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ARTICLE

Sexual and Reproductive Service Interventions for Menstrual Regulation, Safe Abortion, and Post-abortion Care and Their Effectiveness During Disaster Response: A Global Systematic Review

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Abstract

Sexual and reproductive health (SRH) services are crucial for women especially during disasters, to reduce maternal mortality and morbidity from miscarriages, unsafe abortions, and post-abortion complications. This study explored the SRH interventions provided during disaster response. A systematic review was conducted to identify what menstrual regulation (MR), safe abortion (SA), and post-abortion care (PAC) approaches/interventions exist to promote resilience in the health system in disaster settings; what intervention components were most effective; and challenges and opportunities to meeting SRH rights. Five electronic databases were searched, resulting in 4194 records. Following the screening process, seven publications were included. The intervention-related information in each publication was assessed based on availability, accessibility, acceptability, and quality. Two SRH approaches/interventions were found. The effectiveness of intervention components could not be conducted due to the limited number of relevant studies. Challenges were found at facility and community levels, and opportunities included overcoming them, making MR, SA, and PAC integral to the mitigation phase, and policy change to overcome barriers related to unaffordability and inaccessibility. Recommendations are provided to encourage research and policy towards improving neglected SRH in disaster settings to realize Sustainable Development Goal 3 and the Global Strategy and Sendai Framework's priority to promote disaster-resilient health systems.

Keywords Abortion · Disasters · Sendai framework · Sexual and reproductive health · Sustainable development goal

1 Introduction

Access to sexual and reproductive health (SRH) services is vital to save women's lives during disasters. The Alma-Ata Declaration in 1978 emphasized the importance of access to healthcare as a human right, achievable by providing primary healthcare (PHC) (ICPHC 1978; WHO 2023). Sexual and reproductive health services form a core component of primary and secondary healthcare levels. The World Health Organization (WHO) stated that during emergencies and

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all other times, the promotion of SRH through PHC should consist of prenatal, skilled childbirth, and post-natal care, as well as comprehensive abortion care and family planning (FP) services. As such, SRH services must be kept functioning at the PHC level to promote the right to healthcare. Sexual and reproductive health services are also part of the United Nations (UN) Sustainable Development Goals (SDGs), especially Goals: 1 (Reduce Poverty), 3 (Good Health and Well-Being), and 5 (Achieve Gender Equality and Empower all Women and Girls).

Tragically, SRH problems, especially unsafe abortion, and post-abortion complications, are a leading cause of women's illnesses and death worldwide (WHO 2017). In 2008 there were 21.6 million unsafe abortions, with 21.2 million occurring in developing countries (WHO 2017). From 2010 to 2014, it was estimated that about 55.7 million abortions occurred worldwide annually (Sedgh et al. 2016). Sexual and reproductive health issues are under-researched in humanitarian settings and especially during disasters triggered by natural and biological hazards (Koblinsky et al. 2016; Ray-Bennett et al. 2019). By the end of 2015, the United Nations Population Fund (UNFPA 2015) estimated that two out of every three maternal deaths would occur in countries affected by humanitarian crises or fragile conditions. Although the UN's Global Strategy for Women's and Children's Health 2010–2015 led to saving millions of lives and progress towards the health Millennium Development Goals (MDGs—predecessor of the SDGs), far too many women, children, and adolescents worldwide still lacked access to essential, good quality health services and education in general and in disaster and crisis settings in particular towards the end of the MDG era (Every Woman Every Child 2015). To rectify this, the current Global Strategy for Women's, Children's and Adolescents' Health (2016–2030) (hereafter, the Global Strategy) for the first time focuses on safeguarding women, children, and adolescents in humanitarian and fragile settings and upholding their human rights to the highest attainable standard of health, even in the most difficult circumstances (Every Woman Every Child 2015). As such, national governments are working towards reducing maternal deaths to fewer than 70 per 100,000 live births to meet SDG 3 (UNFPA 2015) as well as achieving "health system resilience" that provides quality care in all settings, prepares for emergencies, and ensures universal health coverage (Every Woman Every Child 2015).

The physical vulnerability of healthcare facilities during disasters is of great concern as it can hinder or even cease the delivery of essential healthcare services, including SRH (WHO 2010). For instance, flooding causes structural failures (such as damage to infrastructure, medical equipment, power supplies, communication means, transportation methods, and water supplies) and inhibits health facilities' functionality (Phalkey et al. 2012; Van Minh et al. 2014; Ray-Bennet et al. 2021).

To reduce maternal mortality and morbidity from miscarriages, unsafe abortions, and post-abortion complications during disasters triggered by natural hazards, health systems, particularly PHC in hazard-prone locales, need to be strengthened by holistically expanding their coverage and comprehensiveness to promote health system resilience urged by the Global Strategy. This is also consistent with the Sendai Framework for Disaster Risk Reduction 2015–2030 (hereafter, the Sendai Framework) Global Target 4: "Promote disaster-resilient health system by 2030" and Priority for Action 3, which is to: "Investing in disaster risk reduction for resilience" and clause 30i, 31e, and 33c directly emphasize the importance of enhancing and building the resilience of health systems and infrastructure (UN 2015). Also, the PHC systems should adhere to the "availability, accessibility, acceptability and quality" framework for SRH in disaster-prone areas to promote SRH rights (Starrs et al. 2018).

