

Effectiveness of risk communication and community engagement interventions during mpox outbreaks: A systematic review

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Abstract

Introduction: Mpox emerged as a global threat following the 2022 multi-country outbreak. This review evaluates Risk Communication and Community Engagement (RCCE) effectiveness across all affected populations with sustained transmission across diverse populations, with initial concentration among gay, bisexual, and other men who have sex with men (GBMSM). Risk Communication and Community Engagement (RCCE) constitute a fundamental pillar of outbreak response, yet evidence for intervention effectiveness remains fragmented.

Methods: We conducted a systematic review following PRISMA 2020 guidelines, searching PubMed, Scopus, Web of Science, and Google Scholar. Eligible studies included experimental, observational, mixed-methods, qualitative, and program evaluation designs reporting RCCE interventions or formative research during mpox outbreaks. Two reviewers independently performed screening, data extraction, and quality appraisal.

Results: From 404 records, 84 studies met the inclusion criteria. Only eight studies (9.5%) directly evaluated implemented RCCE interventions; 76 (90.5%) were formative research. Studies spanned 35 countries, but 73.8% originated from high- or upper-middle-income countries. Intervention evaluations reported positive effects on knowledge, risk perception, preventive behaviours, case detection, and trust. Formative research documented substantial knowledge gaps (only 50.1% of Chinese MSM demonstrated adequate knowledge), widespread stigma, and vaccination willingness varying from 28.8% in Palestine to 81.5% in the Netherlands. Enablers included tailored communication, trusted messengers, and community participation. Barriers included stigma, conspiracy beliefs, and low risk perception.

Conclusions: While available evidence suggests RCCE interventions can be effective, the evidence base remains thin with a critical imbalance between formative research and rigorous evaluations. Geographical concentration in high-income countries limits generalizability to resource-constrained settings. Future research must prioritise rigorous intervention evaluations to inform evidence-based, equity-oriented RCCE strategies.

Keywords: Mpox, Risk communication, community engagement, infodemic management, systematic review, health communication, outbreak response, vaccination hesitancy, stigma, misinformation

Citation

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Introduction

Mpox (formerly monkeypox) is a zoonotic disease caused by the mpox virus (MPXV), an Orthopoxvirus comprising two clades: Clade I and Clade II, each with subclades a and b [1]. First identified in humans in 1970, mpox remained endemic in West and Central Africa for decades, with sporadic outbreaks linked to animal-human contact [2]. The global landscape transformed in 2022 when an unprecedented multi-country outbreak of Clade IIb prompted WHO to declare a Public Health Emergency of International Concern (PHEIC) [3]. Unlike prior outbreaks, sustained human-to-human transmission occurred, particularly among sexual networks of gay, bisexual, and other men who have sex with men (GBMSM) [4]. By 2023, African countries experienced a 78.5% surge in suspected cases, and in August 2024, another PHEIC was declared following rapid Clade Ib spread in the Democratic Republic of Congo [4,5]. This evolving transmission landscape demands adaptive public health responses addressing complex social, behavioural, and structural drivers of infection.

Risk Communication and Community Engagement (RCCE), alongside Infodemic Management (IM), constitutes a fundamental pillar of emergency outbreak response [6]. Effective RCCE requires disseminating accurate information and collaborating meaningfully with affected communities to co-create acceptable health guidance [7]. During mpox outbreaks, RCCE has proven essential for reaching marginalized populations, countering stigma, and building trust in vaccination [8]. Interventions encompass community mobilization, mass and social media communication, health education, infodemic management, and community-led health promotion [6]. Effectiveness depends on communication channel appropriateness, messenger credibility, cultural relevance, and genuine community engagement.

Emerging infectious diseases generate infodemics, rapid misinformation spread through digital platforms [9]. During mpox, substantial negative sentiment, homophobia, and misinformation targeted GBMSM communities [10,11]. Effective countermeasures include timely, accessible information, infodemic surveillance, and protection of key populations from misinformation harm [1]. Mpox-related stigma among GBMSM mirrors HIV-era patterns, with anticipated discrimination leading many to delay testing or vaccination [12,13]. Substantial knowledge gaps persist across populations: only 50.1% of Chinese MSM demonstrated adequate knowledge [14]; 87% of Nepalese MSM were unaware whether mpox was contagious [15]. Vaccination willingness varies from 81.5% among Dutch MSM to 28.8% in Palestine [16,17]. Conspiracy beliefs significantly undermine acceptance [18,19]. While GBMSM communities experienced disproportionate initial impact during the 2022 multi-country outbreak, this review adopts a broad,

all-population scope to comprehensively evaluate RCCE effectiveness during mpox outbreaks across all affected communities.

While response efforts have reached millions in some settings [20], rigorous evaluations examining RCCE impact on behavioural outcomes and outbreak control remain limited. This systematic review evaluates the effectiveness of RCCE interventions during mpox outbreaks, identifying intervention types, assessing outcomes, examining methodological approaches, and identifying contextual factors that influence effectiveness.

Methods

The systematic review was performed and reported following the Preferred Reporting Items of Systematic Reviews and Meta-Analyses (PRISMA) statement (2020) (Page et al., 2021). The review protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO) with PROSPERO Registration: CRD420261330594.

Eligibility criteria

The inclusion criteria were predefined and were based on the population, intervention, comparators, outcomes, and study design.

- **Population:** We included studies that were focused on communities, groups or people who are affected or at risk during mpox outbreaks such as general population, priority population gay, bisexual and other men who have sex with men (MSM), healthcare workers and other vulnerable populations such as people living with HIV, immunocompromised individuals, people experiencing homelessness and sexual and gender minorities. There were no age, gender, and geographic limitations.
- **Intervention:** The inclusion of interventions was based on any activity that was specifically described as having some elements of Risk Communication and Community Engagement (RCCE) components. These were community mobilization and participatory engagement programs, risk communication programs through mass, social, or interpersonal communication, social and behaviour change communication programs, health education, digital communication interventions, hotline, infodemic management programs, rumour monitoring and misinformation response programs, and community-led community-based health promotion programs. Research papers that failed to directly assess an RCCE intervention but gave formative information on

knowledge, attitudes, perceptions, or behavioural determinants applicable to the design of research were also incorporated as they are valuable sources of contextual data on the mode of action of interventions.

- **Comparators:** Comparators that were eligible were no intervention, pre-intervention post-intervention, standard public health communication, alternative RCCE strategies and exposed versus unexposed groups of observational studies. Studies that did not include comparator groups could also be included in narrative synthesis in cases where they accompanied them with contextual or implementation insights.
- **Outcomes:** The studies had to report at least one outcome that is pertinent to the effectiveness of RCCE. Knowledge improvement, risk perception change, preventive behavior adoption, health behavior seeking, vaccination intention or uptake, health authority trust, misinformation beliefs reduction and outbreak indicators like incidence or transmission pattern were all specified as primary outcomes. Both quantitative effect measures and qualitative findings were eligible.
- **Study Designs:** A wide spectrum of study designs was included to have the whole range of possible evidence, such as experimental studies, observational studies, mixed-method studies, qualitative studies, program evaluations, and infodemiology studies. The inclusion criteria were limited to English publications because of the constraint of translation. Articles were filtered out where they were not specifically focusing on mpox outbreaks, were commentaries or editorials that lacked original data, were duplicates or abstracts of a conference, or contained a limited amount of data.

Information sources and search strategy

The development of a comprehensive search strategy was done to identify published and unpublished literature. We searched PubMed, Scopus, Web of Science and Google Scholar databases since their inception up to the search date. The reports and documents of international public health organisations such as the World Health Organization, UNICEF, and the United States Centres for Disease Control and Prevention, websites of government public health agencies, non-governmental organization reports, and preprint archives such as medRxiv and bioRxiv were searched to identify grey literature.

The search strategy was developed iteratively with input from the review team. The strategy combined terms related to three key concepts: mpox, risk communication and community engagement, and evaluation or effectiveness.

The complete search strategies for each database are provided in Supplementary File S1. Forward citation tracking of included studies, backward reference searching of all included articles and relevant systematic reviews, and author searches for key researchers in the field were also conducted to identify additional eligible studies.

Study selection

All the records obtained by searches of the database were exported to the Rayyan systematic review software to remove duplicates and handle the screening. Titles and abstracts were screened by two separate reviewers in reference to the eligibility criteria with the help of a standardised screening form. The disagreements were solved by discussing them, and in cases where an agreement could not be reached, the ultimate decision was made by a third reviewer. Cohen's kappa coefficient was used to determine the inter-rater reliability of title and abstract screening.

All potentially eligible studies were then independently retrieved and then assessed by the same two reviewers. Reasons for exclusion at the full-text stage were documented and reported in the PRISMA flow diagram.

Data extraction

A data-extraction form was created using Microsoft Excel and piloted on 5 randomly selected included studies. All the included studies were subject to data extraction by two reviewers, and the differences were resolved via a discussion or consultation with a third reviewer when needed.

The extraction form was used to retrieve bibliometric data, outbreak and contextual data, population data, intervention data, comparators, outcome data and study design data. Other contextual and implementation factors were also elicited, such as the enablers and barriers to the effectiveness of the interventions, equity factors, and the extent of community involvement. In the case of qualitative studies, the essential themes and illustrative quotes pertaining to the RCCE were obtained, and the quantitative and qualitative results were obtained separately in the case of mixed-methods studies.

