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Effectiveness of health education intervention on intention not to perform female genital mutilation/cutting in the future among key decision-makers: a systematic review and meta-analysis

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Abstract

Background Female Genital Mutilation/Cutting (FGM/C) is a form of gender-based violence that has negative health consequences. The decision to perform FGM/C is often made collectively and a variety of actors influence the decision. There is inconsistent and inconclusive evidence that health education interventions lead behavioural changes related to FGM/C among key decision-makers. Therefore, the aim of this systematic review and meta-analysis was to examine the effectiveness of health education interventions on decision-makers intentions not to perform FGM/C in the future.

Methods A systematic review and meta-analysis were performed according to the Preferred Item for Systematic Review and Meta-analysis (PRISRMA) guideline. Studies were obtained from databases such as PubMed, Google Scholar, EMBASE, CINAHL, Cochrane, African Journals Online and relevant lists of identified studies (interventional studies related to FGM/C among key decision-makers). Unpublished sources and organizational websites were also searched for relevant articles. The quality of studies was assessed using the Quality Assessment Tool for Quantitative Studies developed by the Effective Public Health Practice Project's. The meta-analysis was carried out using STATA.17 and Review Manager 5.3 software. Heterogeneity and publication bias were assessed using the I^2 statistic and funnel plot, respectively. The pooled effect size with a 95% confidence interval was presented using a forest plot and random effect model.

Results This meta-analysis included nineteen studies with a total of 13,326 study participants. The overall pooled relative risk of intention not to perform FGM/C in the future was 1.55 (95% CI;1.24, 1.94). In the subgroup analysis, the effect of health education on intention not to perform in the future was higher in studies that used both health education and other interventions (RR = 3.75, 95% CI; 2.04, 6.88) compared to those using only health education

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(RR = 1.35, 95% CI; 0.95, 1.92). Studies with longer intervention duration (above 12 months) had a greater effect on intention not to perform (RR = 1.34, 95% CI; 0.86, 2.09) compared to studies with a short intervention period (6–12 months) (RR = 1.14, 95% CI; 0.61, 2.15).

Conclusion This review examined the impact of health education on key decisions-makers' intention not to perform FGM/C in the future. Although the pooled effect size estimate may have been influenced by heterogeneity, the results suggest that education about FGM/C has a positive influence on the intentions of key decision-makers. It is recommended that health education interventions target local decision-makers such as religious and clan leaders and include them in initiatives aimed at preventing and eliminating FGM/C.

PROSPERO registration number CRD42024542541.

Keywords FGM/C, Health education, Intervention, Effectives, Intention, Key decision-makers

Background

Female Genital Mutilation/Cutting (FGM/C) is a harmful practice that involves the partial or total removal of external female genitalia or other injury to female genital organs for non-medical reasons [1]. The World Health Organization (WHO) [1] has classified FGM/C into four types: (i) Type 1 or clitoridectomy, involving the partial or total removal of the clitoris or the clitoral prepuce, (ii) type 2 or excision, defined as partial or total removal of the clitoris and the labia minora, with or without the excision of the labia majora, (iii) type 3 or infibulation, in which the vaginal opening is narrowed, sometimes by stitching the labia, with or without removal of the clitoris, (iv) type 4, which includes all other harmful procedures to the female genitalia for non-medical reasons [1] .

FGM/C is considered a violation of the human rights of girls and women and should be eliminated to achieve gender equality and women's empowerment [2, 3]. The United Nations strives for its full eradication by 2030, following the spirit of Sustainable Development Goal 5 (SDG-5) [4]. According to the latest data from the United Nations Children's Fund (UNICEF), the exact number of girls and women affected by FGM/C worldwide remains unknown. However, today at least 200 million women and girls have undergone FGM/C, with approximately 3 million at risk of undergoing FGM/C each year [2, 3]. Furthermore, an estimated 68 million girls will undergo FGM/C before 2030 unless additional measures are taken to address it. Eliminating all forms of harmful practices, particularly FGM/C, is one of the highest priority gaols in the SDGs (SDG Target 5.3) [5, 6].

The decision to cut a girl is rarely made by an individual; Rather, the decision is made collectively and a wide variety of actors influence the decision. In most communities, religious leaders, community leaders, traditional practitioners, mothers, grandmothers and fathers are the key decision-makers regarding the FGM/C practice [7–9]. Because of these interventions targeting FGM/C, key community decisions-makers plays an important role in the abandoning this practice [10, 11]. This is true because key decision-makers of FGM/C are very influential and trusted members who mobilize communities to challenge long-held traditions and beliefs.

Globally, health education is one of the locally implemented approaches to abandon the practice of FGM/C. Some of the available individual study evidence showed that educational approaches play a crucial role in preventing the practice of FGM/C through the use of the Health Belief Model (HBM) [12–14]. However, other studies have shown that health education interventions were not effective in behavioural changes related to FGM/C, such as intention to circumcise daughters in the future [15–19]. This is primarily because the health education approach based on the HBM model does not take into account social and peer influences, motivation and self-efficacy [20]. As a result, there is inconsistent and inconclusive evidence in individual studies that health education interventions alone contribute to positive behaviour change towards abandoning of FGM/C. Some of the available reviews focused primarily on interventions aimed at the general public [21–23]. However, there is paucity of systematic appraisal evidence, particularly among key decision-makers who are uniquely positioned to influence FGM/C practice. Therefore, the aim of this systematic review and meta-analysis was to examine the effectiveness of health education interventions on intention not to perform FGM/C in the future among key decision-makers. The results will be helpful in developing national and regional policies and strategies to eliminate the practice of FGM/C. This will ultimately help achieve the UN Substantiable Development Goals 5 by 2030 and eradicate FGM/C worldwide.

Methods

Protocol writing and registration

This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guideline, a widely accepted standard [24]. The selection process, from initial record identification to final study inclusion, was presented in accordance with PRISMA guidelines. The study protocol was registered in the International Prospective Register

of Systematic Reviews (PROSPERO) under registration number CRD42024542541. The protocol was registered before the study was conducted.

Study selection and eligibility criteria

All identified citations were uploaded to EndNote™ software Clarivate Analytics version X8 for management [25].

Participants

Inclusion and exclusion criteria

Population

- All studies that reported the effect of health education interventions on knowledge, attitude and intention towards FGM/C among religious leaders, clan leaders, health professionals, traditional practitioners, grandmothers, older women and men worldwide. Additionally, studies involving both key decision-makers and ordinary members of the community were included if the data could be reported and extracted separately.

Intervention

- An intensified health education intervention that focuses on behavioural change. The educational intervention address health risk of FGM/C such as physical, psychological, social and other consequences.
- We excluded studies whose interventions did not aim to change cognitive or behavioural aspects related to FGM/C, as well as studies in which cognitions or behaviour changes related to FGM/C were not assessed and reported. Additionally, we excluded studies that focused on medical or cosmetic procedures.
- Furthermore, studies focusing on other interventions and studies on circumcision/genital cutting other than female genital cutting, such as male circumcision were excluded.
- There was not restriction in the intervention setting, implementors and duration of the implementation.

Comparison

- Usual/standard/with no active ongoing FGM/C intervention in the study area controlled by other stakeholders.

Outcome

- Primary outcome: Intentions not to perform FGM/C in the future.

Context

- This systematic review and meta-analysis included interventional studies conducted anywhere in the world without geographical boundaries. Both community and institution-based studies on FGM/C behavioural changes globally were included in this review.

Types of studies

- All single-and double-arm interventional studies conducted worldwide such as cluster randomized controlled trails, quasi-experimental and controlled pretest-post-test studies were included in the current review. This review aimed to assess the cause-effect relationship between health education and intention to perform FGM/C in the future among key-decision makers. Therefore, studies that did not include health education interventions to measure intention to perform FGM/C in the future were excluded from the review. For this reason, systematic reviews and meta-analyses, empirical evaluation studies without a comparison group, empirical evaluation studies without pre- and post-measures, and cross-sectional studies were excluded.

Language

- Only studies published in English language were included.

Time period

- All studies published up to May 31, 2024 were included, regardless of the time of data collection and year of publication.

Definition of FGM/C intervention

In this review, an "FGM/C intervention" is defined as FGM/C-related health education at the individual or community level, aimed at bringing behavioural changes among key decision-makers regarding the intention not to circumcise a girl. In this review, the included studies

measured the outcome variable of intention not to perform FGM/C in the future using an interviewer-administered questionnaire in the local language adapted from previous survey tools.

Search strategy

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline was used. The literature search in databases was carried out between March 10 and May 31, 2024. This review followed a three-stage systematic search approach to undertake a comprehensive collection of all published studies in the subject area under consideration. Stage one was to identify and search keywords and indexed terms from titles and abstracts on Medline using Medical Subject Headings (MeSH).

Stage two was the search of other primary databases, such as Cumulative Index for Nursing and Allied Health Literature (CINAHL), ERIC, Clinical Trial registry, HINARI, African Journals Online [26], Cochrane library, Web of Science, and Psych INFO using the keywords and indexed terms developed in stage one and application of the correct syntax and vocabulary for each database was applied.

Stage three was the search of grey literatures on Google Scholar. The reference lists of the identified articles were also retrieved to include additional eligible articles. The websites of World Health Organization [1] and United Nations Children's Fund (UNICEF) were searched. All published articles in English language up to May 31, 2024 were included in the review.

