/charting, but simply did not report them.

Conclusion

This systematic review synthesized the existing evidence on the RDC of women and girls' SRH and GBV within the context of humanitarian and fragile settings. Key methodological and ethical considerations were critically examined, including the consideration of an appropriate sampling frame when relying on online or mobile application samples, the introduction of bias when constraining eligibility on technology ownership/access, as well as how to minimize the gender digital divide and maximize women and girls' safety during data collection. The COVID-19 pandemic and lack of vaccine equity in humanitarian and fragile settings pose considerable challenges to in-person data collection. This review is intended to aid SRH and GBV researchers in critically examining the appropriateness of using RDC in humanitarian and fragile setting.

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Supplemental Material

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