Quality appraisal and risk of bias assessment

Two reviewers independently evaluated methodological quality and risk of bias using tools suited to each design of the study. The disputes were settled either by consensus or by a third reviewer. The Joanna Briggs Institute Checklist was used to evaluate quantitative cross-sectional studies based on the Joanna Briggs Institute Checklist of Analytical Cross-Sectional Studies, and the Critical Appraisal Skills Programme Qualitative Checklist was

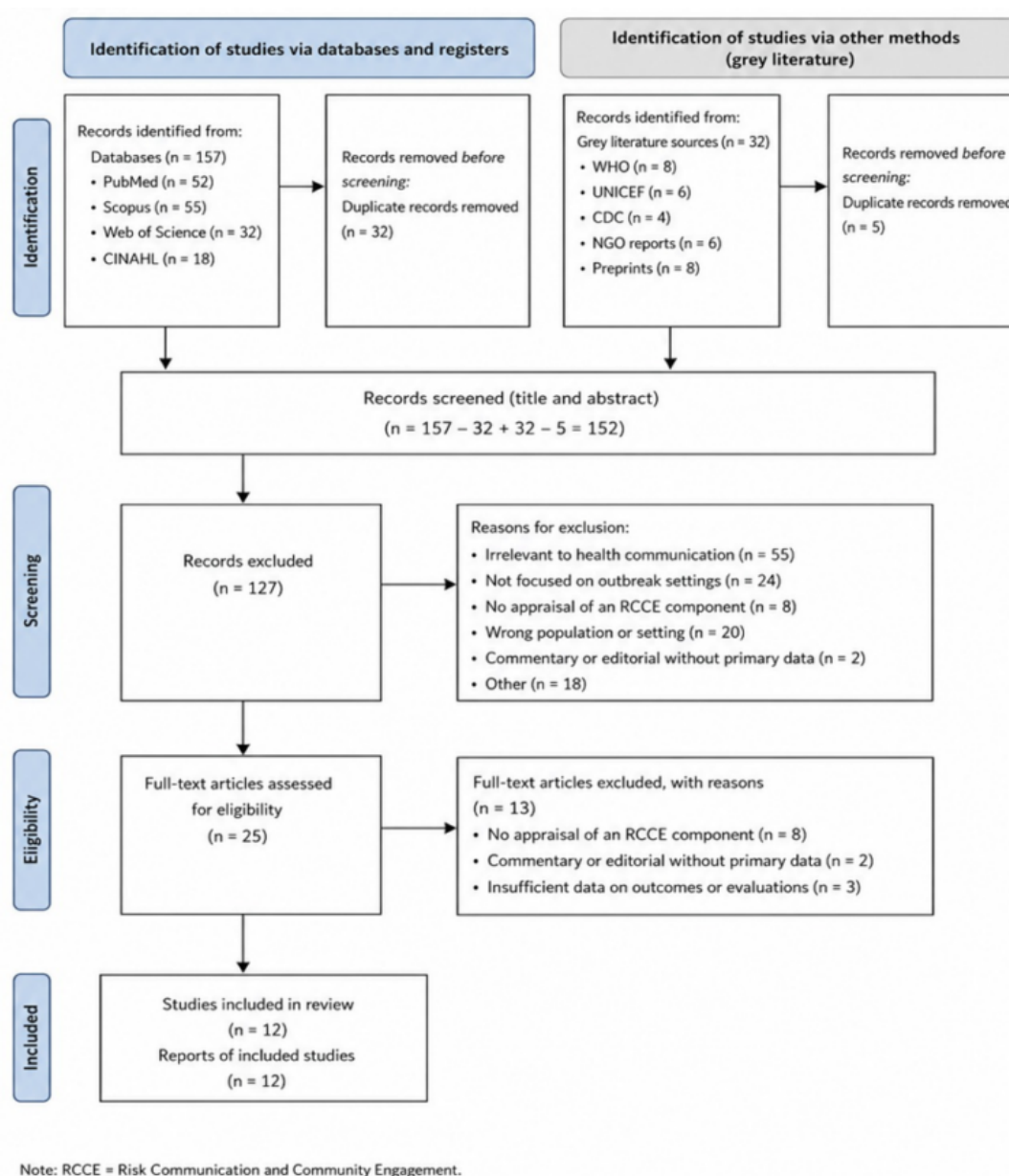


Figure 1. Figure 1: PRISMA 2020 Flow Diagram

utilised to evaluate qualitative studies. Mixed-method studies were reviewed by applying the Mixed Methods Appraisal Tool.

Assessment of the infodemiology and content analysis studies was evaluated with modified criteria according to the WHO and CDC guidelines on how to assess surveillance systems, with the help of the JBI Checklist on Program Evaluation. Evaluations of program assessments were also done by evaluating the JBI Checklist on Program Evaluation and adaptations of CASP checklists to evaluate epidemiological or modelling studies.

These analyses gave a high, moderate, or low-quality rating to each study based on the analysis. High-quality studies had most or all quality criteria and had limitations that

would not significantly influence findings. Moderately rated studies had some methodological limitations, which meant that they could only be cautiously interpreted, and those that had low quality had huge limitations that interfered with confidence in the results. There were no quality exclusion criteria used; nevertheless, quality measures were used to interpret the results during synthesis.

Data synthesis

Given the anticipated heterogeneity in study designs, populations, interventions, and outcome measures, a narrative synthesis was conducted as the primary analytical approach. Studies were organised and summarised using tabulation and thematic grouping based on key

characteristics. Relationships between studies were explored by examining patterns in findings across different contexts, populations, and intervention types, and the robustness of the synthesis was assessed by considering the methodological quality of included studies.

Findings were synthesised thematically around the primary and secondary outcomes specified in the review objectives. For each outcome, evidence from intervention studies was synthesised first, followed by evidence from formative research that informed understanding of behavioural and contextual determinants. Qualitative findings were synthesised using thematic synthesis involving line-by-line coding of extracted data, development of descriptive themes, and generation of analytical themes.

Ethical considerations

The review protocol was registered with PROSPERO under registration number CRD420261330594. As this study involved secondary analysis of published and publicly available data, ethical approval was not required. All the studies included were expected to have obtained appropriate ethical approvals as reported in their original publications.

Results

Study selection

PubMed, Scopus, Google Scholar and Web of Science were searched using a systematic search to yield 404 records. The screening of titles and abstracts was done on 292 distinct records after 188 duplicates were eliminated. Two reviewers (AUA and PDM) conducted this screening, and a third reviewer (VN) resolved any differences of opinion. There was high inter-rater reliability (Cohen $k = 0.78$; 95% CI [0.72, 0.84]), which ensured that there was uniformity in the application of eligibility criteria.

After screening the title and abstract, 194 records were filtered out, and 98 full-text articles were downloaded to undergo further evaluation. Independent screening with full text was performed by the same reviewers and showed an excellent level of agreement (Cohen $k = 0.85$; 95% CI: 0.78, 0.92). The reasons behind the exclusion at this phase were: (a) no appraisal of an RCCE component ($n=8$), (b) commentary or editorial in the absence of primary data ($n=2$), (c) study not about mpox ($n=3$), and (d) duplicate publication ($n=1$). Eighty-four studies were finally selected in the qualitative synthesis after passing all inclusion criteria (Figure 1).

NB: The WHO guidance document (WHO, 2022) was included as grey literature informing the background and discussion but was not appraised as an empirical study and is therefore not listed in this table.

Study characteristics, temporal and geographic distribution

Table 1 provides a comprehensive summary of the 84 included studies. The following sections synthesise key characteristics. Publications spanned from 2011 to 2026, with a marked increase following the 2022 multi-country outbreak. Most of the studies ($n=76$, 90.5%) were conducted during 2022–2026, and this indicates the role that the global health emergency played in driving research activity.

Geographically, the studies were in 35 countries in all six WHO regions. The distribution was:

- **EURO region ($n=28$, 33.3%):** Including the Netherlands (Dukers-Muijers et al., 2023; Wang, H., 2022), the United Kingdom (May et al., 2023; Nerlich et al., 2025; Paterson et al., 2025), Belgium (Vanhamel et al., 2023), Germany (Boender et al., 2023; Gubela et al., 2026), and others.
- **AMRO region ($n=18$, 21.4%):** Primarily the United States (Bates et al., 2022; Boutzoukas et al., 2025; Filardo et al., 2023; Metheny et al., 2023; Yellin et al., 2026) and Canada (Daroya et al., 2025; Xiu et al., 2024).
- **WPRO region ($n=14$, 16.7%):** Including China (Chen et al., 2024; Huang et al., 2025; Xu et al., 2024; Zhang et al., 2024), Hong Kong (Cheung et al., 2024), Japan (Ito et al., 2025), the Philippines (Tendido et al., 2025), and Singapore (Chan et al., 2024).
- **AFRO region ($n=12$, 14.3%):** Studies from Nigeria (Bakare et al., 2024; Iliyasu et al., 2025; Ikon et al., 2025; Olufadewa et al., 2025), the Democratic Republic of Congo (Duda et al., 2024; Olawusi et al., 2025; Roess et al., 2011), Cameroon (Tambo et al., 2024), Kenya (Jonathan et al., 2025), and South Africa (Olaoye et al., 2025).
- **EMRO region ($n=11$, 13.1%):** Studies from Pakistan (Ali et al., 2024; Hafeez et al., 2024; Jamil et al., 2023), Jordan (Sallam, 2022; Sallam et al., 2023), Lebanon (Youssef et al., 2023), and multi-country Middle Eastern studies (Mahmmoud Fadelallah Eljack et al., 2023).
- **SEARO region ($n=1$, 1.2%):** Nepal (Paudel et al., 2023).

Income levels, classified by the World Bank, were predominantly high-income ($n=40$, 47.6%) and upper-middle-income ($n=22$, 26.2%). Fewer studies originated from lower-middle-income ($n=20$, 23.8%) and low-income ($n=2$, 2.4%) settings, highlighting a critical evidence gap in the most resource-constrained contexts.

Study designs and populations

The included studies employed diverse methodological approaches:

Cross-sectional analytical studies (n=52, 61.9%): These formed the backbone of the evidence base, primarily assessing knowledge, attitudes, perceptions, and behavioural intentions.