Search terms were constructed carefully to include the study population, intervention, comparison and expected outcomes using a PICO formulation approach. The search was carried out using the following keywords and search terms, alone or in combination using the Boolean operators; OR and AND; (((((Circumcision, Female/) OR (((Female (genital mutilation* OR circumcise* OR "genital cutting")) OR "FGM", OR "FGC", OR "FGM/C"))) AND ((Health Education/) OR (health literacy OR Health Literacy/))) AND (intervention)) AND (Prevention* OR Behaviour change* OR Behaviour change*)(Table 1)

Table 1 Summary of search strategy from major databases (PubMed, web of Science, SCOPUS)

S. No	MeSH keywords, terms, phrases, and Boolean operators
1.	Circumcision, Female/
2.	(((((Circumcision, Female/) OR (((Female (genital mutilation* OR circumcise* OR "genital cutting")) OR "FGM", OR "FGC", OR "FGM/C"))) AND ((Health Education/) OR (health literacy OR Health Literacy/))) AND (intervention)) AND (Prevention* OR Behaviour change* OR Behaviour change*)
3.	Education*
4.	educat*
5.	intervention*
6.	prevention*
7.	behaviour change*
8.	behaviour change*
9.	traditional circumcisers*
10.	traditional birth attendants*
11.	cultural leaders*
12.	religious leaders*
13.	1 **OR** 2
14.	3 **OR** 4
15.	6 **OR** 7 **OR** 8
16.	9 **OR** 10 **OR** 11 **OR** 12
17.	13 **AND** 14 **AND** 15 **AND** 16

Screening and study selection

Articles identified from the search results were screened by their titles, abstracts, and full article reviews before inclusion in the systematic review. All retrieved articles were exported to the Endnote 8 reference citation manager and duplicate articles were removed. To guide the selection process, a tool was developed according to the inclusion criteria where a screening question can be answered with "yes", "no" and "cannot tell". The titles and abstracts of the studies retrieved from the search were then carefully reviewed by two independent reviewers (WS and GS). Articles with the answer yes and cannot tell were promoted to the next screening level while a no response was excluded from the next screening level.

Articles promoted for title and abstract screening were independently screened for full-text review by the same reviewers (WS and GS). Studies were included and excluded if reviewers agreed to answer yes and no to all pre-developed questions. When one of the reviewers scored cannot tell to any one of the inclusion criteria, it was resolved through discussion, evidence and consensus. At every selection stage the two reviewers compared and discussed their results and any discrepancies were resolved through discussion, re-reading of the text and evidence. In case of disagreement, a third author (AS) was consulted. However, this was not necessary as WS and GS reached at an agreement for all screened studies. In addition, in the event of unclear or ambiguous information, the corresponding author was contacted by email for clarification.

Data extraction

Two authors (WB and GS) independently extracted data from the published sources using a pre-designed, customized Microsoft Excel data extraction form. We extracted the following types of data from studies included in this systematic review: publication identification details (author/s name, publication year, study title), study design, study setting (country and social context), population, intervention description, comparisons, study

outcomes, intervention details (implementer, duration, frequency, modality), co-intervention (if available), outcome data (number of events, number of persons in the groups, and p-values) and effect estimate.

Study quality assessment and risk of bias

In this review, the methodological quality of the included studies was assessed using the Quality Assessment Tool for Quantitative Studies developed by the McMaster University Effective Public Health Practice Project (EPHPP) [27]. It is a standardised validated, and reliable [28] tool recommended by the Cochrane Handbook for public health and health promotion reviews [29]. This tool effectively assesses the quality of interventional study designs such as RCTs, quasi-experimental, and before-and-after studies. The tool assesses six domains as follows: (A) selection bias, (B) study design, (C) confounders, (D) blinding, (E) data collection methods, and (F) withdrawals and dropouts.

Each domain was then rated as strong (3 points), moderate (2 points), or weak (1 point), and the domain scores are averaged to determine the overall score. The maximum total number of points per study is 3.00. Based on their overall score, studies were assigned a quality rating of weak (1.00–1.50), moderate, (1.51–2.50) or strong (2.51–3.00) [30]. The two reviewers (WS and GS) independently assessed the quality of each included study. Any disagreement between the two reviewers regarding the scoring of components (A to F) was resolved through consensus, evidence, and discussion.

Data analysis and synthesis

The meta-analysis was performed using STATA version 17 and Review Manager (RevMan) 5.3 software. A random-effect model was used for the meta-analysis as it potentially minimizes the heterogeneity of the included studies [31]. Forest plots were used to present the pooled effect size, with a 95% confidence interval (CI). Subgroup analyses were also conducted by different study characteristics such as type of intervention (health education only vs. combined), study population, design, time period, duration of intervention (above 12 months, 6–12 months and below 6 months), quality score of the eligible studies (i.e., low vs. high quality score) were carried out.

The heterogeneity test of included studies was assessed by using the I^2 statistic. The p-value for I^2statistic less than 0.05 was used to determine the presence of heterogeneity. Low, moderate and high heterogeneity was assigned to I^2 test statistic results of 25, 50, and 75% respectively [32]. The publication bias was assessed using the Egger regression asymmetry test [33, 34]. For meta-analysis results which showed the presence of publication bias (Egger test=$p<0.05$), the Duval and Tweedie nonparametric trim and fill analysis using the random effect analysis was conducted to account for publication bias [35]. To retrieve the extent of publication bias, funnel plots were also scattered and tested for asymmetry.

To assess robustness of the result as well as to explore the origin of heterogeneity, sensitivity analysis and meta-regression were conducted based on a review of the included studies' demographics and methodology [36, 37]. The effect of aberrant studies was examined via sensitivity analysis by restricting the analysis to those studies judged to be an overall low risk of bias, intervention durations and sample size. This was done by leaving one study out and re-run the analysis. Meta-analysis regression was conducted to estimate the extent to which included study-level covariates explain the source of heterogeneity [38]. The meta-regression result was reported with a regression coefficient and p-value. A negative sign for the coefficient corresponds to a reduction in the outcome variable for given increases in the covariate whereas a positive sign corresponds to an increase in the outcome variable. In this review, the meta-regression was conducted using different study-level covariates including publication year, study intervention duration, sample size, study quality score, and study population. The pooled effect measure and subgroup analysis results were presented using relative risk (RRs) with a 95% confidence interval (CI).

Results

The search resulted a total of 1274 publications, of which nineteen full-text articles met the inclusion criteria presented in the PRISMA flowchart (Fig. 1]. The review included a total sample of 13,326 participants from all included studies.

Characteristics of included studies

The study in Kenya and Ethiopia [12] was conducted among religious and community leaders as study participants. Whereas the other studies were conducted among men, women, religious leaders and community leaders [14, 16, 17, 39–41]. One study was conducted among members of refuge communities in Kenya [12]. Two of the included studies were randomized controlled trails (RCT) [41, 42] while six were pre-test-post-interventional studies [16, 40, 43–45] and eleven of them were quasi- experimental studies [12–14, 17, 39, 46–52].

Most, 15 (78.95%) of the included studies were conducted on the African continent. Three studies were from Nigeria [16, 40, 44], Kenya [12, 43], Ethiopia [12], Mali [39, 46], Senegal [14], Burkina Faso [17], Sudan [41, 45, 48], Egypt [13, 49] and multi-country (Kenya, Somali and Guinea) [42].The rest were from North America, the USA [52], Europe, UK [51] and Asia, Iran [50].

The duration of the intervention varied considerably, ranging from a minimum of two days [51] to a maximum

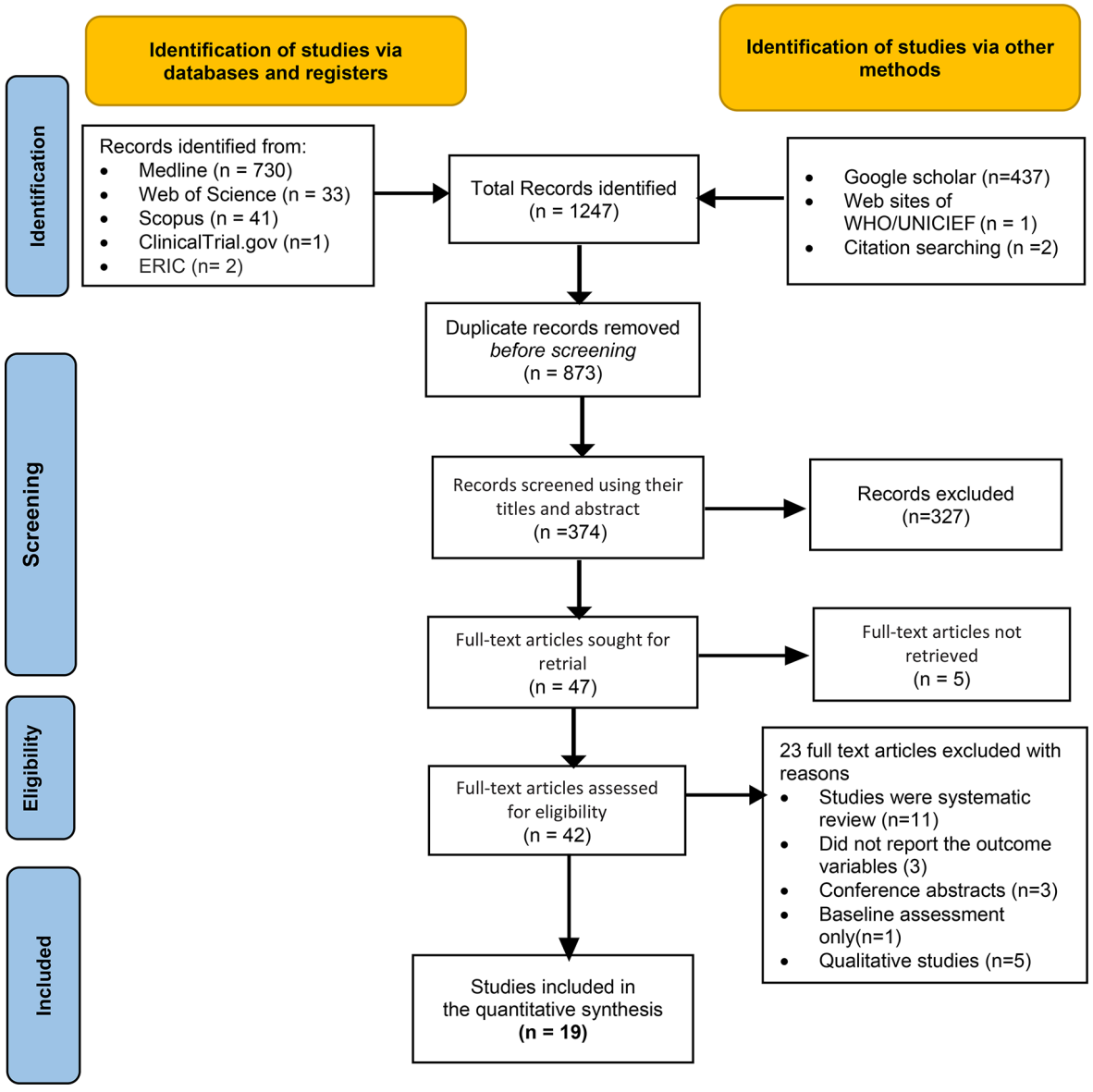

Fig. 1 PRISMA flow diagram representing search methodology and included studies in the systematic review and meta-analysis (24)

of 36 months [14]. The median duration was 7.34 months with a standard deviation of 9.75 months. Almost half of the interventions of the included studies were only health education [14, 16, 17, 39–41, 53], while some of them included health education and advocacy [12] as a combined intervention. The sample size ranged from 26 [43] to 5,634 [45] (Table 2).