Against the background of continuously evolving international frameworks such as the Global Strategy, SDGs, Sendai Framework, and SRH services, a systematic review was conducted to investigate: (1) What SRH for menstrual regulation (MR), safe abortion (SA), and post-abortion care (PAC) approaches/interventions for service delivery have been adopted in disasters settings? (2) What components in those SRH for MR, SA, and PAC interventions implemented were most effective in increasing "availability, accessibility, acceptability and quality" in disaster-prone areas? and (3) What are the challenges and opportunities of implementing these SRH for MR, SA, and PAC inventions during disasters? The overall aim of this study was to explore not only the current state of SRH service interventions and existing gaps but also make recommendations to improve them based on evidence and, by doing so, facilitate rights to healthcare, SDG 3, Sendai Framework's Priority for Action 3 particularly in countries that are vulnerable to disaster risks.

This systematic review was initiated as part of a bigger research project funded by the government of Bangladesh's National Institute of Population Research and Training (NIPORT), Ministry of Health and Family Planning under the ambit of the Procurement of Services Package NPS 29: "Sexual and Reproductive Health Services in Remote and Hard-to-Reach Areas of Bangladesh (Operations Research) and Related Services." One of the aims of this project was to identify SRH interventions for MR and PAC that could be adopted for hard-to-reach disaster-prone health facilities of Barguna District of Barisal Division and Sunamganj District of Sylhet Division. Therefore, some of the selection criteria, such as excluding humanitarian crises in the review, are influenced by this project.

2 Methods

The primary objective of this review was to identify and synthesize quantitative and qualitative studies that examined MR, SA, and PAC service provision in disasters triggered by natural hazards during response and recovery phases. The review protocol was preregistered on the International Prospective Register of Systematic Reviews (PROSPERO ID: CRD42022353014) (Ekezie et al. 2022), and the review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al. 2021). Before performing the study, similar reviews were searched, but none were found. We comprehensively searched peer-reviewed literature in consultation with a medical librarian. A review of published literature was performed to identify publications related to the research questions between 2010 and August 2022. The year 2010 was selected because that year marked the launch of the UN's Global Strategy for Women's and Children's (Health Every Woman Every Child 2015). It was revised in 2015 to become the Global Strategy for Women's, Children's and Adolescents Health (2016–2030) (WHO 2018).

2.1 Search Strategy

The search strategy for the broad project review was applied to the following databases: MEDLINE, EMBASE, PsycINFO, PubMed, and CINAHL. These databases and repositories were selected based on their coverage of public health, SRH, and "natural" disaster topics. For the grey literature, a search was conducted through the first 10 pages of Google Scholar and preprint databases (SocArXiv, MedRXiv, PsyRXiv, and SSRN). For the purpose of this study, we used the subset of the search results from the five academic databases. As such, no findings from international reports and grey literature are produced in this article.

The search terms were based on a combination of keywords for three key concepts: "female" AND "sexual and reproductive health services" AND "natural disasters." Within each concept, keywords were combined with Boolean search operators. The publication search was restricted from 2010 to August 2022. Relevant studies not captured in the database search engines were identified through bibliometric cross-referencing. Only publications available in the English language were considered.

2.2 Eligibility Criteria

Using PICOS (Population, Intervention, Comparator, Outcome, Study Design), the following inclusion criteria were used (Table 1):

Exclusion criteria include: Papers with no empirical data, not in English, and published before 2010; Women and girls who do not undergo menstruation and those who have attained menopause; Women of reproductive age in humanitarian crisis settings; Commentaries, editorials, conference papers, and letters to editors without intervention components evidence; and Animal and laboratory studies.

2.3 Definition of Terms

Sexual and Reproductive Health (SRH): A state of physical, emotional, mental, and social well-being in relation to all aspects of sexuality and reproduction, not merely the absence of disease, dysfunction, or infirmity (Starrs et al. 2018).

Menstrual Regulation (MR): Evacuation of the uterus performed by a trained provider within 12 weeks of a missed period using manual vacuum aspiration or a combination of Mifepristone and Misoprostol medication (Ipas 2018; Ray-Bennett et al. 2021).

Post-Abortion Care (PAC): A medical technique used to reduce injuries and deaths from incomplete and unsafe abortions, as well as any complications that may arise (Ipas 2018). Post-abortion care includes five essential elements: (1) treatment; (2) counselling; (3) contraceptive and family-planning services; (4) reproductive and other services; and (5) community and service-provider partnerships (Ipas 2018).

Availability, Accessibility, Acceptability, and Quality: "Availability" is understood as the services for MR, PAC, contraceptives, and family planning (FP) are available to all women and girls of reproductive age (15–49 years of age)

Table 1 Inclusion criteria

1. Population of interest	Women and girls of reproductive ages (15–49 years) living in disaster settings
2. Interventions	Interventions such as menstrual regulation (MR), safe abortion (SA), and post-abortion care (PAC)
3. Comparator	Comparators such as pre-intervention data, alternative intervention, or control groups
4. Outcomes of interest	SRH components of SRH intervention implemented packages
5. Study designs	All study designs, including quantitative and qualitative, case reports, published from 2010

in the PHC facilities where they reside in their everyday life and during disasters. "Accessibility" is when these services can be accessed by clients. "Acceptability" is when the services provided are acceptable and can be measured through the uptake of services. "Quality" in the context of this study refers to both the technical quality and the perceived quality of services. Technical quality is defined as the degree to which primary healthcare facilities' physically measurable attributes (infrastructure, facilities, and services) meet acceptable standards, and perceived quality is defined as the clients'/patients' perception of the overall quality of the service they received (Ray-Bennett et al. 2018).

Disasters: A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic, and environmental losses, and impacts (UN 2020). Disasters can be triggered by natural or biological hazards (for example, droughts, floods, epidemic, pandemic) (UN 2020).