- **Qualitative studies (n=13, 15.5%):** Providing in-depth exploration of experiences, barriers, and community perspectives (e.g., Drysdale et al., 2026; Duda et al., 2024; Kutalek et al., 2025; May et al., 2023; Zhang et al., 2024).
- **Mixed-methods studies (n=7, 8.3%):** Integrating quantitative surveys with qualitative interviews for richer contextual understanding (e.g., Iliyasu et al., 2025; Paterson et al., 2025; Vanhamel et al., 2023).
- **Infodemiology and content analyses (n=5, 6.0%):** Analyzing social media and online discourse (Fan et al., 2024; Ku et al., 2025; Rajkhowa et al., 2023; Seemanta et al., 2025; Wang, Y., 2024).
- **Program evaluations (n=5, 6.0%):** Assessing specific RCCE interventions (Biesty et al., 2024; Ikon et al., 2025; Jonathan et al., 2025; Reynolds et al., 2013; Wu et al., 2025).
- **Epidemiological and modelling studies (n=2, 2.4%):** Evaluating population-level behavioral impacts (Gubela et al., 2026; Maniscalco et al., 2026).

Target populations reflected the epidemiology of mpox, with gay, bisexual, and other men who have sex with men (MSM) being the most frequently studied group (n=38, 45.2%). Other populations included the general public (n=25, 29.8%), healthcare workers (n=8, 9.5%), and other vulnerable groups such as people living with HIV (PLHIV), cancer patients, people experiencing homelessness, and LGBTQIA+ communities more broadly (n=13, 15.5%).

Categorization of studies: Intervention evaluations vs. formative research

A critical distinction emerged from the data. Only eight studies (9.5%) directly evaluated an implemented RCCE intervention. The remaining 76 studies (90.5%) were classified as formative research, providing essential data on baseline conditions, determinants, and contextual factors necessary for designing effective RCCE strategies. This imbalance underscores the nascent stage of RCCE evaluation science in outbreak contexts. The characteristics of the eight intervention evaluations are summarised in Table 2.

Quality appraisal and risk of bias

Methodological quality was assessed independently by two reviewers (AUA and PDM) using tools appropriate to each

study design. Disagreements (n=7) were resolved through consensus with a third reviewer (VN). A summary of quality ratings by study design is presented in Table 3.

Quantitative studies (n=52)

The JBI Checklist for Analytical Cross-Sectional Studies was the primary appraisal tool.

- **High quality (n=30, 57.7%):** These studies demonstrated clear inclusion criteria, detailed descriptions of study subjects and settings, valid and reliable measurement of exposure and outcomes, identification and management of confounders through multivariable analysis, and appropriate statistical methods. Exemplars included large-scale national studies (Chen et al., 2024, N=7,725; Huang et al., 2025, N=2,079), studies using validated instruments (Amin et al., 2025; Boutzoukas et al., 2025), and those with rigorous analytical approaches (Dukers-Muijters et al., 2023; Xu et al., 2024).
- **Moderate quality (n=19, 36.5%):** These studies generally met most criteria but had limitations such as convenience sampling without clear description of the sampling frame, smaller sample sizes limiting generalizability, or failure to control for key potential confounders in the analysis (e.g., Cheung et al., 2024; Sahin et al., 2025; MohanaSundaram et al., 2025).
- **Low quality (n=3, 5.8%):** These studies had significant methodological weaknesses, including unclear inclusion criteria, inadequate description of the sample, and lack of valid outcome measurement, precluding confident interpretation of findings.

Qualitative studies (n=13)

The CASP Qualitative Checklist was applied.

- **High quality (n=8, 61.5%):** Studies provided clear statements of research aims, employed appropriate qualitative methodologies (e.g., interviews, focus groups, discourse analysis), demonstrated rigorous data analysis (e.g., thematic analysis with clear audit trails), considered the researcher-participant relationship, and provided clear, valuable findings. Exemplars included Nerlich et al. (2025), Kutalek et al. (2025), and May et al. (2023).
- **Moderate quality (n=5, 38.5%):** These studies met most criteria but lacked sufficient detail on the analytical process or did not adequately address the potential influence of the researcher on data collection or interpretation.

Table 1. Characteristics of included studies on Risk Communication and Community Engagement during mpox outbreaks ($n = 84$)

First Author	Year	Country / Region	Income Level	Population / Target Group	Sample Size	Study Design	RCCE Focus	Primary Outcome(s) Measured	Key Findings Summary	Overall Quality
Dukers-Muijters, N.H.T.M.	2023	Netherlands	High-income	MSM and transgender persons	1856	Cross-sectional	Formative	Vaccination willingness	81.5% were willing to be vaccinated. Higher risk perception, protection motivation, and positive social norms were associated with willingness, while rural residence and lack of community connectedness were barriers.	High
Metheny, N.	2023	USA	High-income	Marginalized Latino/a/x SGM	Not specified	Cross-sectional	Formative	COVID-19 vaccine uptake; trusted sources	High trust in community organizations and higher education institutions was associated with improved vaccine uptake.	Moderate
Wang, H.	2022	Netherlands	High-income	MSM, PrEP users, MSM with HIV	394	Cross-sectional	Formative	Perceived concern; perceived risk	MSM living with HIV had significantly higher risk perception ($aOR=4.29$), whereas PrEP users reported lower concern regarding mpox.	Moderate
Vanhamel, J.	2023	Belgium	High-income	Mpox cases (primarily MSM)	139; 12 interviews	Mixed-methods	Formative	Transmission dynamics; self-perceived risk; barriers to detection	Low self-perceived risk and confusion about mpox symptoms were important barriers to timely detection and care seeking.	High
Fan, L.	2024	Not specified	Not specified	General public online	Not specified	Infodemiology	Infodemiology	Topical/network dynamics; toxicity	Online toxicity amplified misinformation. Understanding information network dynamics can improve tailoring of risk communication strategies.	High
Jiao, K.	2023	China	Upper-middle	YMSM	Large	Cross-sectional	Formative	Mpox risk perception	Large-scale assessment of mpox risk perception among young MSM highlighted concerns in a key at-risk population.	High
Muncaster, K.	2024	Not specified	Not specified	At-risk individuals (likely MSM)	Not specified	Mixed-methods	Program evaluation	Access; motivations; stigma	Patient perspectives on healthcare access, vaccination motivations, and stigma were documented, providing insights for community engagement activities.	Moderate
Ali, Z.	2024	Pakistan	Lower-middle	Healthcare workers	Not specified	Cross-sectional	Formative	Mpox vaccine hesitancy	Determinants of vaccine hesitancy among healthcare workers were identified, emphasizing challenges in a lower-middle-income setting.	High
da Silva Bulcão, C.	2024	Brazil	Upper-middle	General male population	Not specified	Qualitative	Formative	Self-care practices; health beliefs	Detailed contextual data highlighted health beliefs and self-care practices relevant for community engagement strategies.	High
Wang, Y.	2024	USA	High-income	SMMGD individuals on Twitter/X	Not specified	Mixed-methods	Infodemiology	Activism, vaccine, mpox discourse	BERTopic-based analysis identified major themes in online mpox discourse, including activism, vaccination, and community narratives.	Moderate
Cheung, D.H.	2024	Hong Kong, China	High-income	GBMSM	Not specified	Cross-sectional	Formative	Mpox vaccine uptake	Perceptions regarding disease risk and information exposure influenced vaccine uptake and health decision-making.	Moderate

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First Author	Year	Country / Region	Income Level	Population / Target Group	Sample Size	Study Design	RCCE Focus	Primary Outcome(s) Measured	Key Findings Summary	Overall Quality
Sallam, M.	2022	Jordan	Lower-middle	General population	Not specified	Cross-sectional	Formative	Conspiratorial attitudes towards emerging viruses	Conspiracy beliefs were identified as a significant barrier to effective RCCE interventions and public health response.	High
Sahin, T.K.	2025	Turkey	Upper-middle	Cancer patients	275	Cross-sectional	Formative	Mpox knowledge; vaccination willingness	Only 30.9% expressed willingness to receive vaccination. Younger age, previous information exposure, and better knowledge facilitated uptake, while safety concerns were barriers.	Moderate
Boutzoukas, A.E.	2025	USA	High-income	Sexual minority men	122	Cross-sectional	Formative	Barriers to treatment and vaccination; perceived stigma	Nearly half of respondents believed others would avoid them if infected. Limited vaccine accessibility and stigma were important barriers.	Moderate
Filardo, T.D.	2023	USA	High-income	People experiencing homelessness	273	Cross-sectional	Formative	Mpox vaccine acceptability	Vaccine uptake reached 59%, while willingness was reported by 52%. Risk perception and vaccine education encouraged uptake; stigma reduced acceptance.	High
Rajkhowa, P.	2023	Global (Twitter data)	Mixed	General public online	149,133 tweets	Mixed-methods	Infodemiology	Factors influencing vaccination decisions	Communication challenges, stigmatization, vaccine accessibility, and safety concerns emerged as dominant themes affecting vaccination decisions.	High
Paudel, K.	2023	Nepal	Lower-middle	MSM	250	Cross-sectional	Formative	Mpox knowledge	Approximately 87% of participants were unaware of the contagious nature of mpox, highlighting substantial knowledge gaps.	High
Rawat, R.S.	2023	India	Lower-middle	Medical students and graduates	404	Cross-sectional	Formative	Mpox knowledge; sources of knowledge	Only 17.8% had received institutional teaching on mpox; important knowledge gaps were identified among future healthcare workers.	Moderate
Huang, S.	2025	China	Upper-middle	YMSM	2079	Cross-sectional	Formative	Vaccination intention; mpox-related perceptions	Media literacy had a positive indirect effect on vaccination intentions through perceptions (indirect effect=0.165, $p<0.001$).	High
Chen, H.J.	2024	China	Upper-middle	MSM	7725	Cross-sectional	Formative	Mpox knowledge awareness	50.1% aware; 79.3% trusted official media. New media and social organizations facilitated awareness.	High
Mahmmoud Fadelallah Eljack, M.	2023	Middle East	Mixed	General public	11016	Cross-sectional	Formative	Knowledge; perceptions	Knowledge was generally poor. Social media was the main information source (61.8%).	Moderate
Mohana Sundaram, A.	2025	India/Bangladesh	Lower-middle	Health sciences students	902	Cross-sectional	Formative	Knowledge; attitudes	Most relied on vaccination. Misconceptions regarding mpox treatment were common.	Moderate
Youssef, D.	2023	Lebanon	Lower-middle	General population	NA	Cross-sectional	Formative	Conspiracy beliefs	Reliance on social media and poor knowledge were associated with conspiracy beliefs.	High