Description of methods and materials for health education

In this review, the health education intervention was delivered through a multifaceted approach using various information education communication (IEC) materials. Mass media communication (newspaper, radio/television, show celebrating national events) and community meetings focusing on awareness and dialogue about FGM/C in the community [12, 16, 45] were used to bring about behavioural change in the intervention groups. Both traditional and interactive lectures were common health education methods used in a significant number of the studies included in this review [13, 17, 39, 48–52]. Training [43, 46, 51, 54], health talk [13, 44], group discussion [13, 14, 48–50, 52, 55], workshops [17, 39, 51, 52] and demonstration videos session [12, 41, 48, 49] were also used to address the target study participants. The most frequently cited IEC materials were leaflets and brushers [13], posters [54], pictures [40, 49], flipcharts [46] and audiovisual media [50].

Table 2 Summary of characteristics of studies included

Authors	Country	Study design	Intervention (Total)	Control (Total)	Type of Intervention	Health education methods	Duration of the intervention	Study Participants	Study setting
Babalola, 2006	Nigeria	Pre-test-post-test	484	473	Education	Multimedia activities (e.g. newspaper, radio call-in shows), and community meetings.	12 Months	General community including key decision makers	community based
Chege (a), 2004	Kenya	Quasi	720	720	Education and advocacy	Community education and public discussion with meeting, popular theatre groups performances, and national event celebration mass media activities.	18 Months	Refugees community including key decision makers	institution based
Chege (b), 2004	Ethiopia	Quasi	407	419	Education and advocacy	Community education and public discussion with meeting, popular theatre groups performances, and evening video sessions.	15 Months	Clan leaders and religious leaders	community based
Diop and Askew, 2009	Senegal	Pre-test-post-test	949	383	Education	Games, small group discussions, flipcharts, theatre, dancing, and culturally sensitive customs such as FGM/C	36 Months	Community including key decision makers	community based
Easton, 2002	Mali	Pre-test-post-test	132	107	Education	Three educational modules on hygiene, problem solving, and human rights were provided through interactive lecture sessions while the fourth module, which covered FGM/C, was offered as intensive workshop.	6 Months	Community members including men, women, religious leaders, community leaders	community based

Table 2 (continued)

Authors	Country	Study design	Intervention (Total)	Control (Total)	Type of Intervention	Health education methods	Duration of the intervention	Study Participants	Study setting
Ouoba, 2004	Burkina Faso	Pre-test-post-test	1012	453	Education	Three educational modules on hygiene, problem solving, and human rights were provided through interactive lecture sessions while the fourth module, which covered FGM/C, was offered as intensive workshop.	8 Months	community members such as men, women, religious leaders, community leaders	community based
Vogt, 2016	Sudan	Cluster Randomized	105	117	Health eduaction through entertainment film	Four entertaining movies	1 Month 19 days	community members with negative attitude towards uncut girl	community based
Asekun-Olarinmoye and Amusan, 2008	Nigeria	Pre-test-post-test	400	412	Education	Health talks, pictures, questions and answer sessions	3 Months	community members such as men, women, religious leaders, community leaders	community based
Diop, 2007	Mali	Quasi	108	108	Health education	Training (role-playing) and health talks using IEC (flip chart) materials.	3 Months	healthcare professionals	institution based
Jacoby and Smith, 2013	USA	Pre-test-post-test	50	50	Health education and training	Lecture on FGM/C, cultural roundtable discussion, simulation workshop.	1 Day	nurse-midwives'	institution based
Elliott, 2015	UK	Pre-test-post-test	49	47	training and education	Group workshop, lecture a handout based on the teaching slides and training videos, books and articles.	2-Days	Women affected by FGM/C	community based
Kimani, 2018	Kenya	Pre-test-post-test	26	26	Training and healthe ducation	Interactive training sessions, trainer guided questions and group discussions.	3- Days	nurse-midwives	institution based

Table 2 (continued)

Authors	Country	Study design	Intervention (Total)	Control (Total)	Type of Intervention	Health education methods	Duration of the intervention	Study Participants	Study setting
Evans, 2019	Sudan	Pre-test-post-test	5634	5634	Saleema, Health education	Community dialogue, colours campaign, media (TV/radio) outdoor/print, website, community events.	24 Months	General community members	community based
Mahgoub, 2019	Sudan	Quasi	150	150	Health education	A lecture, group work, the session also included the display of a video that tells a story of a girl who suffered from FGM complication throughout her life, questions-and-answers break.	1 Month and 2 weeks	Female Student at secondary School	institution based
Mounir, 2003	Egypt	Pre-test-post-test	354	328	hHalth education	Formal classroom lecture, health talks, group discussion and role play and use of educational aids such as leaflet and brushers.	1 Month	female university students, Egypt	institution based
Ndavi P, 2024	Kenya, Somali and Guinea	Cluster Randomized	105	117	Health education through Person centered communication	Included policy directives and posters opposing FGM medicalisation and promoting the provision of FGM prevention and care services, interactive training, WHO's clinical handbook on	6 Months	ANC provider healthcare provider staffs	institution based
Amusan, OA, 2008	Nigeria	Pre-test-post-test	400	400	Health education	Health talks, pictures, questions and answer sessions	3 Months	Community members	community based
Khalil, A. I, 2017	Cairo, Egypt	Pre-test-post-test	30	30	Health education	Lecture, showing pictures, group discussion, listening for feedback, video showing about female genital system and its function.	3- Days	Female school teachers	institution based

Table 2 (continued)

Authors	Country	Study design	Intervention (Total)	Control (Total)	Type of Intervention	Health education methods	Duration of the intervention	Study Participants	Study setting
Mojahed S, 2021	Iran	Pre-test-post-test	32	32	Health education and training	Traditional lecture, group discussion, audiovisual	1-Month	Mothers/Pregnant women	community based

Table 3 Component quality assessment rating of individual studies included in this systematic review

S. No	Study ID	Selection bias	Study design	Confounders	Blinding	Data collection	Withdrawals, drop outs	Quality Score	Quality level	Risk of Bias
1.	(Babalola et al., 2006)	Weak	Weak	Weak	Moderate	Weak	Moderate	**1.33**	**Weak**	**High risk**
2.	(Chege et al., 2004) (a)	Weak	Moderate	Weak	Weak	Moderate	Moderate	**1.50**	**Weak**	**High risk**
3.	(Chege et al., 2004) (b)	Weak	Moderate	Weak	Weak	Moderate	Moderate	**1.50**	**Weak**	**High risk**
4.	(Easton et al., 2002)	Weak	Moderate	Weak	Weak	Moderate	Weak	**1.33**	**Weak**	**High risk**
5.	(Diop and Askew, 2009)	Weak	Moderate	Moderate	Weak	Moderate	Strong	**1.83**	**Moderate**	**Low risk**
6.	(Ouoba et al., 2004)	Weak	Moderate	Weak	Weak	Moderate	Weak	**1.33**	**Weak**	**High risk**
7.	(Asekun-Olarinmoye and Amusan, 2008)	Weak	Moderate	Weak	Weak	Moderate	Weak	**1.33**	**Weak**	**High risk**
8.	(Abdulah et al., 2019)	Weak	Moderate	Weak	Weak	Moderate	Strong	**1.67**	**Moderate**	**Low risk**
9.	(Vogt et al., 2016)	Moderate	Strong	Strong	Moderate	Moderate	Weak	**2.1**	**Moderate**	**Low risk**
10.	(Diop et al., 2007)	Weak	Moderate	Weak	Weak	Moderate	Weak	**1.33**	**Weak**	**High risk**
11.	(Elliott et al., 2015)	Weak	Weak	Weak	Moderate	Weak	Moderate	**1.33**	**Weak**	**High risk**
12.	(Barnawi, 2018)	Weak	Moderate	Weak	Weak	Moderate	Moderate	**1.50**	**Weak**	**High risk**
13.	(Evans, W.D, 2019)	Weak	Moderate	Weak	Weak	Moderate	Moderate	**1.50**	**Weak**	**High risk**
14.	(Mahgoub, E., 2019)	Weak	Moderate	Weak	Weak	Moderate	Strong	**1.67**	**Moderate**	**Low risk**
15.	(Mounir, G.M, 2003)	Weak	Moderate	Weak	Weak	Moderate	Weak	**1.33**	**Weak**	**High risk**
16.	(Ndavi P, 2024)	Moderate	Strong	Strong	Moderate	Moderate	Weak	**2.1**	**Moderate**	**Low risk**
17.	Amusan, OA, 2008	Weak	Weak	Weak	Moderate	Weak	Moderate	**1.33**	**Weak**	**High risk**
18.	Khalil A, 2017	Weak	Moderate	Weak	Weak	Moderate	Moderate	**1.50**	**Weak**	**High risk**
19.	Mojahed S, 2021	Weak	Moderate	Weak	Weak	Moderate	Moderate	**1.50**	**Weak**	**High risk**

Quality and risk of bias assessment of the included studies

The quality of included studies was assessed using the Quality Assessment Tool for Quantitative Studies developed by the McMaster University Effective Public Health Practice Project [27] (Table 3. **Component quality assessment rating of individual studies included in this systematic review).** The tool also assesses six domains: (1) selection bias; (2) study design; (3) confounders; (4) blinding; (5) data collection method; and (6) withdrawals/dropouts. Guidelines for the tool indicate that each domain be rated as strong (3 points), moderate (2 points) or weak (1 point), and domain scores are averaged to provide the total score. The maximum total score per study is 3.00. Based on their total score, studies are assigned a quality rating of weak (1.00–1.50), moderate (1.51–2.50) or strong (2.51–3.00) [30]. The included studies were rated weak [12, 16, 17, 39, 40] to moderate [14, 41, 42, 48] in quality due to several factors. Among the included studies five [41, 42, 46, 48, 53] of them were found to be low risk of bias (Fig. 2).