2.4 Study Selection

The records were uploaded to "Rayyan" review manager (Rayyan 2022), a free web application with semi-automation that supports the screening of abstracts and titles based on the eligibility criteria. After removing the duplicates, the remaining records were manually screened to determine whether they met the eligibility criteria. Discrepancies were resolved by discussing with two reviewers. Studies that met the inclusion criteria underwent full-text screening. The reference lists of the articles included in full-text screening were reviewed for additional articles.

This systematic review focused on women and girls of reproductive ages in disaster settings. The review aimed to identify the components of implemented SRH packages that contributed to the success of MR, SA, and PAC interventions offered in everyday life and under a comprehensive SRH service package during active disaster crises. In contrast, in standard humanitarian set-ups, permanent and physical primary health facilities may not exist, making it difficult to implement appropriate SRH services properly. Hence, studies focusing only on humanitarian settings (including conflict-related disasters) were not considered for this review.

2.5 Data Extraction and Analysis

Data from all included studies were extracted into an Excel spreadsheet. Key variables extracted included: author(s), year, country, intervention details, study population, design, setting, intervention details, and outcomes. Two reviewers conducted data screening and extraction, and disagreements were resolved through discussions with a third reviewer. Only descriptive data analysis was performed as the studies were highly heterogeneous, and meta-analysis was not possible.

2.6 Study Appraisal

Quality assessment was conducted using JBI Critical Appraisal Tools (JBI 2024). The JBI quality assessment is not judged as a numerical scoring of the checklist components; therefore, this review had a subjective element to the grading decision. Studies were graded based on how many of the assessment requirements were met: $< 60\%$ requirements (low), 60–79% (medium), and $\geq 80\%$ (high). The high cut-off for the low range was used to factor in the limitations of studies that are often not reflected in quality assessments, for example, variation in populations and study time points.

2.7 Synthesis Method

Findings from the included studies were entered into tables, and descriptive narrative synthesis of the SRH interventions was conducted. The intervention components and evidence were assessed based on the availability, accessibility, acceptability, and quality of SRH services. Due to the limited number of relevant studies, the most effective service components could not be summarized into a simple model recommending the best package, as initially proposed in the review proposal (Ekezie et al. 2022). There were significant levels of heterogeneity between the included studies; hence, a comparative quantitative analysis was not conducted. Considering the differences between the studies, the narrative aimed to summarize the related information across the studies; hence the summary might be subjective and not easily generalizable.

3 Results

This section presents the results specific to the research questions (see Sect. 1). First, it presents the selection and characteristics of included studies, followed by the interventions found based on the review of empirical and review studies and case reports. Second, it provides the intervention effectiveness, factors that influence interventions, and the challenges and opportunities surrounding MR, SA, and PAC interventions.

3.1 Study Selection

A total of 4194 search results were identified (Fig. 1). After removing duplicates, the titles and abstracts of 4037 studies were screened. This resulted in the selection