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First Author	Year	Country / Region	Income Level	Population / Target Group	Sample Size	Study Design	RCCE Focus	Primary Outcome(s) Measured	Key Findings Summary	Overall Quality
Xu, Y.	2024	China	Upper-middle	YMSM	2493	Cross-sectional	Formative	Self-isolation; contact notification	Knowledge and perceived threat encouraged preventive intentions while depression and self-stigma reduced intentions.	Moderate
Sallam, M.	2023	Jordan	Lower-middle	Healthcare workers	341	Cross-sectional	Formative	Vaccination acceptance	Lower conspiracy beliefs and favourable attitudes toward mandatory vaccination increased acceptance.	Moderate
Nerlich, B.	2025	UK	High-income	GBMSM	91 items	Qualitative	Formative	Stigma; identity	Community highlighted stigma reduction as a key communication priority.	High
Chen, C.	2025	China	Upper-middle	General population	63	Descriptive	N/A	Clinical and epidemiological characteristics	Delayed healthcare seeking and unemployment emerged as barriers.	High
Amin, S.M.	2025	Egypt	Lower-middle	Nursing students	505	Cross-sectional	Formative	Fear; preventive practices	Fear predicted significantly preventive practices. Lower family income was associated with poorer outcomes.	High
Tendido, M.G.	2025	Philippines	Lower-middle	General population	502	Cross-sectional	Formative	KAP; knowledge predictors	Female sex and higher education were associated with better knowledge levels.	Moderate
El Sharif, N.	2025	Palestine	Lower-middle	General population	NA	Cross-sectional	Formative	Vaccine willingness	Trust in vaccines and previous COVID-19 vaccination increased willingness. Misconceptions remained barriers.	High
Gubela, N.	2026	Germany	High-income	General population	NA	Observational	Observation	Behaviour change	Behaviour change contributed substantially to outbreak decline.	High
Drysdale, K.	2026	NA	NA	LGBTQIA+, BBV populations	NA	Qualitative	Formative	Community support needs	Findings highlighted unmet community support and engagement needs.	Moderate
Ibrahim, A.M.	2025	NA	NA	Nursing students	NA	Quasi-experimental	Intervention	Educational programme effectiveness	Health education programmes improved knowledge and attitudes.	Moderate
Bakare, D.	2024	Nigeria	Lower-middle	Healthcare workers	NA	Cross-sectional	Formative	Knowledge; risk perception	Important gaps in knowledge and risk perception among frontline health workers were documented.	High
Paterson, A.	2025	UK	High-income	General population	NA	Mixed-methods	Formative	Mpox stigma	Stigma was shown to impede outbreak control and communication efforts.	Moderate
Olawusi, L.F.	2025	DRC	Low-income	Healthcare workers	NA	Cross-sectional	Formative	Vaccine hesitancy	Determinants of vaccine hesitancy among healthcare workers were identified.	Moderate
Tambo, E.	2024	Cameroon	Lower-middle	General population	NA	Cross-sectional	Formative	Risk perception	Risk perception and behavioural determinants identified, providing insights for community engagement strategies.	High
Sahin, T.K.	2022	Turkey	Upper-middle	Physicians	NA	Cross-sectional	Formative	Knowledge; vaccination attitudes	Assessed physicians' knowledge and vaccination attitudes, highlighting their role as trusted RCCE messengers.	High
Paradise Vit, A.	2025	NA	NA	Health organisations/public	NA	Content analysis	Infodemiology	Topics; emotions; sentiment	Social media content analysis revealed dominant topics, emotions, and sentiment patterns relevant to health communication.	High

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First Author	Year	Country / Region	Income Level	Population / Target Group	Sample Size	Study Design	RCCE Focus	Primary Outcome(s) Measured	Key Findings Summary	Overall Quality
Boyce, M.R.	2025	USA	High-income	Public health department	NA	Content analysis	Content analysis	Communication themes	Evaluated official public health communication content and messaging strategies on social media.	Moderate
Cruz Neto, J.	2024	Brazil	Upper-middle	Sexual minorities	NA	Qualitative	Formative	Stigma; social representations	Highlighted stigma, pathologization, and social representations affecting outbreak responses.	High
Nath, S.D.	2025	Bangladesh	Lower-middle	General population	NA	Cross-sectional	Formative	Mpox knowledge	Knowledge assessment revealed important awareness gaps among community members.	High
Olufadewa, I.I.	2025	Nigeria	Lower-middle	General population	NA	Qualitative	Formative	Awareness; vaccination barriers	Identified barriers to vaccination and factors influencing awareness and acceptance.	Moderate
Wu, X.	2025	NA	NA	MSM	NA	Quasi-experimental	Intervention evaluation	Knowledge improvement	Educational intervention successfully improved mpox knowledge among MSM participants.	Moderate
Iliyasu, Z.	2025	Nigeria	Lower-middle	PLHIV	NA	Cross-sectional	Formative	Risk perception; acceptability	Explored vaccine acceptability and perceived risk among people living with HIV.	High
Seemanta, S.	2025	NA	NA	Social media users	NA	Infodemiology	Infodemiology	Perception trends	Instagram analysis identified changing public perception trends over time.	Moderate
Al-Fatlawi, N.	2025	Iraq	Upper-middle	HCWs and students	NA	Cross-sectional	Formative	Knowledge; anxiety	Assessed knowledge, attitudes, and anxiety regarding mpox among healthcare workers and students.	Moderate
Ito, S.	2025	Japan	High-income	Content creators	119 pages	Content analysis	Content analysis	Readability; actionability	AI-generated educational material demonstrated superior understandability and readability compared with many web sources.	High
Iliyasu, Z.	2025	Nigeria	Lower-middle	General population	NA	Mixed-methods	Formative	Vaccine acceptability	Mixed-methods study identified factors affecting vaccine acceptability in northern Nigeria.	High
Ku, K.Y.	2025	NA	NA	Social media users	NA	Content analysis	Infodemiology	Misinformation correction	Examined hashtag framing and misinformation correction approaches on Instagram.	High
Wang, H.	2024	NA	NA	General population	NA	Cross-sectional	Formative	Vaccination willingness	Information exposure was significantly associated with willingness to accept mpox vaccination.	Moderate
Zhang, W.	2024	China	Upper-middle	Stakeholders	NA	Qualitative	Formative	Challenges; recommendations	Stakeholders described prevention and practical response recommendations.	High
Chan, Z.Y.S.	2024	Singapore	High-income	GBMSM	NA	Mixed-methods	Formative	Communication strategies	Tailored communication approaches improved vaccine receptiveness among GBMSM.	High
Duda, R.	2024	Central African Republic	Low-income	General population	NA	Qualitative	Formative	Eco-anthropological factors	Provided contextual understanding of cultural and social drivers relevant to mpox prevention.	Moderate
Wang, Y.	2024	USA	High-income	SMMGD individuals	NA	Infodemiology	Infodemiology	Discourse patterns	Online discourse analysis identified key narratives and communication themes among affected communities.	Moderate

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Table 1 continued from previous page

First Author	Year	Country / Region	Income Level	Population / Target Group	Sample Size	Study Design	RCCE Focus	Primary Outcome(s) Measured	Key Findings Summary	Overall Quality
Zhang, W.	2024	China	Upper-middle	Mpox patients	NA	Qualitative	Formative	Patient experiences	Patient perspectives highlighted prevention, treatment, and community support needs.	High
Zheng, M.	2023	China	Upper-middle	MSM	NA	Observational	Formative	Vaccine hesitancy	National study documenting mpox vaccine hesitancy among MSM and factors associated with acceptance.	Moderate
Jamil, H.	2023	Pakistan	Lower-middle	General population	NA	Cross-sectional	Formative	Preventive behaviour	Assessed determinants of mpox preventive behaviour and identified knowledge-related influences.	Moderate
Shi, A.	2023	NA	NA	TikTok users	NA	Content analysis	Content analysis	Information quality	Evaluated information quality and audience engagement of mpox-related TikTok content.	High
Ren, F.	2023	China	Upper-middle	General population	NA	Cross-sectional	Formative	Awareness; knowledge; worry	Community survey identified awareness gaps and varying levels of concern regarding mpox.	High
Bates, B.R.	2022	USA	High-income	Clinicians	NA	Cross-sectional	Formative	Knowledge; attitudes; practices	Evaluated clinicians' KAP regarding mpox during the outbreak period.	High
Reynolds, M.G.	2013	Republic of the Congo	Lower-middle	General population	NA	Program evaluation	Intervention evaluation	Case detection	Intensive community education activities improved human monkeypox case detection.	Moderate
Roess, A.A.	2011	DRC	Low-income	General population	NA	Quasi-experimental	Intervention evaluation	Community intervention effectiveness	Community interventions improved knowledge, risk perception, and preventive behaviours.	High
Yellin, H.	2026	USA	High-income	SGM, PLHIV	NA	Cross-sectional	Formative	Vaccination; research participation	Focused on mpox vaccination and willingness to participate in research among SGM adults with and without HIV.	High
Lake, S.	2025	NA	NA	Gay and bisexual men	NA	Cross-sectional/Qualitative	Formative	Sexual identity-related shame	Examined shame and stigma as barriers to prevention and health-seeking behaviours.	Moderate
Peptan, C.	2025	Romania	High-income	General population	NA	Longitudinal	Formative	Vaccination acceptance trends	Longitudinal assessment demonstrated changing acceptance patterns and the influence of anti-vaccination rhetoric.	Moderate
Jonathan, N.C.	2025	Kenya	Lower-middle	General population	NA	Quasi-experimental	Intervention evaluation	Knowledge improvement	Media campaigns significantly improved mpox knowledge among community members.	High
WHO	2022	WHO European Region	N/A	RCCE practitioners	N/A	Guidance	Guidance	Infodemic management	Provided practical guidance for infodemic management and RCCE planning during outbreaks.	Moderate
Biesty, C.P.	2024	UK	High-income	GBMSM; community organisations	NA	Program evaluation	Intervention evaluation	Stigma reduction; trust	Community-led approaches reduced stigma and strengthened trust in public health responses.	Moderate
May, T.	2023	UK	High-income	GBMSM	NA	Qualitative	Formative	Knowledge; behaviours; barriers	Generated evidence to inform tailored public health messaging among GBMSM.	High
Kutalek, R.	2025	Europe	High-income	RCCE practitioners; civil society	NA	Qualitative	Formative	Lessons learned from RCCE-IM	Reflections from experts and civil society highlighted lessons learned and best practices.	High