Effect of health education intervention on intention not to perform FGM/C in the future

Cumulative meta-analysis

Cumulative meta-analysis forest plot confirmed an increasing trend (52%) in the relative risk measures for the period 2002 to 2003, followed by progressive decreasing trend (86%) for the period 2004 to 2015 and most recently i.e., 2015 to 2024, the effect of health education on intention showed a stabilizing trend (6%)(Fig. 3).

The pooled effect of intention not to perform FGM/C

Nineteen studies were included to estimate the pooled effect of health education interventions on intention not

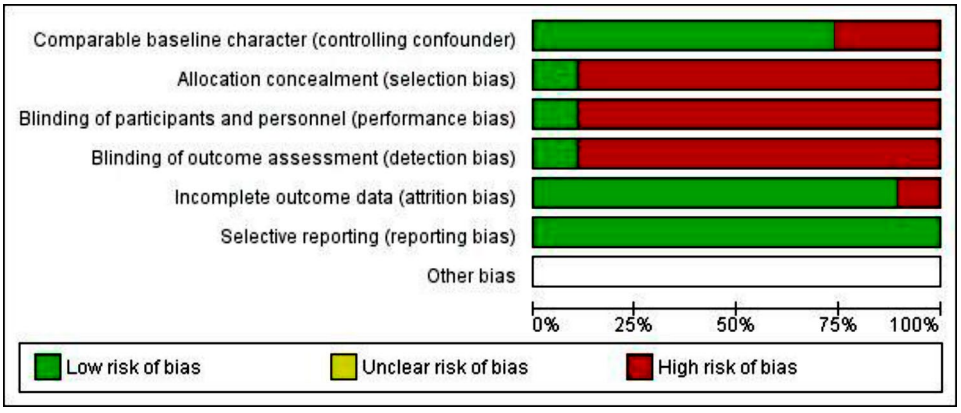

Fig. 2 Graphical presentation for the risk of bias among the includes studies

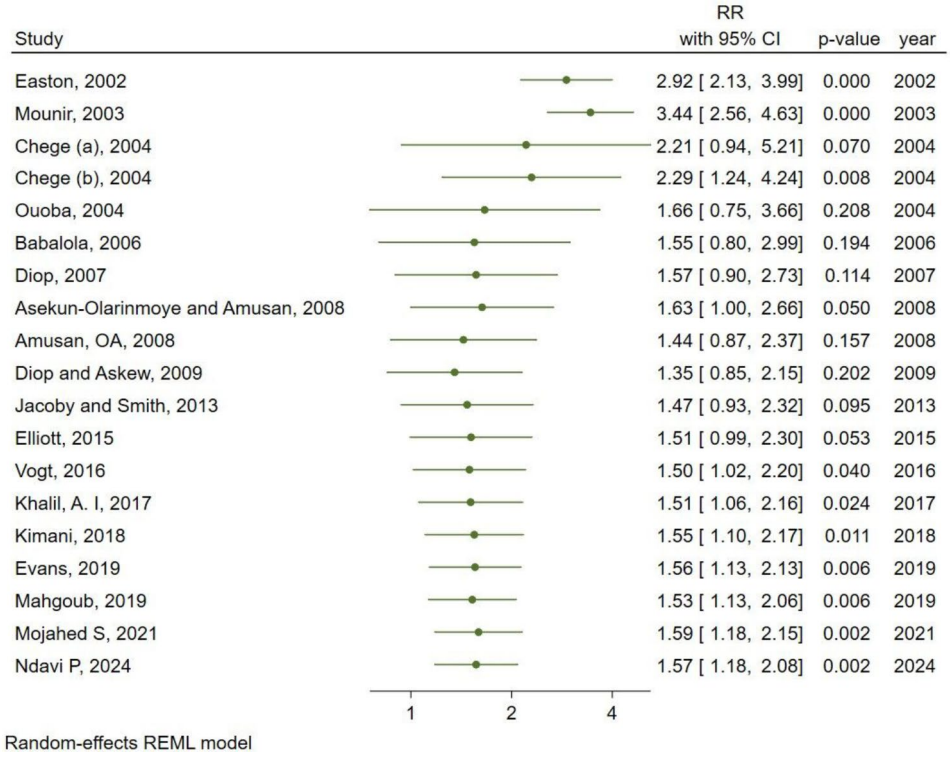

Fig. 3 Forest plot for cumulative meta-analysis result

to perform FGM/C in the future. The relative risk estimates of individual studies among study participants varied considerably, ranging from 0.46 [17] to 3.95 [13]. The overall pooled relative risk was 1.55 (95% CI; 1.24–1.94). Health education is an effective intervention to change the intention not to perform FGM/C in the future among key decision-makers compared to their counter parts. The heterogeneity of the relative risk estimates between the included studies on "intention not to perform" was very high (I^2=96.4% and p<0.000), suggesting that a subgroup analysis should be performed (Fig. 4).

Subgroup analysis

To address the high heterogeneity, we conducted a subgroup analysis by; Study period (2000–2005, 2006–2010, 2011–2015, 2016–2020, 2021 and above), study design (randomized vs. non- randomized), risk of bias (high vs. low), intervention content (health education only vs. combined), intervention duration (above 12, 6–12 and below 6 months), study participants (key decision makers vs. mixed), study setting (community vs. institutional) (Table 4)

In the subgroup analysis, the heterogeneity score showed a slight reduction for the subgroup intervention content (I^2=89.9%) (Fig. 5), the risk of bias (I^2=89.7%)

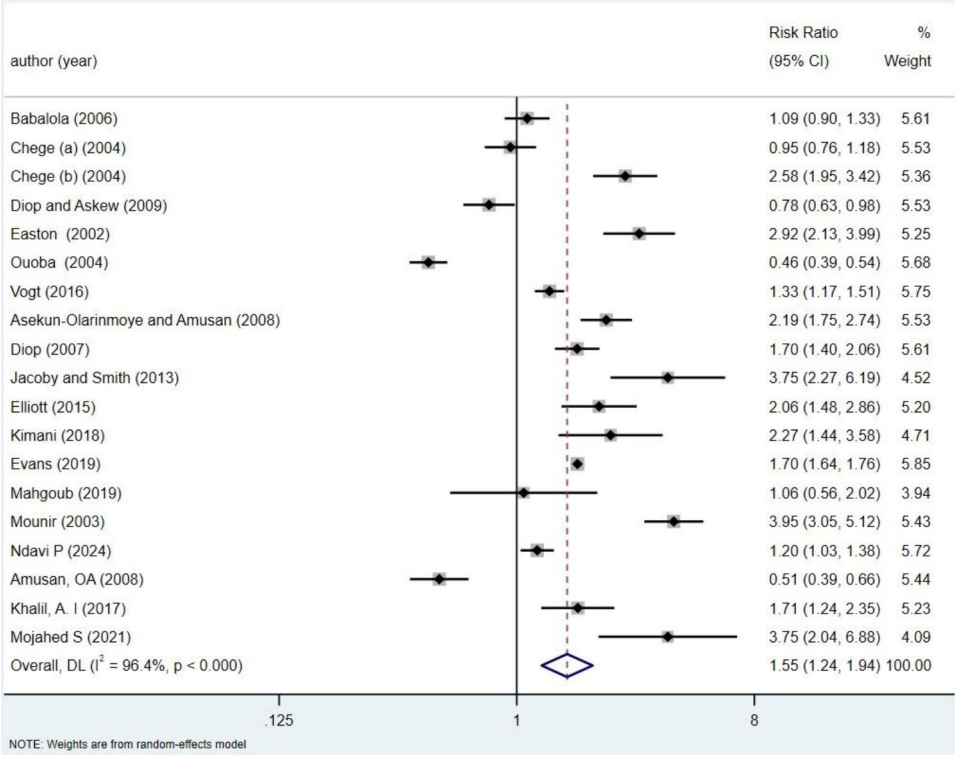

Fig. 4 Forest plot for pooled relative risk (RR) estimation for the effect of health education intervention on intention not to preform FGMC in the future

Table 4 Subgroup analysis of effectiveness of health education intervention on intention not to perform FGM/C in the future

Subgroup		Number of studies	Intention not to perform FGM/C RR (95% CI)	Heterogeneity	
				I^2	*p*-value
Study participants	Both key decision makers and others	12	1.28 (0.94, 1.75)	97.6%	< 0.001
	Only key decision makers	7	2.19 (1.59, 3.00)	87.9%	< 0.001
Study design	Randomized	2	1.27 (1.142, 1.41)	15.3%	0.277
	Non randomized	17	1.61 (1.22, 2.10)	96.7%	< 0.00
Intervention content	Only health education	11	1.35 (0.95, 1.92)	97.7%	< 0.001
	Health education and training/advocacy	8	3.75 (2.04, 6.88)	89.9%	< 0.001
Duration of intervention	Above 12 months	4	1.34 (0.86, 2.09)	96.2%	< 0.001
	6–12 months	4	1.14 (0.61, 2.15)	97.8%	< 0.001
	Below 6 months	11	1.28 (1.34, 2.64)	93.9%	< 0.001
Study setting	Institution based	8	1.81 (1.26, 2.59)	92.9%	< 0.000
	Community based	11	1.41 (1.02, 1.94)	97.5%	< 0.000
Publication Period	2000–2005	6	1.55 (0.78, 3.09)	98.2%	< 0.000
	2006–2010	4	1.11 (0.59, 2.08)	96.9%	< 0.000
	2011–2015	2	2.69 (1.50, 4.84)	74.1%	0.050
	2016–2020	5	1.58 (1.32, 1.89)	75.8%	0.002
	2021 and above	2	2.04 (0.67, 6.22)	92.2%	< 0.000
Risk of bias	Low	5	1.74 (1.24, 2.43)	89.7%	< 0.000
	High	14	1.51 (1.13, 2.02)	97.2%	< 0.000
Total		**19**	**1.55 (1.24, 1.94)**	**96.4%**	**< 0.000**

(Fig. 6) and publication period (I^2=74.1%) (Fig. 7). Among these, the heterogeneity for the subgroup study design changed significantly from high I^2 (96.4%) to low I^2 (15.3%) with a p-value=0.277 (Fig. 8).