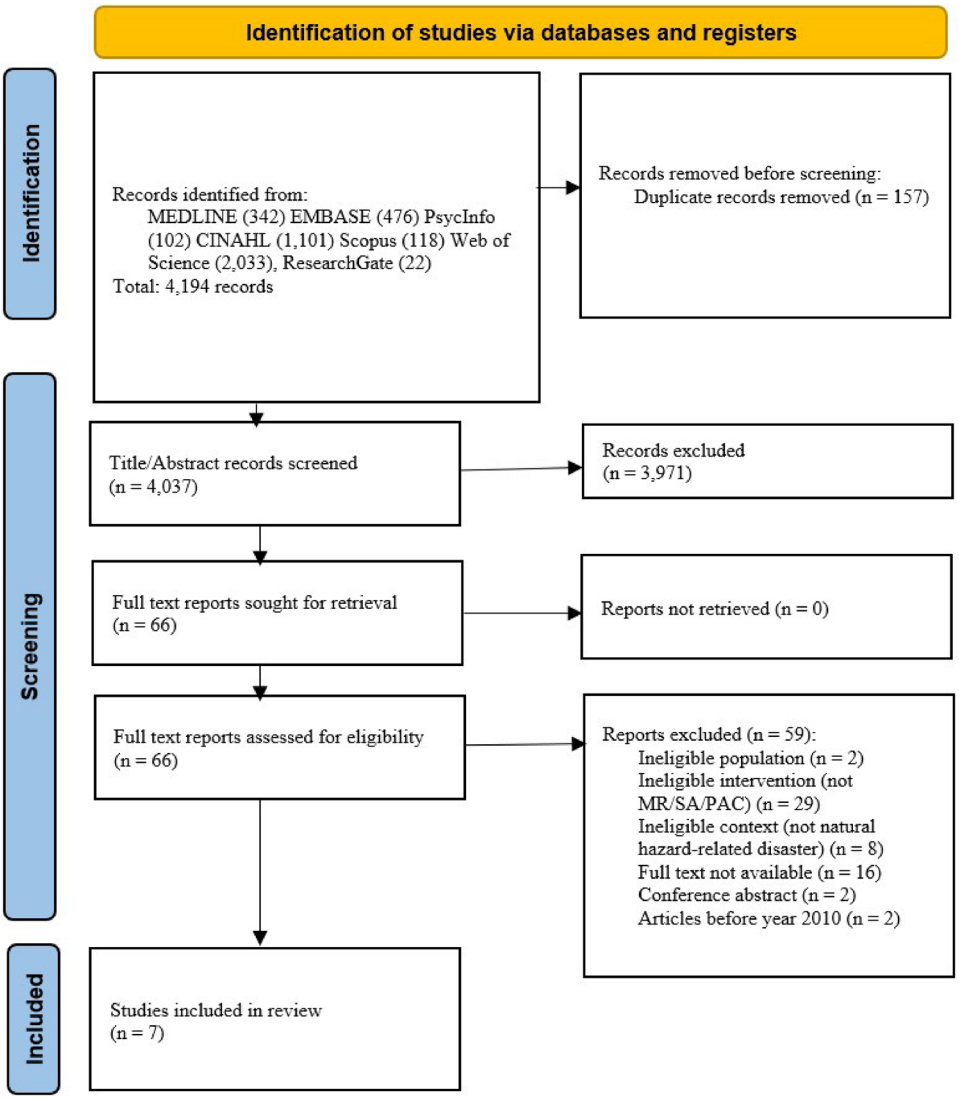

Fig. 1 Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram of study inclusion

of 66 articles and following the full text screening seven publications were included in this review: three empirical studies, two review studies (one scoping review and one systematic review), and two case reports. Due to the limited number of eligible primary studies, this current review presents the findings of all seven related publications. The included studies used were based on qualitative and mixed methodology approaches.

Quality of the three empirical studies was medium-high (one medium and two high). The primary difference between the study quality was the methodological appropriateness for the study objectives, which was also a challenge in the other study types (that is, review and case report studies). The low number of studies shows the general limitation in the methodological processes in the SRH disaster studies. Consequently, the study quality outcomes were not used to interpret the findings in order not to limit the interpretation of the information provided.

3.2 Characteristics of Included Studies

Studies identified represented four countries—Bangladesh, Nepal, Turkey, Zambia—and broad geographic regions (North America, South and Central America, Europe, Oceania, and Asia) (Table 2). These studies aimed to identify related challenges; describe how disasters affected SRH services and care-seeking patterns; evaluate healthcare facilities' capacity to provide PAC during disasters, the need for culturally-appropriate SRH care; and understand why SRH services are missing from national mitigation frameworks.

Populations in the studies included women, adolescents, and people of diverse sexual identities aged between 15 and 73 years old. Flooding and earthquakes were the primary disasters reported. Two studies reported on SA, four on PAC, and three on MR. The duration of the studies ranged from 2 months to 15 years. Outcomes measured were women making informed decisions and self-diagnoses, spontaneous

Table 2 Summary of the included studies

Author(s)	Country/region of Study	Study design	Disaster type	Sample size/group	Intervention type (MR, SA, or PAC)	Intervention duration	Outcomes	Findings/results
Freed et al. (2021)	North America, South and Central America, Europe, Oceania, Asia, Turkey	Scoping review	Disease outbreak and pandemic	108	MR	2010–2020	Contraception needs during disasters	Four key themes: - Importance of contraception during disasters; - Impact of disasters on contraceptive behavior; - Barriers to contraception during disasters; and - Ways of improving the use of contraception during disasters.
Husaini and Davies (2022)	Bangladesh	Case report	Flood	73	PAC	2015–2021	Recovery-centered approach to disaster	SRHR neglected from climate-related event policies and frameworks due to national and international neglect of SRHR in climate change policy.
Loewen et al. (2021)	Africa, Asia, and the Caribbean	Systematic review	Earthquake, flood, disease outbreak	13	MR, PAC, SA	2005–2020	Disruption of SRH services	Disruptive events worsened the availability of and women's access to SRH services, contributed to decreased utilization of SRH services, and often resulted in lower use of family planning, particularly methods requiring facility-based interaction.

Table 2 (continued)

Author(s)	Country/region of Study	Study design	Disaster type	Sample size/group	Intervention type (MR, SA, or PAC)	Intervention duration	Outcomes	Findings/results
Ray-Bennett et al. (2019)	Bangladesh	Mixed methods	Flood	372 married women	MR, PAC	January–February 2017	Facility and community-level challenges	48% of women sought MR from the residence of a nurse or family welfare visitor; 73.2% of women who experienced post-abortion complications sought medical care.
Ray-Bennett et al. (2021)	Bangladesh	Mixed methods	Flood	372 women (15 to 49 years old)	MR, PAC	27 months	Self-diagnosed "spontaneous abortion," "menstrual regulation."	The intervention increased skilled management among health workers, quality of care, and availability of PAC at three PHC facilities during floods.
Rogers et al. (2019)	Nepal	Report	Earthquake	Women of reproductive age (No sample size)	SA	Not reported	Women making informed decisions about pregnancy termination	Service providers are not always equipped with accurate information to support women in times of disasters.
Rosen et al. (2021)	Zambia	Qualitative	Drought	181 women	MR	Not reported	Family planning services susceptible to drought-related disruptions	Drought-related disasters linked to reduced fertility intentions.

SRH Sexual and reproductive health, *SRHR* Sexual and reproductive health rights, *MR* Menstrual regulation (MR), *SA* Safe abortion, *PAC* Post-abortion care, *PHC* Primary health care

abortion, MR, FP services susceptibility in drought, disruption of SRH, services facility and community level challenges, and contraception needs during disasters.

3.3 Sexual and Reproductive Health (SRH) Service Approaches/Interventions

The SRH (MR, SA, and PAC) services delivered or assessed in the included studies are summarized based on study type (that is, empirical studies, reviews, case reports).