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Table 1 continued from previous page

First Author	Year	Country / Region	Income Level	Population / Target Group	Sample Size	Study Design	RCCE Focus	Primary Outcome(s) Measured	Key Findings Summary	Overall Quality
Ikon, A.O.	2025	Nigeria	Lower-middle	General population	NA	Program evaluation	Intervention evaluation	Radio jingles	Radio jingles improved community sensitisation and awareness regarding mpox and prevention.	High
Maniscalco, D.	2026	France	High-income	General population	NA	Epidemiological modelling	Observational	Behaviour change	Behavioural adaptations contributed to outbreak control and reduced transmission.	Moderate
Hafeez, U.	2024	Pakistan	Lower-middle	General population	NA	Cross-sectional	Formative	Knowledge; attitudes; behaviours	Assessed community knowledge, attitudes, and behaviours toward mpox.	High
Daroya, E.	2025	Canada	High-income	Community and public health actors	NA	Qualitative/ Descriptive	Program description	Collaborative response model	Described a collaborative community-led public health response model.	Moderate
Novacek, A.	NA	Austria	High-income	MSM	NA	Cross-sectional	Formative	Vaccine acceptance	Secondary analysis examining determinants of mpox vaccine acceptance among MSM.	Moderate
Svartstein, A.W.	2023	Denmark	High-income	MSM with HIV	NA	Observational	Formative	Incidence; vaccine uptake	Provided objective measures of mpox incidence and vaccine uptake among MSM living with HIV.	High
Prochazka, M.	2024	Europe/ Americas	Mixed	General population; likely MSM	Large	Cross-sectional	Observational	Sexual behaviour adaptation	Large multinational study documenting temporary behavioural adaptations during the outbreak.	Moderate
Boender, T.S.	2023	Germany	High-income	Public health institute	N/A	Program description	Program description	Infodemic framework	Described establishment of a framework supporting infodemic insights and RCCE activities.	Moderate
Olaoye, A.	2025	South Africa	Upper-middle	General population	NA	Quasi-experimental	Intervention evaluation	Community radio effectiveness	Community radio programmes improved promotion of health information and awareness.	High
Xiu, F.	2024	Canada	High-income	GBMSM	NA	Modelling	Intervention impact evaluation	Impact on transmission	Linked previous interventions to reductions in mpox transmission.	High
Pluijmert, D.	2026	Aruba	High-income	Community members; stakeholders	NA	Qualitative	Formative	Risk and prevention perspectives	One Health study documenting stakeholder and community perspectives on mpox risks and prevention.	High

Mixed-methods studies (n=7)

The Mixed Methods Appraisal Tool (MMAT) was used.

- **High quality (n=4, 57.1%):** Studies demonstrated adequate rationale for using a mixed-methods design, effective integration of qualitative and quantitative components to address the research question, and adherence to quality criteria for both strands. Iliyasu et al. (2025) and Paterson et al. (2025) were notable examples.
- **Moderate quality (n=3, 42.9%):** These studies had stronger performance in one component than the other, or the integration of findings could have been more explicit.

Infodemiology and content analyses (n=5)

Given the absence of a single validated tool, these studies were appraised using adapted criteria from WHO/CDC guidelines for evaluating surveillance systems and the JBI Checklist for Program Evaluation.

- **High quality (n=3, 60.0%):** These studies provided clear descriptions of the data source and sampling strategy, used appropriate analytical techniques (e.g., BERTopic, sentiment analysis), and derived meaningful insights relevant to RCCE. Fan et al. (2024), Ito et al. (2025), and Rajkhowa et al. (2023) were rated highly.
- **Moderate quality (n=2, 40.0%):** Limitations included less clarity on the representativeness of the sample or a more descriptive rather than analytical approach.

Program evaluations (n=5)

Assessed using the JBI Checklist for Program Evaluation.

- **High quality (n=2, 40.0%):** Reynolds et al. (2013) and Roess et al. (2011) provided clear descriptions of the intervention, used appropriate evaluation designs (pre-post with comparison), and measured objective outcomes (e.g., case detection).
- **Moderate quality (n=3, 60.0%):** These evaluations relied on weaker designs (e.g., post-intervention only) or self-reported outcomes without triangulation.

Epidemiological/modelling studies (n=2)

These were assessed using relevant CASP checklists adapted for modelling studies.

- **High quality:** Gubela et al. (2026) provided a well-described model with clear assumptions and robust data sources.
- **Moderate quality:** Maniscalco et al. (2026) had less detailed reporting of model parameters.

No study was excluded based solely on quality appraisal; however, findings from lower-quality studies were interpreted with greater caution in the narrative synthesis.

Characteristics of RCCE interventions

As detailed in Table 2, the eight intervention evaluations employed diverse strategies, channels, and delivery modes.

Intervention types and channels

The interventions were aimed at direct community engagement. Reynolds et al. (2013) applied face-to-face communication and community meetings as the main aspects of intensive community education applied in the Republic of the Congo. Roess et al. (2011) measured a community-based intervention in the DRC that focused on participatory engagement. Wu et al. (2025) aimed at the educational intervention of MSM, but the channels were not specified. Ibrahim et al. (2025) provided a health education programme to students of nursing in an academic environment.

- **Media Campaigns (n=3):** These leveraged mass and social media. Jonathan et al. (2025) evaluated a campaign combining social and mainstream media in Kenya. Olaoye et al. (2025) assessed the effectiveness of a community radio station in South Africa. Ikon et al. (2025) specifically appraised the impact of radio jingles broadcast by Passion FM in Nigeria.
- **Community-Led Health Promotion (n=1):** Biesty et al. (2024) described and evaluated a community-led model in the UK, where community-based organizations (CBOs) for GBMSM led peer-to-peer health promotion efforts.

Duration, implementers, and theoretical foundations

Intervention duration was poorly reported, with most studies (n=6, 75%) not specifying the period over which the intervention was delivered. Implementers varied, including public health authorities, academic institutions, and, crucially, community-based organisations. Only one study (Roess et al., 2011) explicitly mentioned a theoretical framework, and none explicitly incorporated infodemic management or misinformation countering as a core intervention component, although these were mentioned as recommendations in some formative studies.

Synthesis of findings: Effectiveness of RCCE Interventions

Impact on knowledge improvement

Evidence from intervention studies: All four intervention studies measuring knowledge reported positive effects. Wu et al. (2025) found a statistically significant improvement in mpox knowledge among MSM following an educational intervention (effect size not reported). Jonathan et al.

Table 2. Characteristics of Included RCCE Intervention Evaluations (n=8)

Author	Yr	Country	Population	Intervention	Description	Channel	Delivery	Comparator	Outcome	Effect
Reynolds	2013	Republic of the Congo	General population	Program evaluation	Intensive community education to improve case detection	Community education	Face-to-face	Pre/post	Detection of human mpox cases	Positive
Roess	2011	DRC	General population	Intervention evaluation	Community intervention for mpox prevention	Community engagement	Face-to-face; participatory	Pre/post	Knowledge, risk perception and preventive behaviours	Positive
Ibrahim	2025	NR	Nursing students	Intervention evaluation	Health education programme on mpox and palliative care	NR	NR	Pre/post	Knowledge improvement; attitudes toward palliative care	Positive
Wu	2025	NR	MSM	Intervention evaluation	Educational intervention to improve mpox knowledge	NR	NR	Pre/post	Mpox knowledge improvement	Positive
Jonathan	2025	Kenya (Kiambu County)	General population	Intervention evaluation	Impact of social and mainstream media campaigns on knowledge	Social media; mainstream media	Mass media; digital	Exposed vs. unexposed	Mpox knowledge	Positive
Olaoye	2025	South Africa (Eastern Cape)	General population	Intervention evaluation	Community radio for health information promotion	Community radio	Broadcast	Exposed vs. unexposed	Health information promotion effectiveness	Positive
Ikon	2025	Nigeria (Akwa Ibom)	General population	Program evaluation	Appraisal of radio jingles for health sensitisation	Radio (Passion FM)	Mass media	Exposed vs. unexposed	Effectiveness of radio jingles	Positive
Biesty	2024	UK	GBMSM; community organisations	Program evaluation	Community-led health promotion to counter stigma and increase trust	Community engagement; peer-led	Face-to-face; participatory	Pre/post	Stigma reduction; trust increase	Positive

(2025) demonstrated that exposure to a multi-media campaign was associated with higher knowledge scores among residents of Kiambu County, Kenya. Olaoye et al. (2025) reported that listeners of Mdantsane FM community radio in South Africa had significantly better health information related to mpox compared to non-listeners. Ikon et al. (2025) similarly found that exposure to radio jingles improved health sensitization on mpox in Akwa Ibom State, Nigeria.