Meta regression analysis

A meta-regression analysis was conducted by three study level covariates such as year of publication, quality score and intervention duration since there was statistically significant heterogeneity, I-square test statistics less than

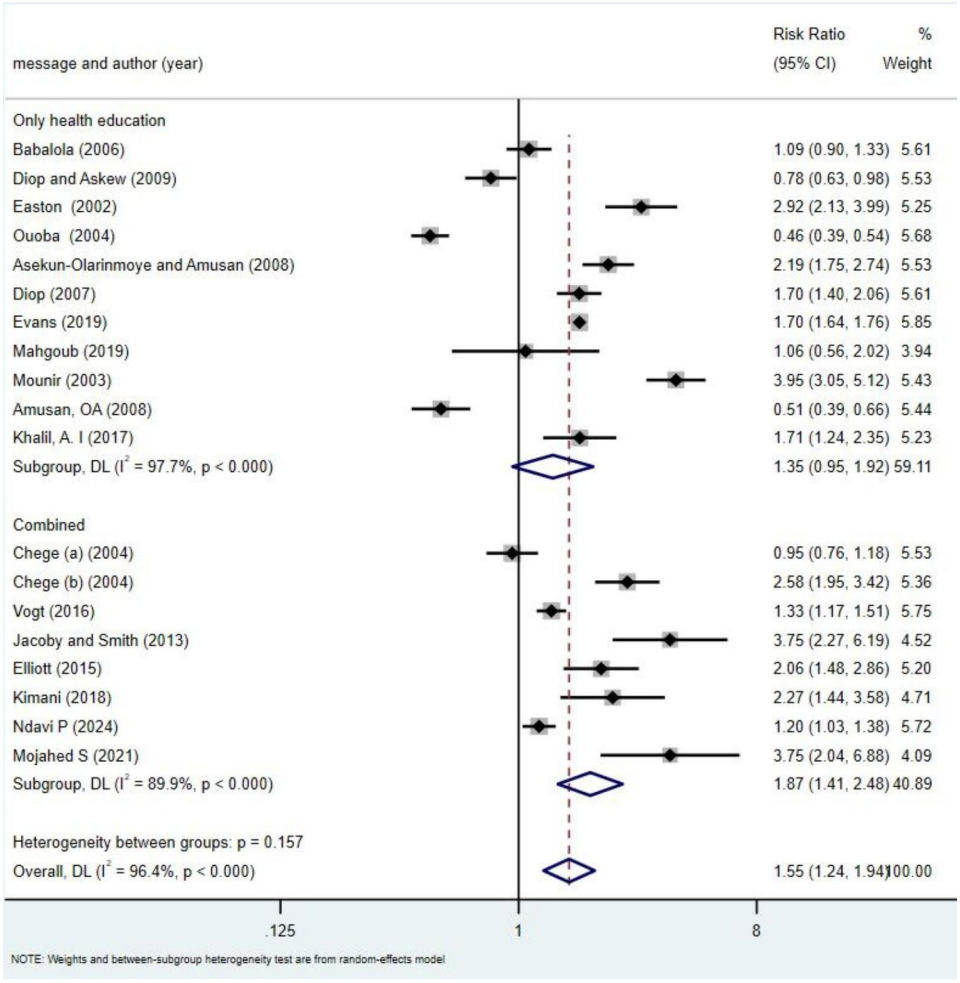

Fig. 5 Subgroup analysis by intervention content

0.05 (I^2=96.4% and p=<0.000). The purpose of the analysis was to identify the source of heterogeneity to allow correct interpretation of the result. However, the meta-regression analysis found no significant variable which can explain the heterogeneity. There was no statistically significant study level covariate: publication year, study quality score, and duration of the intervention. Therefore, the heterogeneity can be explained by other factors not included in this review (Table 5).

Sensitivity analysis

Sensitivity analysis were done by removing studies with too small [43, 49] and too large sample size [12, 17, 45] and as well as by removing studies with very short intervention durations [43, 49, 51]. However, there was no significant reduction in I^2 values by removing one study at a time (Table 6. **Sensitivity analysis of the included studies to estimate the pooled effect of health education intervention on intention not to perform in the future).**

Publication bias assessment

Small study effect of the included studies was assessed through visually and statistically. In this meta-analysis there was no publication bias since the included studies were distributed symmetrically in the funnel plot. Additionally, the result of Egger's test showed that no publication bias (p- value=**0.1037**)(Fig. 9).

Discussion

Nineteen studies with 13,326 participants were included in this systematic review and meta-analysis. The synthesis of the systematic review identified three main themes related to health education interventions aimed at influencing the future intentions of key decision-makers regarding the practice of FGM/C. The importance of tailoring interventions to the local contexts, assessing community readiness, and using a combination of messages and methods was emphasised. In the meta-analysis, the overall pooled relative risk for the effect of health education interventions on intention not to perform FGM/C in the future was 1.55 (95% CI; 1.24, 1.94).

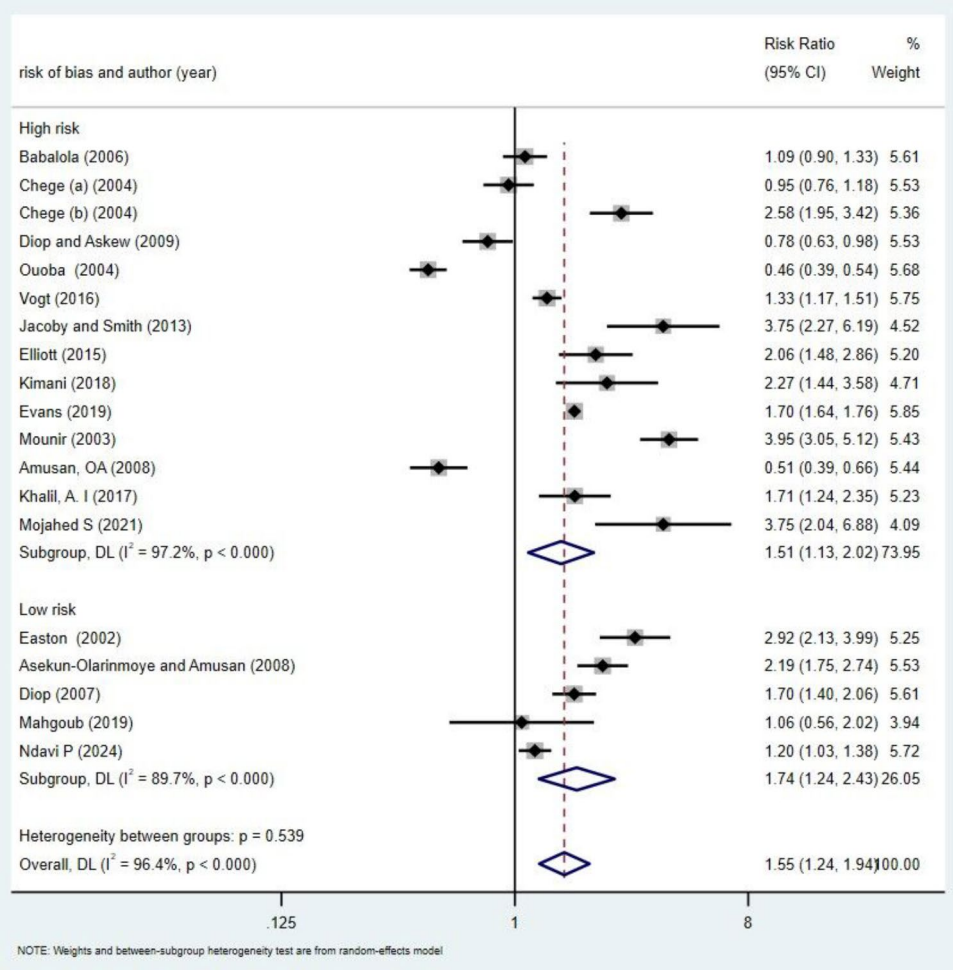

Fig. 6 Subgroup analysis by risk of bias

Local context tailored

For a designed health education intervention to successfully achieve the desired outcomes, it should be preceded by pre-intervention mapping to truly understand the context (reason for practice, gender of facilitators, religious perspective, local laws, educational status, ongoing intervention, and many more) the community in which FGM/C is practiced. This ultimately allows us to propose an intervention that can be tailored to the local context. Interventions that are not adapted can lead to backlash [56, 57]. Some studies report that the intervention was viewed as culturally changing and religiously affecting the target communities. For example, following the intervention in Senegal, the proportion of men who believed FGM/C was religiously sanctioned increased [14].

Local contexts must be taken into account when selecting implementing partners, data collectors, moderators and facilitators. This is evidenced by the study conducted in Kenya, where facilitators who made their opposition to FGM/C public received threats [12] from communities. The fact that the intervention in Kenya among Muslim Somali refugees was carried out by the National Council of Churches of Kenya (a predominately Christian organization) may have been an important factor in the backlash [23]. Ethnic and religious differences between a facilitator and FGM/C practicing communities can negatively impact the effectiveness of FGM/C interventions [58].