3.3.1 Empirical Studies

Three studies with empirical data focused on MR and PAC—MR in all studies and PAC in two studies (Ray-Bennett et al. 2019; Ray-Bennett et al. 2021; Rosen et al. 2021). The studies, including PAC, were on flooding in Bangladesh, and one study highlighted challenges of PHC facilities for pregnant women that may inform policy and enhance disaster resilience (Ray-Bennett et al. 2019). The same study measured self-diagnosed "spontaneous abortion," observing that 59.7 and 40.3% of the participants received MR and PAC services, respectively, during the flood of 2016 in Bangladesh. Most popular method used was IUD/Copper-T, rather than oral contraceptive pill and birth control injection. After the floods, only 11.2% returned to the same facility to receive FP methods. This study was the feasibility component for the Ray-Bennett et al. (2021) study, which developed an intervention package called RHCC based on three components: the UNFPA Reproductive Health Kit 8, Capacity building, and **C**ommunity awareness.

The RHCC was implemented in three phases (Feasibility, Intervention, and Evaluation) over 27 months. After the implementation, 53% of the participants (372) self-reported their most recent failed pregnancy as spontaneous abortion, and 47% reported menstrual regulation/induced abortion. A Basic and Refresher Medical Course on how to administer the Kits was offered as part of the intervention to 10 health workers. Three community awareness programs were conducted and over 400 people attended. Post-intervention discussions revealed that all the participants rated their skill level as 5 (highest point) and stated the training also improved their knowledge and skills in other areas, such as FP counselling. However, the evaluation phase revealed that 55.6% of the participants recalled the program but could not remember its content.

The other MR study, a qualitative study by Rosen et al. (2021), explored the impact of severe and prolonged droughts on SRH outcomes in Zambia. The findings reveal that SRH services became increasingly inaccessible during droughts as dwindling income constrained resources and opportunities for seeking and obtaining healthcare. Family planning and contraceptive services were particularly impacted by drought. Stockouts at health facilities were frequently reported diverting women away from public health facilities (where contraceptives were available for free) to private sources like pharmacies. Findings from this study also indicate declining fertility intentions among men and women who competed for diminished access to health resources, including contraception provisions that could empower families to delay childbearing (Rosen et al. 2021).

3.3.2 Review Studies

The two review studies summarized interventions in different disaster settings: earthquake, flooding, and disease outbreaks across different countries (Freed et al. 2021; Loewen et al. 2021). These studies presented general overviews of SRH service-related factors from different studies but no specific interventions.

The scoping review by Freed et al. (2021) explored the impact of naturally triggered and biological disasters on contraception in the Organisation for Economic Co-operation and Development (OECD) member countries; 108 articles were included, and most focused on Zika virus outbreak (n = 50) and COVID-19 pandemic (n = 28). The study reported on MR interventions over 10 years (2010–2020) and assessed contraception needs during disasters. The four themes identified were the importance of contraception during disasters, impact of disasters on contraceptive behavior, barriers to contraception during disasters, and ways of improving contraception use during disasters.

The review study by Loewen et al. (2021) reported on MR, SA, and PAC interventions over 15 years (2005–2020) and assessed SRH service delivery disruptions and outcomes from natural hazards and epidemics. Thirteen studies were included across different countries: Africa (n = 8, Sierra Leone, Liberia, Guinea, Democratic Republic of Congo), Asia (n = 3, Indonesia, Bangladesh), and the Caribbean (n = 3, Haiti). Findings showed that across all contexts, disruptive events worsened availability and access to SRH services, and decreased SRH and FP services utilization, particularly methods requiring facility-based interaction.

3.3.3 Case Report

The report by Husaini and Davies (2022) investigated the recognition of SRH rights during disaster responses in Bangladesh using secondary data between 2015 and 2020. Seventy-three reports were analyzed, and key findings were: practical exclusion of SRH rights and services from climate-related events (CRE) analysis in Bangladesh SRH rights at the national level in recovery context and framed for economic empowerment with a focus on the Rohingya refugee women population. The findings revealed that most reports

presented recovery-centered approaches that excluded SRH rights and services.

The other report by Rogers et al. (2019) presented an intervention in Nepal provided by a nongovernmental organization (NGO) addressing women's decision-making processes around abortion. The report showed that women's decision making was impacted by misinformation and how the intervention tailored their abortion counselling to ensure that women could make informed decisions regarding their choice to terminate their pregnancy.

3.4 Intervention Effectiveness

The intervention-related information in each study was assessed based on four factors: availability, accessibility, acceptability, and quality. Effectiveness could not be analyzed due to the limited number of studies. Hence, only generic information related to the four factors assessed is summarized (Table 3)

3.4.1 Availability

From the RHCC intervention by Ray-Bennett et al. (2021), 82.8% of the participants received information about FP methods. For continuity of PAC, 52.7% of the participants did not receive information about FP methods, and 51.9% were not told when to return to the health facility again. With no previous record of MR and PAC services at the selective PHC facilities, service uptake could not be compared. Therefore, it is difficult to establish whether the RHCC increased the utilization rate of MR and PAC services.

Rosen et al. (2021) reported that drought-induced financial insecurity limited women's capacity to afford SRH services in the context of pre-existing unavailability (that is, long distances to facilities from rural communities) and fledgling health systems infrastructure (that is, supply stockouts). Also, before the drought, frequent contraception shortages at health facilities drove women to purchase FP commodities from private sources like pharmacies. For women using shorter-acting hormonal methods, like injectables or pills, routine contraceptive purchases from private sources became unaffordable as household incomes shrank during prolonged periods of drought. Routine commodity stockouts at health facilities disincentivized women from travelling long distances for follow-up contraceptive services and getting turned away. High stockouts at health facilities were reported, diverting women away from public health facilities (free contraceptives offered) to private sources selling contraceptives at unsubsidized rates. This resulted in higher FP service interruptions and contraceptive discontinuation rates.