Evidence from formative research: Consistent and often substantial knowledge gaps were documented across diverse populations and settings, reinforcing the critical need for effective knowledge-oriented RCCE. Poor knowledge was documented among:

- **At-risk populations:** MSM in China (Chen et al., 2024) found only 50.1% awareness; MSM in Nepal (Paudel et al., 2023) reported 87% unaware if mpox was contagious.
- **General populations:** In the Middle East, Mahmoud Fadelallah Eljack et al. (2023) reported generally poor knowledge; in the Philippines, Tendido et al. (2025) identified knowledge gaps mediated by attitudes; in Bangladesh, Nath et al. (2025) found knowledge gaps associated with sociodemographic factors; in Shenzhen, China, Ren et al. (2023) found low specific knowledge.
- **Healthcare workers and students:** Sahin et al. (2022) found knowledge gaps among Turkish physicians; Rawat et al. (2023) found low knowledge among Indian medical students, with only 17.8% receiving institutional teaching; Mohana Sundaram et al. (2025) found prior information-seeking via

Google/ChatGPT was a predictor of higher knowledge among health sciences students in India and Bangladesh.

Impact on risk perception

- **Evidence from intervention studies:** Only one intervention study explicitly measured risk perception as an outcome. Roess et al. (2011) found that a community intervention in the DRC was effective in improving risk perception related to mpox prevention.
- **Evidence from formative research:** Risk perception was consistently identified as a critical determinant of behavioral intentions. Higher risk perception was significantly associated with:
Vaccination willingness: Among MSM in the Netherlands (Dukers-Muijters et al., 2023; adjusted odds ratio [OR] for high-risk perception ranged from 2.2 to 2.4, 95% CI [1.2-3.9]).
- **Self-isolation intentions:** Among YMSM in China (Xu et al., 2024; aOR 1.37-1.47, 95% CI [1.002-2.097]). Information seeking and protective behaviors: Tambo et al. (2024) in Cameroon and Amin et al. (2025) in Egypt found risk perception and fear were positively correlated with preventive practices.

However, discrepancies in risk perception were also identified. Wang, H. (2022) found that PrEP-using MSM in the Netherlands had lower perceived concern compared to other MSM groups (aOR 2.55 for non-PrEP users having greater concern), suggesting that some sub-populations

may underestimate their risk. Vanhamel et al. (2023) identified low self-perceived risk as a barrier to timely healthcare seeking among mpox cases in Belgium.

Impact on preventive behaviours

- **Evidence from intervention studies:** Roess et al. (2011) reported that the community intervention in the DRC was associated with increased adoption of preventive behaviors. No other intervention study directly measured behavior change as a primary outcome.
- **Evidence from observational and modelling studies:** Two epidemiological modelling studies provided strong evidence for population-level behavior change. Gubela et al. (2026) demonstrated that behavior change, alongside infection-induced immunity, was a primary driver of the decline in the 2022 mpox outbreak in Berlin. Maniscalco et al. (2026) similarly concluded that behavior change played a crucial role in controlling the outbreak in Paris. Prochazka et al. (2024), in a large multi-country survey across 23 countries in Europe and the Americas, documented widespread temporary adaptations to sexual behavior among respondents, indicating spontaneous risk reduction in the absence of formal messaging.

Barriers to preventive behaviors identified in formative research:

- **Stigma:** Lake et al. (2025) identified sexual identity-related shame as a significant barrier to prevention among gay and bisexual men. Paterson et al. (2025) and Boutzoukas et al. (2025) also documented stigma as an impediment to engaging with public health measures.
- **Low perceived risk:** As noted above, Vanhamel et al. (2023) found low self-perceived risk led to delays in seeking care.
- **Symptom confusion:** Vanhamel et al. (2023) and Chen, C. et al. (2025) reported that confusion with other conditions delayed consultation.
- **Depression and self-stigma:** Xu et al. (2024) found that depression and self-stigma were negatively associated with intentions to self-isolate among YMSM in China.

Impact on healthcare-seeking behaviours

Evidence from intervention studies: Reynolds et al. (2013) provided the only direct evidence, showing that intensive community education in the Republic of the Congo led to improved detection of human mpox cases, serving as a proxy for increased healthcare-seeking

behaviour.

Evidence from formative research: Studies identified significant delays in healthcare seeking. Chen, C. et al. (2025) documented delayed consultation among mpox cases in Hubei Province, China. Vanhamel et al. (2023) found that low self-perceived risk and symptom confusion contributed to these delays. These findings highlight a critical area for future RCCE interventions.

Impact on vaccination uptake and intention

This was the most extensively studied outcome, addressed in 25 studies (29.8%). However, only one intervention study provided direct evidence.

Evidence from intervention studies: Biesty et al. (2024) reported that a community-led health promotion intervention in the UK was effective in increasing trust among priority populations (GBMSM), which is a known precursor to vaccine acceptance. The study did not directly measure changes in vaccination uptake attributable to the intervention.

Evidence from formative research on vaccination intention:

- **Levels of willingness:** Wide variation was observed. High willingness was reported among MSM in the Netherlands (81.5%; Dukers-Muijters et al., 2023). Moderate to low willingness was found among cancer patients in Turkey (30.9%; Sahin et al., 2025), the general population in Palestine (28.8%; El Sharif et al., 2025), healthcare workers in Pakistan (Ali et al., 2024), and nurses/physicians in Jordan (37.0%; Sallam et al., 2023).
- **Determinants of willingness/hesitancy:**
 - **Positive determinants (enablers):** Higher risk perception (Dukers-Muijters et al., 2023), higher knowledge (Sahin et al., 2025), prior COVID-19 vaccination (El Sharif et al., 2025), favorable attitudes toward mandatory vaccination (Sallam et al., 2023), trust in official media and community organizations (Chen et al., 2024; Metheny et al., 2023), and prior information-seeking (MohanaSundaram et al., 2025; Wang, H., 2024).
 - **Negative determinants (barriers):** Vaccine conspiracy beliefs (Sallam et al., 2023; Sallam, 2022; Youssef et al., 2023), stigma (Boutzoukas et al., 2025), rural residence and lack of community connection (Dukers-Muijters et al., 2023), safety concerns and potential interference with treatment (Sahin et al., 2025), and a range

of factors identified in studies on vaccine hesitancy (Olawusi et al., 2025; Zheng et al., 2023).

- **Trusted sources for vaccine information:** Studies consistently highlighted the importance of trusted messengers. Chen et al. (2024) found that 79.3% of MSM in China trusted official media. Metheny et al. (2023) reported that high trust in community organizations was associated with COVID-19 vaccine uptake among Latinx SGM individuals, providing transferable lessons for mpox. Dukers-Muijters et al. (2023) noted the importance of knowing vaccinated persons, highlighting the role of social norms.

Impact on trust in authorities

Evidence from intervention studies: Biesty et al. (2024) explicitly reported that a community-led approach was effective in increasing trust amongst priority populations. This finding directly supports the value of participatory, community-engaged RCCE.

Evidence from formative research: Trust was identified as both a facilitator and a barrier. High trust in official sources facilitated positive health behaviours (Chen et al., 2024). Conversely, negative attitudes toward the government were associated with higher endorsement of conspiracy beliefs in Lebanon (Youssef et al., 2023), demonstrating that low trust can undermine RCCE efforts.

Impact on misinformation and infodemic management

Evidence from intervention studies: No intervention study explicitly designed to counter misinformation was identified among the included records. However, Ku et al. (2025) analyzed correction approaches on Instagram, finding that specific strategies (e.g., hashtag framing) could be effective in addressing mpox misinformation, offering promising directions for future interventions.

No intervention evaluation explicitly designed to counter misinformation or manage infodemics was identified among the 84 included studies.

Evidence from formative research:

- **Prevalence of misinformation and conspiracy beliefs:** Sallam (2022) documented conspiratorial attitudes towards emerging viruses among the Jordanian public. Youssef et al. (2023) found that conspiracy beliefs around mpox were prevalent in Lebanon and were associated with social media reliance, poor knowledge, and negative attitudes toward the government. Sallam et al. (2023) linked vaccine conspiracies to lower mpox vaccine acceptance among healthcare workers in Jordan.

- **Infodemic dynamics:** Fan et al. (2024) analyzed toxicity on social media during the mpox emergency, highlighting how high toxicity fuels misinformation. Rajkhowa et al. (2023) conducted sentiment analysis of tweets, identifying key themes related to communication, stigmatization, and vaccine accessibility. Boender et al. (2023) described the establishment of an infodemic management framework in Germany, providing a practical example of institutionalizing social listening. WHO (2022) provided implementation guidance for infodemic management in the European Region, underscoring its importance in RCCE.

Impact on outbreak metrics

Evidence from intervention studies: Reynolds et al. (2013) used case detection as an outcome measure, demonstrating a link between community education and improved surveillance. Roess et al. (2011) also used surveillance data to assess the impact of their community intervention on mpox prevention.

Evidence from epidemiological studies: Gubela et al. (2026) and Maniscalco et al. (2026) provided the strongest evidence linking population-level behaviours to outbreak control, demonstrating that behaviour change contributed significantly to declining incidence. Xiu et al. (2024) modelled the impact of past interventions on mpox transmission in Canadian cities, suggesting a positive effect.