Know the community readiness stage

Studies of community-wide program effectiveness often include treatment and control communities, where the treatment community implements the program and the control does not. Researchers do their best to match treatment and control communities to have a more consistent basis for comparison [59]. The Community Readiness Assessment (CRA) allows researchers to assign communities according to their stage of readiness. This is an important advantage because even two communities of the same size may be at very different stages of readiness to respond to a problem, and assessment of the

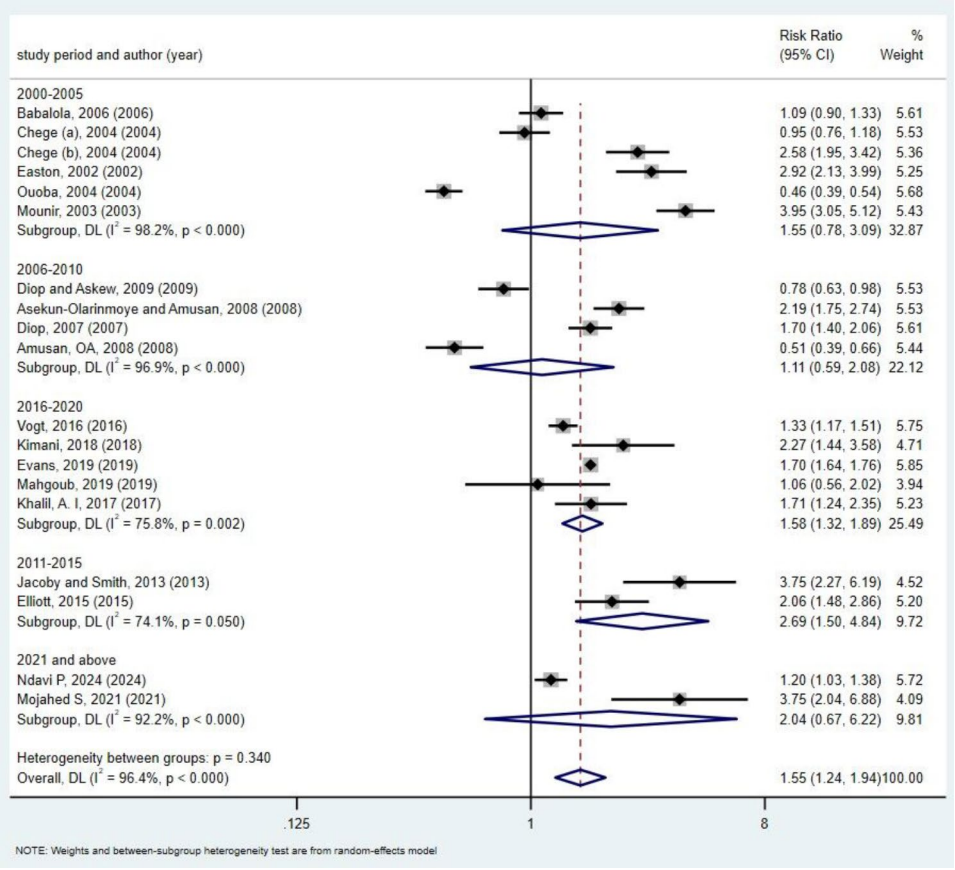

Fig. 7 Subgroup analysis by publication period

effectiveness of a program in both communities could be confounded by many factors.

The premise of the model is that a community must be prepared to implement an intervention. If this is not case, the intervention will most likely fail [59]. Of the included studies, only one was in Sudan by Vogt et al. [41] and colleagues conducted study of pre-intervention community readiness.

Combined messages and methods

A health education message that solely focuses about the health risks associated with FGM/C is not significantly effective in promoting behavioural change and efforts to abandon the practice. Although there is no universal approach to changing "sticky" social norms such as FGM/C, some studies appear to indicate that there is a need for multidimensional interventions [18, 58]. The communication intervention studies in Sudan and Nigeria suggest that a higher exposure to a message across multiple channels, including combined anti-FGM messages, may be most effective. The "edutainment" intervention suggests that to abandon FGM/C, anti-FGM messages should be locally anchored and that arguments are more effective in changing attitudes when combined [41]. In the case of Nigeria, exposure to consistent health messages from multiple sources (in this case media and community-level activities) was more effective than exposure to just one component of the intervention [16].

In the meta-analysis, the overall pooled relative risk for the effect of health education interventions on intention not to perform FGM/C in the future was 1.55 (95% CI; 1.24, 1.94). This finding is consistent with other studies as well [21, 60, 61]. In order for interventions to be effective in eliciting a positive behavioural change of people towards FGM/C, it is essential that key members of the communities have to involved in the intervention program from the very beginning. This reflects the findings of this study because it reveals that a common factor associated with the interventions that achieved a positive change in behavioural change was the involvement of the community leaders such as village chiefs and religious leaders [7, 8, 22].

On the other hand, health education alone is not an effective intervention to bring about behaviour change in communities [62, 63]. Although pooled effect measure showed improvements in intention not to perform, studies using health education and the health belief model indicates only the measurement of short-term behaviour

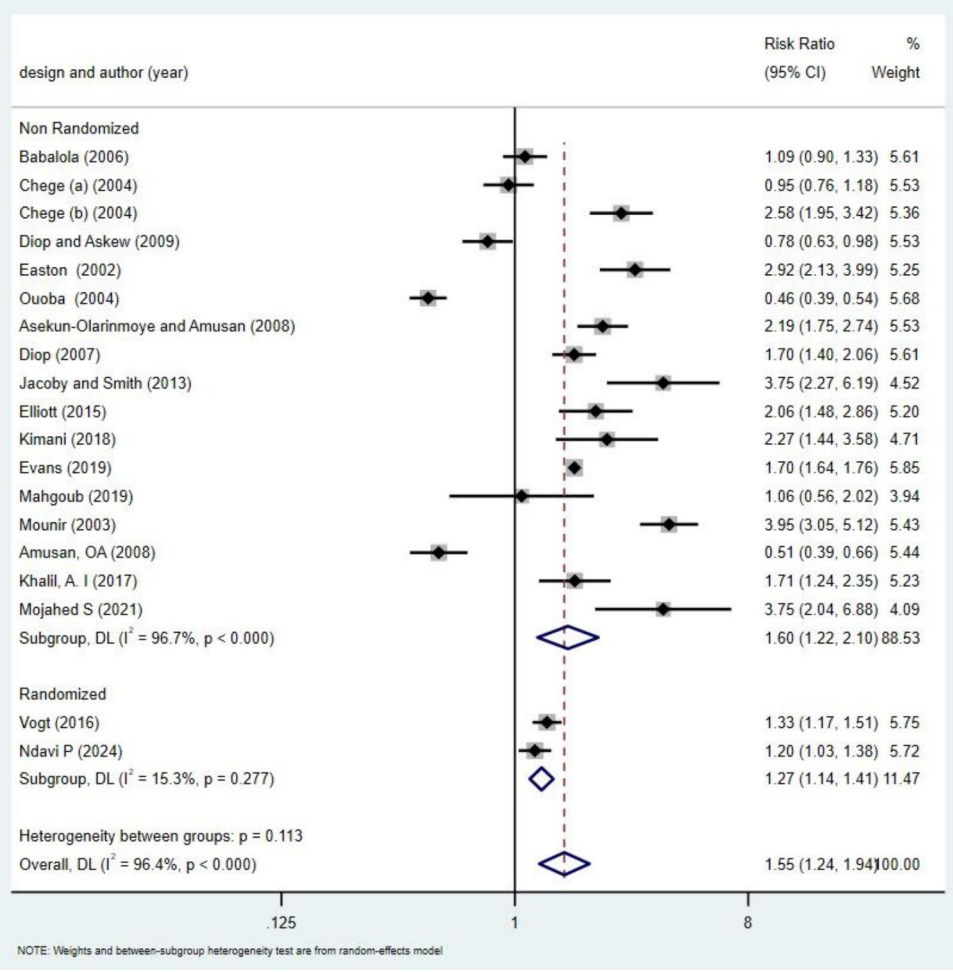

Fig. 8 Subgroup analysis by study design

Table 5 Meta-regression analysis of the different study-level covariates to explain the sources of heterogeneity for meta-analysis of the effect of health education on intention not to perform FGM/C in the future

Variables	Coefficient	*P*-value
Publication year	1.005658	0.771
Intervention duration	0.9880193	0.322
Quality score	0.7105648	0.787

change and not the measurement of practices. An evaluation report from over 19 countries suggested that ownership should be transferred to the community, individuals from within the community should be trained as change agents, sociocultural values should be respected, partners need to get the trust of communities before implementing interventions, and information should be delivered in combined approaches in order to abandoned and sustainable change achieved [63].

In this review, the estimate of the pooled relative risk may have been influenced by the significant heterogeneity, as indicated by the very high I^2 statistic (96.4%). This could be attributed to the differences in methodology, context and duration of intervention among the included studies. In addition, the methodological quality of the included studies was low to moderate, which may also contribute. We conducted a subgroup analysis by study period, study design, risk of bias, intervention type, intervention duration, and study participants. Among these, the heterogeneity for study design subgroup changed significantly (from high to low). The heterogeneity score decreased from 96.4 to 15.3% with a p-value=0.277. This may be true since two [41, 42] of the included studies were randomized trails and are more similar and have good methodologically quality.