To address misinformation about women's decision-making processes around abortion, the report by Rogers et al. (2012) reported how an NGO tailored their abortion counselling to ensure that women could make informed decisions regarding their choice to terminate their pregnancy. The other reports by Husaini and Davies (2022), which previewed the CRE Policy Instruments in Bangladesh, reported no existing guidelines or strategies on how local or national government can accommodate women's needs and survival. In the review by Freed et al. (2021), a range of actions related to contraception was deployed to mitigate disaster effects, and these included government communication with the public (for example, health campaigns), increased access to contraception (for example, distribution of condoms, removal of financial barriers), and transforming the delivery of contraception (for example, telehealth, drive-throughs, curbside administration). Mixed evidence on whether disasters increased contraceptive needs and changed contraceptive behavior depended on individual personal situation and relationship status. Lack of evidence of contraception use during disasters and non-disaster periods made it difficult to assess how disasters affected demand and usage and general evaluation of contraception use changes.

Table 3 Summary of factors influencing menstrual regulation (MR), safe abortion (SA), and post-abortion care (PAC) interventions

Domains	Influencing factors
Availability	Structural facilities Availability of sexual and reproductive health (SRH) resources Availability of trained service providers Willingness of service provider
Accessibility	Location of services Cost of services
Acceptability	Awareness and knowledge of services Religious and cultural factors Stigma Past experiences Ability to care for children
Quality	Availability of equipment Follow-up services Complications after receiving service

3.4.2 Accessibility

Loewen et al. (2021) assessed patterns of utilization of FP services during disruptive events and observed that the assessments largely used national service delivery databases to analyze monthly usage before, during, and after disruptive events. Included studies reported that the utilization of FP services dropped during and after disruptive events. Also, it was reported that during an earthquake in Indonesia, women were less likely to practice FP than before the earthquake due to decreased service availability. This supported the findings by Rosen et al. (2021), about SRH services

becoming inaccessible during droughts due to dwindling income, constrained resources, and reduced opportunities for seeking and obtaining healthcare. Rosen et al. (2021) also reported that maternal healthcare continuum, from antenatal care appointments to facility-based birthing services, were financially untenable during droughts because, with minimal discretionary income for transportation and out-of-pocket expenses for facility-based services, women opted for home births.

At an individual level, the studies by Ray-Bennett et al. (2019, 2021) observed that without public transport and boat services, access to health facilities was a challenge during the flood of 2016, leading to increased access and availability through varied locations, including residential care. Most participants (48.48%, 179/370) received MR from the home/residence of a nurse or female welfare visitor. Of the participants, 73.2% also reported MR-related complications. However, overall, the review by Freed et al. (2021) highlighted a lack of evidence on the use of contraception in times of disaster and in non-disaster periods, making it difficult to assess how disasters affect the demand for and use of contraception.

3.4.3 Acceptability

Factors that affected SRH service acceptance by women who needed the services were highlighted by Freed et al. (2021) under two major themes: "demand and usage of contraception" and "contraceptive choice." Demand was related to wanting to delay childbearing during and considered use of Long-Acting Reversible Contraception (LARC), while contraceptive usage differed among women (for example, married and cohabiting women and non-cohabiting and single women). The demand perspective was also observed by Rosen et al. (2021) who discovered how participants sometimes preferred smaller families during droughts. This motivated the use and adherence to contraceptives despite barriers to SRH services, which intensified during droughts, showing the financial impact on SRH services acceptance decision making.

Another influencing factor was religion and culture. The study by Husaini and Davies (2022) highlighted that among women in rural communities, topics related to SRH were still taboo. So, instead of accessing services from health providers, young girls and women often sought information from peers and friends, leaving room for misconception and false information sharing, which can be detrimental to the health and well-being of women. In addition, Ray-Bennett et al. (2019) revealed how religion influenced service providers' and recipients' consideration of the services. Ray-Bennett et al. (2021) reported that after the floods of 2016, the low utilization rate was due to society's religious beliefs towards menstrual regulation ("that menstrual regulation is a sin").

3.4.4 Quality

The technical quality and perceived quality of services from study participants were considered. Ray-Bennett et al. (2019) observed that there were poorly equipped shelters for the reproductive health needs of women. Rosen et al. (2021) reported that while drought increased demand for health services as more people suffered from malnutrition and disease, accessibility and quality of these services simultaneously decreased as households struggled to find income to pay for basic expenses, like food and school fees. This contributed to some women delaying seeking antenatal care due to high service costs. Additionally, community members and health providers alike reported an increase in childbirths outside health facilities as health services became increasingly unaffordable and inaccessible during drought.

The facility assessments to ascertain technical quality in Ray-Bennett et al. (2019) study revealed that 26% of health staff required training to administer the RH Kit 8, and 62% of participants felt health workers did not assure them about the confidentiality of their information. On the effectiveness of the SRH product, Freed et al. (2021) identified the importance of different contraceptive choices and identified that while LARC did not consistently achieve menstrual suppression, it made the bleeding lighter and more manageable.

3.5 Intervention Challenges and Opportunities

The studies noted several challenges at the facility, community, and individual levels and opportunities for intervention implementation (Table 4).