Healthcare workers as RCCE messengers and recipients

Eight studies focused on healthcare workers (HCWs) as either target populations for RCCE or as potential RCCE messengers. Key findings include: knowledge gaps among HCWs were consistently documented, with only 37.0% of Jordanian HCWs accepting mpox vaccination (Sallam et al., 2023); 17.8% of Indian medical students received institutional mpox teaching (Rawat et al., 2023); and Turkish physicians demonstrated knowledge gaps requiring targeted education (Sahin et al., 2022). In low-income settings, HCW vaccine hesitancy determinants were identified in DRC (Olawusi et al., 2025) and Nigeria (Bakare et al., 2024). The connection between HCW knowledge deficits and their capacity to function as trusted community RCCE messengers was not explicitly examined in any included study. This represents a missed opportunity: HCWs are routinely identified as trusted information sources in outbreak responses, yet no intervention in this review evaluated RCCE strategies designed to improve HCW knowledge specifically to enhance.

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Factors influencing intervention effectiveness: Enablers and barriers

Synthesis of formative and qualitative research, as well as findings from intervention studies, revealed a consistent set of enablers and barriers that influence the effectiveness of RCCE.

Enablers (key success factors):

- **Tailored, population-specific communication:** Interventions and messages that were tailored to the specific needs, language, and concerns of priority populations (e.g., MSM, PLHIV) were more likely to be effective (Chan et al., 2024; Dukers-Muijters et al., 2023).
- **Leveraging trusted messengers and channels:** Utilizing trusted sources, including community-based organizations, peer networks, and official media, was critical for message acceptance and behavior change (Biesty et al., 2024; Chen et al., 2024; Metheny et al., 2023).
- **Community participation and leadership:** Interventions that actively involved communities in design and delivery, such as the community-led model in the UK (Biesty et al., 2024), were more successful in building trust and addressing stigma.
- **Addressing social norms:** Positive social norms, such as knowing vaccinated persons, facilitated vaccination willingness (Dukers-Muijters et al., 2023).
- **Multi-channel approaches:** Combining different communication channels (e.g., social media, radio, community engagement) appeared more effective than single-channel strategies (Jonathan et al., 2025).

- **Proactive infodemic management:** Implementing social listening and addressing misinformation promptly was identified as a crucial enabler for maintaining trust and promoting accurate health behaviours (Boender et al., 2023; WHO, 2022).

Barriers (key challenges):

- **Stigma and discrimination:** Stigma associated with mpox, particularly its initial association with MSM communities, was a pervasive barrier. It discouraged healthcare seeking (Boutzoukas et al., 2025; Paterson et al., 2025), hindered prevention (Lake et al., 2025), and fueled misinformation (Nerlich et al., 2025).
- **Misinformation and conspiracy beliefs:** The prevalence of misinformation and conspiracy theories eroded trust in authorities and vaccines, directly undermining RCCE efforts (Sallam, 2022; Sallam et al., 2023; Youssef et al., 2023).
- **Low risk perception:** Many individuals in at-risk groups did not perceive themselves to be at risk, leading to low engagement with preventive measures and delayed healthcare seeking (Vanhamel et al., 2023; Wang, H., 2022).
- **Knowledge gaps and misconceptions:** Persistent knowledge gaps about transmission, symptoms, and prevention, even among healthcare workers and students, created a fertile ground for misinformation and reduced the effectiveness of health messaging (Bates et al., 2022; MohanaSundaram et al., 2025; Paudel et al., 2023; Rawat et al., 2023).
- **Access barriers:** Practical barriers such as limited vaccine access (Boutzoukas et al., 2025), unemployment (Chen, C. et al., 2025), and rural residence (Dukers-Muijters et al., 2023) hindered the translation of intention into action.
- **Lack of trust in authorities:** In settings where trust in government or public health institutions was low, RCCE messages were less likely to be accepted (Youssef et al., 2023).
- **Inadequate engagement of vulnerable populations:** Several studies noted the failure to effectively reach and engage marginalized groups, including people experiencing homelessness (Filardo et al., 2023) and specific ethnic minority groups (Metheny et al., 2023).

Equity and community participation

Community engagement levels varied across studies. The majority of formative research (n=58, 76.3%) was consultative, using surveys and interviews to inform future strategies.

Genuinely participatory or collaborative methods, where communities participated in intervention design decisions, were rare (n=5; Biesty et al., 2024; Daroya et al., 2025;

Duda et al., 2024; Kutalek et al., 2025; Nerlich et al., 2025).

To systematically characterize equity dimensions, we applied the PROGRESS-Plus framework (Place of residence, Race/ethnicity/culture/language, Occupation, Gender/sex, Religion, Education, Socioeconomic status, Social capital, Plus other vulnerable groups). Across included studies, reporting of equity-relevant dimensions was inconsistent. Studies explicitly targeting vulnerable or underserved populations included people experiencing homelessness (Filardo et al., 2023), people living with HIV (Iliyasu et al., 2025; Svartstein et al., 2023; Yellin et al., 2026), cancer patients (Sahin et al., 2025), and marginalized sexual and gender minorities (Metheny et al., 2023).

However, only two studies (Biesty et al., 2024; Daroya et al., 2025) demonstrated equity-centred intervention design where vulnerable populations were not merely included as subjects but participated in intervention leadership. A critical distinction emerged: inclusion of vulnerable populations in samples ($n=12$ studies) versus genuine equity-centring in design ($n=2$ studies). The evidence synthesis reveals a clear gap in low-income countries and in interventions designed and led by affected communities themselves.

Discussion

Principal findings

This systematic review synthesised 84 studies examining RCCE interventions during mpox outbreaks, revealing a critical imbalance: 90.5% were formative research documenting knowledge, attitudes, and perceptions, while only 9.5% directly evaluated implemented interventions. This disparity reflects the nascent state of RCCE evaluation science in outbreak contexts, consistent with observations from Ebola and COVID-19 reviews, which similarly noted a predominance of descriptive research over intervention effectiveness studies [6,21]. The eight intervention evaluations identified all reported positive effects on primary outcomes, including improved knowledge [22-24], enhanced risk perception [25], increased case detection [26], and reduced stigma with increased trust [27].

However, methodological limitations, weak designs, poor intervention reporting, small sample sizes, and absence of theoretical frameworks limit conclusion strength, mirroring findings from systematic reviews of community engagement in low- and middle-income countries [28]. This evidence base, while promising, remains insufficient to definitively establish which RCCE approaches are most effective across different contexts.

Although GBMSM communities were central to the 2022 outbreak epidemiology, the evidence base for RCCE interventions identified in this review spans general

populations, with GBMSM representing one of several priority groups alongside healthcare workers, people experiencing homelessness, and other vulnerable populations.

Geographical and temporal distribution

Research concentrated on high-income (47.6%) and upper-middle-income (26.2%) countries, predominantly in the WHO European Region (33.3%) and the Americas (21.4%). This reflects the 2022 outbreak's disproportionate initial impact on wealthy nations [3], where rapid transmission among GBMSM networks triggered urgent research responses. However, only 14.3% of studies originated from the AFRO region, with minimal low-income country representation (2.4%), despite Africa bearing the highest historical mpox burden and recent Clade I resurgence [4,5].

This evidence gap raises serious concerns about generalising findings to resource-constrained settings characterised by weaker health systems, lower literacy rates, limited digital access, higher community distrust, and concurrent humanitarian crises [29]. The temporal distribution shows 90.5% of studies published between 2022 and 2026, reflecting the catalytic effect of the PHEIC declaration on research activity. However, the concentration during such a narrow timeframe raises questions about research sustainability as global attention shifts, potentially repeating the pattern of neglect that characterized mpox for decades prior to 2022 [2].

Effectiveness across outcome domains

Knowledge improvement

All four intervention studies measuring knowledge reported positive effects across diverse modalities: targeted MSM education in an unspecified setting [22], multi-media campaigns in Kenya [23], and community radio in South Africa [24]. These findings align with systematic reviews demonstrating that well-designed communication campaigns can significantly improve infectious disease knowledge [30]. However, the substantial knowledge gaps documented across diverse populations in formative research underscore the insufficiency of current RCCE efforts. Only 50.1% of Chinese MSM demonstrated adequate knowledge [14]; 87% of Nepalese MSM were unaware of mpox contagiousness [15]; and healthcare workers showed persistent gaps, with only 17.8% of Indian medical students receiving institutional mpox teaching [31,32]. These gaps are particularly concerning given healthcare workers' role as trusted community information sources [5] and the direct link between misconceptions and delayed care-seeking [33].

The persistence of knowledge gaps despite widespread information campaigns suggests that passive information

dissemination is insufficient and that more intensive, targeted, and culturally tailored approaches are required, for what works.

Risk perception

Higher risk perception is consistently associated with greater vaccination willingness [16], stronger self-isolation intentions [34], and increased preventive practices [35], aligning with Health Belief Model constructs [36]. These findings confirm that risk perception operates as a fundamental driver of health-protective behaviours during outbreaks. Critically, risk perception discrepancies were identified: PrEP-using MSM in the Netherlands showed lower concern despite elevated risk [37], illustrating optimistic bias whereby individuals with perceived protection against one infection underestimate risk for others [38].

Low self-perceived risk among Belgian mpox cases contributed to delayed healthcare seeking [33], highlighting a key RCCE target. These findings suggest that effective RCCE must not only provide accurate risk information but actively address cognitive biases leading to risk underestimation, particularly among sub-populations that may feel falsely protected by existing health practices. Messaging should explicitly counter the “not me” phenomenon by personalizing risk and using relatable peer examples.