In the subgroup analysis, the pooled effect of health education was highest in studies with an intervention duration of more than twelve months (RR: 1.34 (95% CI; 0.86, 2.09) than in studies with a duration of less than twelve months (RR:1.14 (95% CI; 0.61, 2.15). Behavioural changes will be more appreciated if the intervention period has lasted for a reasonable period of time [60, 61, 64]. Likewise, the pooled effect measure was higher in

Table 6 Sensitivity analysis of the included studies to estimate the pooled effect of health education intervention on intention not to perform in the future

S. No	Study Omitted	Reason for omission	Pooled RR of intention not to perform in the future (95% CI)	I^2 values (%)	*p*-value
1.	Elliott et al., 2015	Short intervention duration (2-days)	1.53 [1.21, 1.93]	97	0.0003
2.	Kimani et al., 2018	Short intervention duration (3-days)	1.52 [1.21, 1.92]	97	0.0003
3.	Khalil, A. I., 2017	Short intervention duration (3-days)	1.55 [1.23, 1.95]	97	0.0002
4.	Elliott et al., 2015	Small sample size ($n=47$)	1.53 [1.21, 1.93]	97	0.0003
5.	Kimani et al., 2018	Small sample size ($n=26$)	1.52 [1.21, 1.92]	97	0.0003
6.	Khalil, A. I., 2017	Small sample size ($n=30$)	1.55 [1.23, 1.95]	97	0.0002
7.	Mojahed S, 2021	Small sample size ($n=32$)	1.50 [1.19, 1.88]	97	0.0002
8.	Evans, W.D, 2019	Large sample size ($n=5634$)	1.56 [1.18, 2.06]	96	0.002
9.	Chege (Kenya), 2004	Large sample size ($n=720$)	1.60 [1.27, 2.02]	96	< 0.0001
10.	Ouoba, 2004	Large sample size ($n=1012$)	1.66 [1.38, 1.99]	94	< 0.00001
Overall			**1.55 [1.24, 1.94]**	**96.4**	**0.0001**

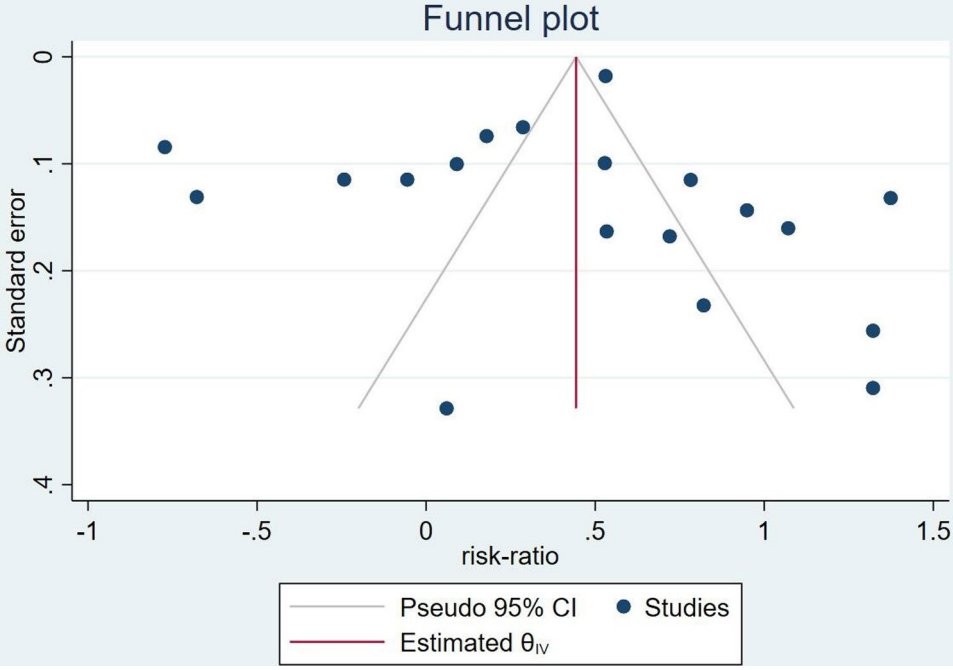

Fig. 9 Funnel plot for publication bias assessment

studies with combined interventions (RR: 3.75 (95% CI; 2.04, 6.88) compared with mere health education (RR: 1.35 (95% CI; 0.95, 1.92) interventions. A health education message that only addresses the negative health effects of FGM/C is not very effective in attempting to change behaviour. Some studies suggest that multifaceted interventions are necessary, although there is no single, universal strategy to change persistent social norms such as FGM/C [18, 58]. Anti-FGM/C messages can be more effective in changing attitudes and intentions when combined with training, advocacy, and other local context-based interventions.

Furthermore, a meta regression was performed based on the study quality score, publication period, intervention duration, and a sensitivity analysis based on sample size and intervention duration. Despite all these efforts, I^2 remained high and this could be explained by other factors not covered in this review, such as the community readiness stage, the intensity of the intervention and the measurement of the outcome variables. The impact of these covariances was not assessed because we were unable to obtain data on the primary studies.

Strengths and limitations

Our review has attempted to include articles from Africa, North America, Europe and Asia, although it is narrow from a global perspective. Therefore, comparison in different countries depending on culture and socioeconomic status helps contextualize to the potential transferability of the results. We also conducted sensitivity analysis and

meta-regressions in which we considered risk of bias, sample size, and duration of intervention to account for heterogeneity between studies. Furthermore, this review used a comprehensive and recommended quality assessment tool, the Quality Assessment Tool for Quantitative Studies, developed by McMaster University Effective Public Health Practice Project. However, this study has three key limitations and considerations must be taken into account when using the results of this review. First, most of the included studies measured the intervention effect among key decision-makers and other ordinary members of the community. As a result, the outcome of behavioural change (intention not to perform FGM/C in the future) result could be overestimated. Second, the search strategy that only included articles published in English has an impact on the generalizability of this review result. Some important publications in other languages such as Arabic, where FGM/C is widespread, could potentially be overlooked. Furthermore, pooled effect size estimate may have been influenced by heterogeneity, as indicated by the very high I^2 statistic of 96.4%. This could be due to the differences in methodology, sociocultural context, intensity and duration of the intervention between the included studies. Additionally, the methodological quality of the included studies was low to moderate, indicating a need for further research in this area.

Conclusion and recommendation

This systematic review examined the effectiveness of FGM/C education among key decisions-makers through nineteen studies. Although the included studies were characterized by low methodological quality, and we had to view their results with caution, the results still suggests that health education makes a positive contribution to improving the intention of key decision-makers. to perform FGM/C in the future. However, for health education on FGM/C to be effective in averting and abandoning the practice of FGM/C in a given community, it must be implemented with socio-cultural contexts in mind, targeted at key decision-makers, and designed with combined messages and methodologies, knowing the community readiness stage and integration in reproductive health and gender education. To achieve UN SDGs 5 [65] on gender equality and the empowerment of women and girls by 2030, health education interventions related to FGM/C should include local community leaders such as religious and clan leaders in their efforts to control and eradicate FGM/C. Furthermore, health education interventions should be complemented by training and/or advocacy through local involvement to achieve desired behavioural changes. We recommend a randomized, community-based trails using stages of change theories and participatory action research with comparable prognostic factors at baseline between intervention and control groups. Furthermore, future research should consider into account regional, cultural and sociodemographic differences in the practice of FGM/C.

Abbreviations

CI	Confidence Interval
EPHPP	Effective Public Health Practice Project
FGM/C	Female Genital Mutilation/Cutting
IEC	Information Education Communication
HBM	Health Belief Model
MeSH	Medical Subject Headings
RR	Relative Risk
PICO	Population, Intervention, Comparison, Outcome
PRISMA	Preferred Reporting Items of Systematic Reviews and Meta-Analysis
PROSPERO	Prospective Register of Systematic Reviews
RCTs	Randomised Controlled Trails
SE	Standard Error
SDGs	Sustainable Development Goals
UN	United Nation
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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Author contributions