3.5.1 Challenges

At the facility level, the main challenges were a lack of services and a shortage of medicines and equipment. The lack of services at the facilities was caused by three reasons: absence of trained family welfare visitors, religious beliefs of health workers, and lack of staff motivation to increase contraception uptake (Ray-Bennett et al. 2019). Shortage of trained health staff was also driven by the retirement of older staff, who accounted for the most trained to provide MR, and limited new staff recruitments to replace them. Also, Rogers et al. (2019) reported that service providers were not always equipped with accurate information to support women in times of crisis. At the community level, the challenges were displacement, spontaneous abortion, complications after receiving MR, and poor accessibility due to the unavailability and disruption of public transportation services (Ray-Bennett et al. 2019). Individual care-seeking

Table 4 Summary of challenges and opportunities of service implementation

Challenges	Facility level - Structural damage (disruption to the water supply, electricity) - Lack of training on MR, SA, and PAC - Shortage of trained staff - Retirement of older and most trained staff - Refusal to offer service due to religious reasons - Ill-equipped shelters for reproductive health needs - Poor follow-up - Distance - Costs - Stockouts (non-availability)
	Community and individual level - Displacement - Spontaneous abortion - Medical complications after receiving menstrual regulation and post-abortion care - Limited transportation - Cost - Fear of services - Relationship conflict
Opportunities	- Varied locations for receiving menstrual regulation - Home/residence care - Top methods: IUD/Copper-T, oral contraceptive pill, birth control injection - Education for pregnant women on how to treat and manage spontaneous abortion - Procurement and promotion of long-acting reversible contraceptive methods - Task-shifting to and expanded financing of non-facility-based health workforce cadres (that is, community-based distributors) - Construction and staffing of additional rural health posts - Communication with the public - Strategies to increase access to contraception - SRH rights

SRH Sexual and reproductive health, *MR* menstrual regulation (MR), *SA* safe abortion, *PAC* post-abortion care

patterns influenced the uptake of services, and most participants received the MR from the health staff. Some complications were reported after receiving MR, including severe pain, excessive bleeding, weakness, irregular menstrual cycle, and so on, and these experiences increased fear and deterred women from accessing the services.

The intervention programs in the Ray-Bennett et al. (2021) study were planned to take place prior to the 2017 floods to raise awareness about the availability of MR and PAC, but due to organizational challenges between collaborating partners, this was not fully achieved and thus was held during the flood. During the peak of the floods, it was then too difficult to gather details of the participants for a follow-up interview study.

Loewen et al. (2021) described FP access and local abortion services availability variation by geography and context. For instance, in Indonesia, following the 2006 earthquake, women reported difficulty accessing contraception, mainly because there was no contraception available at health facilities; and following another earthquake in 2009, health facilities suffered devastating structural damage that impacted their ability to provide SRH services. These physical damages were the cause of 83% respondents experiencing difficulties accessing maternal and child health services that they had not previously experienced, and 90% reported worsened availability of services compared with before the earthquake (Djafri et al. 2013). Similarly, Rosen et al. (2021) discovered how drought in Zambia heightened the demand for FP services as women's and men's fertility intentions shifted alongside deteriorating household incomes.

Freed et al. (2021) summarized the barriers to the use of contraception during disasters, which included the closure of health providers; lack of safety when travelling to health facilities; policies and institutional organizations; lack of ability to afford contraception; health providers' unwillingness to provide contraception; lack of knowledge about adverse outcomes of infectious diseases; and supply shortages. Similarly, Husaini and Davies (2022) also reported that most participants knew little about safe abortions, and many considered abortion a sin. Most women were also unaware of the health adversity that could arise from unsafe and failed abortions. It was also noted that women who did not have a choice in their bodily autonomy (either to failed abortions or cultural and family pressures) were forced to proceed with unwanted pregnancies and would receive very little medical support or care during and post-pregnancy.

3.5.2 Opportunities

Ray-Bennett et al. (2019) stated that to reduce the distress and suffering of pregnant women during a flood evacuation, governments and NGOs must include reproductive health as an integral part of relief and response activities. Sexual and reproductive health should also play an integral role in the management of flood shelters to increase their utility.

In the study by Rosen et al. (2021), since the main challenge observed was SRH unaffordability and inaccessibility of SRH services, the study suggested the following: policy solutions to rectify the immediate SRH needs of women, prioritization of procurement and promotion of long-acting reversible contraceptive methods. It also advised task-shifting and increasing health workforce density, including investing in community-based distributors.

Freed et al. (2021) proposed areas for improving the use of contraception during disasters, such as proactive communication, provision of contraception, and innovative strategies to increase access to contraception. These also support the appeal by Loewen et al. (2021) on the need for SRH in disaster response plans to be prioritized, as women often lose access to these essential services at a time when they are at their most vulnerable, and the need for evidence regarding effective interventions and policies, which is currently lacking.

4 Discussion

This section discusses the results specific to the three research questions (see Sect. 1). It also identifies a few strengths and weaknesses of this study.

4.1 Sexual and Reproductive Health (SRH) Interventions for Menstrual Regulation (MR), Safe Abortion (SA), and Post-abortion Care (PAC) Interventions in Disaster Settings

Of the seven selected studies, only one empirical study by Ray-Bennett et al. (2021) developed and evaluated an evidence-based MR and PAC RHCC intervention at the PHC level during a major flood in Bangladesh. This RHCC intervention engaged with the Sendai Framework's "disaster resilience" concept and the availability, accessibility, acceptability, and quality framework for evaluation. This indicates that more such context-specific SRH interventions are needed to promote health system resilience in disaster settings to achieve SDG 3.