WS contributed to the development of the study concept, designing, and running electronic literature search, study selection, data extraction, data synthesis, writing manuscript, and final approval of the version submitted. NA, TA, GS, EW, AA, SY contributed to the development of the study concept, the study selection, risk of bias assessment, revision of the manuscript, and final approval of the version submitted. All the authors read and approved the final manuscript. All authors took responsibility for the accuracy of the analysis and the contents of the article.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Female genital mutilation. key facts [https://www.who.int/news-room/fact-sheets/detail/female-genital-mutilation]; Accessed 4 May, 2024
2. Ending Female Genital Mutilation. by 2030 [https://www.un.org/en/observances/female-genital-mutilation-day]
3. Banks E, Meirik O, Farley T, Akande O, Bathija H, Ali M. Female genital mutilation and obstetric outcome: WHO collaborative prospective study in six African countries. Lancet (London England). 2006;367(9525):1835–41.
4. Transforming, OurWorld. The 2030 Agenda for Sustainable Development (A/RES/70/1). [https://www.refworld.org/docid/57b6e3e44.htm]
5. Female Genital Mutilation. A New Generation Calls for Ending an Old Practice [https://data.unicef.org/resources/female-genital-mutilation-a-new-generation-calls-for-ending-an-old-practice/]
6. Female Genital Mutilation/Cutting. A Global Concern. [https://data.unicef.org/resources/female-genital-mutilationcutting-global-concern (].
7. Ahmed H, Battle J, Oladeji O. Key factors, drivers and gatekeepers of female genital mutilation in Ethiopia: a Meta-synthesis of National and Regional studies. Adv Res. 2022;23(6):30–7.
8. Leon-Himmelstine C, Rivett J, Samuels F, Newman A. Social norms related to female genital mutilation/cutting (FGM/C) and behaviour change approaches to challenge FGM/C and child marriage in Mali: Summary of the literature review. 2022.
9. Shell-Duncan B, Naik R, Feldman-Jacobs C. A state-of-the-art synthesis on female genital mutilation/cutting: what do we know now? 2016.
10. Johansen REB, Diop NJ, Laverack G, Leye EJO. International g: what works and what does not: a discussion of popular approaches for the abandonment of female genital mutilation. 2013, 2013(1):348248.
11. Norbakk M, Tønnessen L. Prevalence, drivers, and review of the literature on the effects of interventions to reduce the prevalence of female genital mutilation. CMI Rep 2020.
12. Chege J, Askew I, Igras S, Muteshi-Strachan J. Testing the effectiveness of integrating community-based approaches for encouraging abandonment of female genital cutting into CARE's reproductive health programs in Ethiopia and Kenya. 2004.
13. Mounir GM, Mahdy NH, Fatohy IM. Impact of health education program about reproductive health on knowledge and attitude of female Alexandria University students. J Egypt Public Health Assoc. 2003;78(5–6):433–66.
14. Diop NJ, Askew I. The effectiveness of a community-based education program on abandoning female genital mutilation/cutting in Senegal. Stud Fam Plann. 2009;40(4):307–18.
15. Baum A, Revenson TA, Singer J. Handbook of Health psychology, Second Edition. 2nd ed. edn. New York: Psychology; 2011.
16. Babalola S, Brasington A, Agbasimalo A, Helland A, Nwanguma E, Onah N. Impact of a communication programme on female genital cutting in eastern Nigeria. Tropical Med Int Health. 2006;11(10):1594–603.
17. Ouoba D, Congo Z, Diop NJ, Melching M, Banza B, Guiella G, Baumgarten I. Experience from a community-based education program in Burkina Faso: The Tostan program. 2004.
18. Plested BA, Edwards RW, Jumper-Thurman P. A handbook for successful change. *F rt Collins*. Tri-Ethnic Center for Prevention Research; 2006.
19. Waigwa S, Bradbury-Jones C, Doos L, Taylor J. Six aspects of female genital mutilation education (SAFE) model: findings from a qualitative study. BMJ open. 2024;14(5):e077838.
20. Mimiaga MJ, Reisner SL, Reilly L, Soroudi N, Safren SA. Individual interventions. HIV prevention. edn.: Elsevier; 2009. pp. 203–39.
21. Denison E, Berg RC, Lewin S, Fretheim A. NIPH Systematic Reviews. In: *Effectiveness of Interventions Designed to Reduce the Prevalence of Female Genital Mutilation/Cutting*. edn. Oslo, Norway: Knowledge Centre for the Health Services at The Norwegian Institute of Public Health (NIPH) Copyright ©2009 by The Norwegian Institute of Public Health (NIPH). 2009.
22. Matanda D, Croce-Galis M, Gay J, Hardee K. Effectiveness of interventions designed to prevent or respond to female genital mutilation: a review of evidence. 2021.
23. Berg RC, Denison EM. A realist synthesis of controlled studies to determine the effectiveness of interventions to prevent genital cutting of girls. Paediatrics Int Child Health. 2013;33(4):322–33.
24. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Syst Reviews. 2021;10(1):89.
25. EndNote. [https://support.clarivate.com/Endnote/s/article/Citing-the-EndNote-program-as-a-reference?language=en_US]n_US]
26. Fajobi O, Adeoye O, Fajobi D, Ojo TO, Afolabi OT. Girls at risk: FGM intentions among in-school adolescents of a rural community in Osun State, Nigeria. Eur J Contracept Reproductive Health Care. 2023;28(1):72–8.
27. Project EPHP. Quality assessment tool for quantitative studies. *National Collaborating Centre for Methods and Tools, McMaster University, Hamilton, Ontario* 1998Updated 03 October, (2017).
28. Thomas B, Ciliska D, Dobbins M, Micucci SJWEBN. A process for systematically reviewing the literature: providing the research evidence for public health nursing interventions. 2004, 1(3):176–84.
29. Jpt HJhwc-ho. Cochrane handbook for systematic reviews of interventions. 2008.
30. Armijo-Olivo S, Stiles CR, Hagen NA, Biondo PD, Cummings GG. Assessment of study quality for systematic reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Project Quality Assessment Tool: methodological research. J Eval Clin Pract. 2012;18(1):12–8.
31. Higgins JP, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. BMJ (Clinical Res ed). 2003;327(7414):557–60.
32. Sterne JAC, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, Cates CJ, Cheng HY, Corbett MS, Eldridge SM, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ (Clinical Res ed). 2019;366:l4898.
33. Begg CB, Mazumdar M. Operating characteristics of a rank correlation test for publication bias. Biometrics 1994:1088–101.
34. Egger M, Smith GD, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. BMJ (Clinical Res ed). 1997;315(7109):629–34.
35. Duval S, Tweedie R. A nonparametric trim and fill method of accounting for publication bias in meta-analysis. J Am Stat Assoc. 2000;95(449):89–98.
36. Mathur MB, VanderWeele TJJJRSSSCAS. Sensitivity analysis for publication bias in meta-analyses. 2020, 69(5):1091–1119.
37. Thompson SG, Sharp SJJS. Explaining heterogeneity in meta-analysis: a comparison of methods. 1999, 18(20):2693–708.
38. Thompson SG, Sharp SJ. Explaining heterogeneity in meta-analysis: a comparison of methods. Stat Med. 1999;18(20):2693–708.
39. Easton P, Miles R, Monkman K. Final report on the evaluation of the Tostan/IEP village empowerment program pilot project in the Republic of Mali. Tallahassee, Florida: Florida State University; 2002.
40. Asekun-Olarinmoye EO, Amusan OA. The impact of health education on attitudes towards female genital mutilation (FGM) in a rural Nigerian community. Eur J Contracept Reproductive Health Care. 2008;13(3):289–97.
41. Vogt S, Mohmmed Zaid NA, El Fadil Ahmed H, Fehr E, Efferson C. Changing cultural attitudes towards female genital cutting. Nature. 2016;538(7626):506–9.
42. Ndavi P, Balde M, Ahmed A, Diriye A, Soumah A, Sall A, Diallo A, Munyao J, Kemboi J, Esho T. A person-centred approach to female genital mutilation prevention: results of a multi-country, cluster-randomized trial. J Obstet Gynecol East Cent Afr 2024, 36(1).
43. Kimani S, Esho T, Kimani V, Muniu S, Kamau J, Kigondu C, Karanja J, Guyo J. Female genital mutilation/cutting: innovative training approach for nurse-midwives in high prevalent settings. *Obstetrics and gynecology international* 2018, 2018.
44. Amusan O, Asekun-Olarinmoye E. Knowledge, beliefs, and attitudes to female genital mutilation (FGM) in Shao Community of Kwara State, Nigeria. Int Q Community Health Educ. 2008;27(4):337–49.
45. Evans WD, Donahue C, Snider J, Bedri N, Elhussein TA, Elamin SA. The Saleema initiative in Sudan to abandon female genital mutilation: outcomes and dose response effects. PLoS ONE. 2019;14(3):e0213380.
46. Diop NJ, Traore F, Diallo H, Traore O, Toure AH, Diallo Y, Sangare M, Tandia F, Toure KA. Study of the effectiveness of training Malian social and health agents in female genital cutting issues and in educating their clients. 2007.
47. Barnawi NA. The effects of a digital educational intervention on undergraduate nursing students' attitudes, knowledge and self-efficacy with female genital cutting. State University of New York at Binghamton; 2018.
48. Mahgoub E, Nimir M, Abdalla S, Elhuda DA. Effects of school-based health education on attitudes of female students towards female genital mutilation in Sudan. East Mediterr Health J. 2019;25(6):406–12.
49. Khalil A, Orabi A. A community-based intervention: impact of an educational program in exchanging knowledge, attitude, and practices of female genital mutilation (FGM). Health Care Curr Reviews. 2017;5(209):2.
50. Mojahed S, Shekari M, Bokaie M, Dehghani A. The effect of training in pregnant women on beliefs and intention to do FGM. J Adv Pharm Educ Research| Oct-Dec. 2021;11(4):137.

51. Elliott C, Creighton SM, Barker M-J, Liao L-M. A brief interactive training for health care professionals working with people affected by female genital mutilation: initial pilot evaluation with psychosexual therapists. Sex Relatsh Therapy. 2016;31(1):70–82.
52. Jacoby SD, Smith A. Increasing certified nurse-midwives' confidence in managing the obstetric care of women with female genital mutilation/cutting. J Midwifery Women's Health. 2013;58(4):451–6.
53. Abdulah DM, Dawson A, Sedo BA. The impact of health education on attitudes of parents and religious leaders towards female genital mutilation. BMJ Sex Reprod Health. 2019;46:51–8.
54. Ndavi P, Balde MD, Milford C, Mochache V, Soumah A-M, Esho T, Sall AO, Diallo A, Ahmed W, Stein KJGPH. The feasibility, acceptability, appropriateness and impact of implementing person-centered communication for prevention of female genital mutilation in antenatal care settings in Guinea. Kenya Somalia. 2024;19(1):2369100.
55. .
56. Shell-Duncan B, Hernlund Y. Female circumcision in Africa: Dimensions of the practice and debates. *Female circumcision in Africa: Culture, controversy, and change* 2000:1–40.
57. Gruenbaum E. The female circumcision controversy: an anthropological perspective. University of Pennsylvania; 2001.
58. Waigwa S, Doos L, Bradbury-Jones C, Taylor J. Effectiveness of health education as an intervention designed to prevent female genital mutilation/cutting (FGM/C): a systematic review. Reproductive Health. 2018;15:1–14.
59. Center E. Community readiness for community change. *Tri-Ethnic Center community readiness handbook* 2014.
60. Matanda DJ, Van Eekert N, Croce-Galis M, Gay J, Middelburg MJ, Hardee K. What interventions are effective to prevent or respond to female genital mutilation? A review of existing evidence from 2008–2020. PLOS Global Public Health. 2023;3(5):e0001855.
61. Abidogun TM, Alyssa Ramnarine L, Fouladi N, Owens J, Abusalih HH, Bernstein J, Aboul-Enein BH. Female genital mutilation and cutting in the Arab League and diaspora: a systematic review of preventive interventions. Tropical Med Int Health. 2022;27(5):468–78.
62. Berg RC, Denison E. Effectiveness of interventions designed to prevent female genital mutilation/cutting: a systematic review. Stud Fam Plann. 2012;43(2):135–46.
63. Feldman-Jacobs C, Ryniak S. Abandoning female genital mutilation/cutting: an in-depth look at promising practices. Population Reference Bureau; 2006.
64. Diaz MMP, Brown AE, Fleet J-A, Steen M. Effectiveness of female genital mutilation/cutting education for health professionals: an integrative review. Nurse Educ Pract. 2023;69:103621.
65. ESCAP U. Sustainable Development Goal 5: achieve gender equality and empower all women and girls. 2016.

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