The case report by Hussaini and Davies (2022) highlighted the significant absence of national and international frameworks for SRH service delivery in response to climate-related events. Therefore, it is important that national frameworks for SRH service delivery are promoted to achieve the Global Strategy, Sendai Framework, and SDG targets by 2030 and beyond.

4.2 Effective Components

Due to the limited number of relevant studies, and the absence of specific intervention details mentioned above, the effectiveness of the intervention components could not be conducted. Therefore, generic information related to the four factors of availability, accessibility, acceptability, and quality were assessed. These four factors are helpful for assessing adequate health coverage (Homer et al. 2018) and health services in disaster settings of low- and middle-income countries (Heckman, n.d.). The latest WHO Abortion Care Guideline (Gerdts et al. 2022), as well as the Lancet-Guttmacher Commission (Starrs et al. 2018), recommend that essential SRH services for MR, SA, and PAC must meet the global standards of availability, accessibility, acceptability, and quality to promote the right to health because they are fundamental to meeting the SDGs 3.8 (Universal Health Coverage) and 5 (Gender Equality). The review suggests that persistent demand and supply side bottlenecks continue to exist in health systems in disaster settings, indicating the scale of challenges and that barriers related to availability, accessibility, acceptability, and quality still need to be addressed in low- and middle-income countries to meet SDGs and promote health systems resilience by 2030.

4.3 Overcoming Challenges and Leveraging Opportunities

In this review, multi-level challenges were identified (facility, community, and individual levels), and the opportunities for service implementation were related to SRH services, including overcoming these mentioned challenges, making SRH services integral to the mitigation phase, and policy change to overcome barriers related to unaffordability and inaccessibility. These findings resonate with the challenges and opportunities identified by Homer et al. (2018) using the availability, accessibility, acceptability, and quality framework. Although the authors did not focus on disaster settings, findings from 800 participants from 36 low- and middle-income countries are telling and applicable to this study. That study identified similar opportunities at the facility level, which included improving human resources for health strategic planning and human resources management; streamlining recruitment and deployment procedures; incentivizing health service providers to work in rural areas; provisioning of respectful care; and inclusion of respectful care in curricula and continuing professional development (Homer et al. 2018). At the community level, the opportunities for local and national governments include providing

affordable, safe transport for women to get to and return from services, improving referral and integration and national policy to ensure universal health coverage, including health insurance systems (Homer et al. 2018). Addressing these opportunities by national and local health and development authorities will be a step change towards meeting SDGs and health systems resilience for the Sendai Framework and the Global Strategy.

5 Strengths and Weaknesses

The systematic review was limited to peer-reviewed English-language publications only and time-restricted from 2010; hence, it may have excluded some relevant studies. The data may not adequately reflect within-country variations due to publication selection bias. Strict inclusion criteria focusing on MR, PAC, and SA interventions and disaster settings may have excluded some relevant SRH interventions and implementation in other disaster settings. Additionally, wide variations in study aim, intervention approach, and countries reported made it challenging to perform extensive comparisons and in-depth statistical analysis. Future country-specific studies may augment this review with national datasets. Furthermore, in real world the differentiation between disasters and humanitarian crises is difficult to discern. Many disasters involving mainly natural hazards are certainly humanitarian crises and are often framed as such, in research, policy, and practice. This is another caveat of this study that the inclusion criterion focused on the search phrase "natural disasters" and this was largely influenced by the project design and its focus on health facility set-up (Sects. 1 and 2.4). It is likely that the search phrase "natural disasters" may have excluded literature that used the phrase "disaster(s)" without "natural."

6 Conclusion and Recommendations

This study has identified and synthesized the available evidence on SRH interventions, their effectiveness in increasing the availability, accessibility, acceptability, and quality of SRH services, and challenges and opportunities related to SRH interventions during disasters. The synthesis is provided under three study types: empirical studies, reviews, and case reports. A key strength of this review is its focus on an essential intervention but neglected aspects of disaster planning and response. While highlighting significant gaps and deficiencies in the current body of evidence particularly those published post-Sendai (Table 2), our findings provide evidence of what exists, albeit a few studies, which can help draw more attention to the need to improve SRH in disaster settings commensurate with SDG 3 and the Global Strategy and Sendai Framework's plea for health system resilience in disaster settings.

Based on the review, we found two recommendations for research: (1) More qualitative and quantitative research is required in different population groups to understand how SRH—MR, PAC, and SA—services can be improved through culturally appropriate strategies or campaigns; (2) At the community level, sociological and anthropological research is needed to understand the circumstances under which spontaneous abortions occur during a flood and how to treat and manage spontaneous abortion through self and medical care.

In addition, we recommend mixed methods research to investigate whether disasters increase the need for contraception, with differing changes in contraceptive behavior depending on an individual's personal situation and relationship status. The review highlighted that a lack of evidence on contraception use in disaster and non-disaster periods makes it difficult to assess how disasters affect the demand for and use of contraception.

We also recommend that governmental and nongovernmental organizations promote evidence-based intervention packages for SRH—MR, PAC, and SA—services during disasters. Only two intervention packages (RHCC and counselling) were found. These interventions merit scaling.

Finally, we recommend that national and international organizations such as the United Nations Office for Disaster Risk Reduction (UNDRR), United Nations Population Fund (UNFPA), UN Women, and WHO should develop guidelines and strategies on how local actors/service providers at the PHC level can promote the SRH rights framework that incorporates the Global Strategy and Sendai Framework's priority for promoting health systems resilience in disaster settings. Without integrating disaster resilience, SRH services in low- and middle-income countries will be unable to mitigate the increasing impact of disasters and meet SDG 3 by 2030 and beyond.

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