Preventive behaviours

Epidemiological modelling provided strong evidence for population-level behaviours change, demonstrating that spontaneous sexual behaviours adaptations contributed significantly to outbreak control in Berlin [39] and Paris [40]. A 23-country survey documented widespread temporary behavioural adaptations including reduced partner numbers and avoidance of venues associated with transmission [41], suggesting communities can rapidly modify behaviours when perceiving credible threats. These findings have profound implications: they demonstrate that behaviour change can occur at population level and measurably impact outbreak trajectories, providing strong rationale for investing in behavioural interventions as core outbreak response components.

However, identified barriers, stigma [42,43], low risk perception [33], symptom confusion [33], and depression [34], indicate that barrier removal is as important as information provision. RCCE interventions addressing these barriers directly, through stigma reduction, mental health support, and clear symptom recognition guidance, are likely more effective than those focused solely on information provision. The absence of intervention studies measuring behaviour change as a primary outcome represents a missed opportunity to build the evidence base

Healthcare seeking behaviours

Only one intervention study demonstrated that intensive community education improved case detection in the Republic of Congo [26], serving as a proxy for increased healthcare seeking. Documented delays, up to 9 days in China [44] and Belgium [33], represent substantial transmission windows during which onward transmission can occur. The reasons for delays- low risk perception, symptom confusion, and stigma- are potentially addressable through well-designed RCCE, yet the absence of interventions specifically targeting healthcare seeking constitutes a critical evidence gap. This gap is particularly concerning given that early diagnosis and isolation are fundamental to outbreak control for infectious diseases like mpox [7].

Future RCCE interventions should explicitly target healthcare seeking as a primary outcome, with messages designed to increase symptom recognition, reduce stigma-associated barriers, and provide clear guidance on when and where to seek testing. The success of community education in improving case detection in Congo [26] suggests that similar approaches could be adapted and evaluated in other settings.

Vaccination uptake and intention

Vaccination intention, the most studied outcome (29.8% of studies), showed wide variation: 81.5% among Dutch MSM [16] versus 28.8% in Palestine [17] and 30.9% among Turkish cancer patients [45]. This variation reflects the profound influence of context, population characteristics, and prior health system experiences on vaccine acceptance. Positive determinants, higher risk perception, knowledge, prior vaccination, trust, and positive social norms suggest multi-pathway RCCE approaches addressing multiple determinants simultaneously. Negative determinants, conspiracy beliefs, stigma, rural residence, and safety concerns require active barrier addressing through targeted messaging and community engagement.

The association between conspiracy beliefs and lower vaccine acceptance across multiple populations [18,19,46] underscores the critical importance of infodemic management as an integral RCCE component. Trusted messengers consistently mattered: 79.3% of Chinese MSM trusted official media [14]; community organization trust associated with uptake [47]; and knowing vaccinated persons facilitated willingness [16], highlighting the role of social norms and peer influence. These findings suggest that RCCE should invest in partnerships with community-based organizations, train peer messengers, and leverage existing trusted networks rather than relying

solely on mass media campaigns.

Trust and misinformation

A community-led UK intervention effectively increased trust among priority populations [27], demonstrating that trust can be built through participatory, community-engaged approaches. High trust facilitated positive behaviours [14]; conversely, negative government attitudes associated with higher conspiracy beliefs in Lebanon [46], demonstrating that low trust can fundamentally undermine RCCE efforts. This finding has relevance for conflict-affected settings where distrust of government and foreign actors is widespread [29]. No intervention explicitly designed to counter misinformation was identified among included studies, despite documented conspiracy belief prevalence [18,19,46] and clear guidance on infodemic management importance [9,11]. This represents a major evidence gap. Ku et al. identified promising Instagram correction strategies [48], suggesting that specific approaches like hashtag framing and corrective messaging could be effective. Infodemic dynamics analyses revealed that high toxicity fuels misinformation [49] and identified key themes, communication, stigmatization, vaccine accessibility, safety concerns—requiring proactive communication [50].

Germany's infodemic management framework exemplifies institutionalizing social listening and signal detection [51], providing a practical model that should be integrated into all RCCE programmes. The complete absence of IM intervention evaluations represents a critical evidence gap. Despite WHO guidance on infodemic management as a core outbreak response pillar, and despite documented mpox-related misinformation across multiple countries and digital platforms, no study in this review tested an intervention designed to counter misinformation, improve digital health literacy, or reduce the spread of conspiracy beliefs.

This gap is particularly concerning given that conspiracy beliefs were significantly associated with lower vaccine acceptance across multiple populations. Future research must prioritize development and rigorous evaluation of IM interventions, including social listening-informed messaging, misinformation correction strategies, and community-led digital health literacy programmes.

Outbreak metrics

Intervention studies linked community education to improved case detection [25,26], demonstrating that RCCE can impact surveillance outcomes. Epidemiological studies demonstrated behaviour change's contribution to declining incidence [39,40], providing the strongest evidence linking population-level behaviours to outbreak control. These findings validate the fundamental premise of RCCE: that communication and engagement can influence behaviours

at sufficient scale to alter epidemic trajectories. Xiu et al. modelled the impact of past interventions on mpox transmission in Canadian cities, suggesting positive effects [52].

However, the small number of studies using outbreak metrics as outcomes limits the evidence base for this critical aspect of RCCE effectiveness. Future evaluations should prioritize objective, population-level outcomes including incidence trends, transmission rates, and vaccination coverage, rather than relying solely on self-reported intentions and attitudes.

Absence of theoretical frameworks in intervention design

Only one of the eight intervention evaluations (Roess et al., 2011) explicitly grounded its approach in a behavioural theory. This absence is not merely a reporting limitation; it has substantive implications for interpreting RCCE effectiveness. Established frameworks such as the Health Belief Model (HBM), the COM-B model (Capability, Opportunity, Motivation – Behaviour), the Theory of Planned Behaviour (TPB), and Social and Behaviour Change Communication (SBCC) frameworks provide structured approaches to identifying behavioural determinants, selecting intervention components, and measuring theoretically specified outcomes.

Without explicit theoretical grounding, it is difficult to determine why an intervention worked (or failed), which components were active ingredients, and whether findings can be replicated across different contexts. The seven intervention studies that did not report theoretical frameworks may still have been implicitly theory-informed, but the lack of explicit articulation limits the strength of conclusions that can be drawn and impedes evidence synthesis. Future RCCE intervention research should prospectively apply and report behavioural frameworks to enhance design quality, replicability, and cumulative evidence building.

Enablers and barriers

Synthesis of formative and qualitative research, alongside intervention findings, revealed consistent enablers and barriers influencing RCCE effectiveness. Enablers included: tailored population-specific communication addressing the language, concerns, and contexts of priority populations [16,53]; leveraging trusted messengers including community-based organizations, peer networks, and official media [14,27,47]; community participation and leadership in intervention design and delivery [27,54]; addressing social norms through highlighting peer behaviours [16]; multi-channel approaches combining mass, social, and interpersonal communication [23]; and proactive infodemic management with social listening and rapid response [51]. These enablers align with WHO RCCE guidance principles [7] and findings from

community engagement systematic reviews [28,55].

Barriers included: stigma and discrimination discouraging healthcare seeking [42,43] and fueling misinformation [13]; misinformation and conspiracy beliefs eroding trust [18,19,46]; low risk perception leading to low engagement [33,37]; knowledge gaps and misconceptions creating fertile ground for misinformation [14,15,31]; access barriers including limited vaccine access [43], unemployment [44], and rural residence [16]; lack of trust in authorities undermining message acceptance [46]; and inadequate engagement of vulnerable populations including people experiencing homelessness [56] and ethnic minorities [47]. Many barriers are interconnected, stigma fuels misinformation, misinformation erodes trust, low trust reduces engagement, and reduced engagement perpetuates knowledge gaps. Effective RCCE must address this complex web through comprehensive, multi-component interventions rather than isolated information campaigns.

Implications for policy and practice

First, substantial knowledge gaps across diverse populations indicate insufficient current RCCE efforts. National and international RCCE strategies should be reviewed and strengthened, prioritising at-risk populations with accessible, accurate information about mpox transmission, symptoms, and prevention. Second, modifiable determinants of vaccination willingness, risk perception, knowledge, trust, and social norms provide clear intervention targets. Campaigns should address these determinants simultaneously using multi-channel approaches combining mass media with community engagement and peer communication. Third, misinformation prevalence demands integrated infodemic management: investment in social listening systems, rapid response mechanisms for addressing misinformation, and partnerships with social media platforms are urgently needed. Fourth, addressing stigma requires both programmatic responses and legal-policy reforms protecting marginalized populations.

RCCE alone cannot eliminate stigma, but can contribute by countering stereotypes, amplifying positive narratives, and engaging affected communities in message development. Fifth, geographical research imbalance calls for investment in research capacity in low- and middle-income countries where mpox has been endemic for decades. International research partnerships that genuinely build local capacity and prioritise locally identified questions should be supported.

Research priorities

- Urgent research priorities include: rigorous intervention evaluations using quasi-experimental designs including pre-post studies with comparison

groups; improved intervention reporting following TIDieR guidelines to enable replication and evidence synthesis [57]; research in under-represented low-income and conflict-affected settings where RCCE conditions differ fundamentally from high-income contexts; testing specific RCCE strategies including community-led approaches, infodemic interventions, and stigma reduction programmes; longitudinal studies examining effect durability beyond immediate outbreak periods; and cost-effectiveness analyses to guide resource allocation in constrained settings. The predominance of cross-sectional designs (61.9%) limits causal inference; future research should prioritize designs capable of demonstrating attribution.

- Development and evaluation of infodemic management (IM) interventions, including misinformation correction strategies and digital health literacy programmes, as well as assessment of digital communication interventions, such as social media campaigns, hotlines, and mobile health messaging, for mpox RCCE. This is particularly important given their widespread use in GBMSM community health communication and the documented role of digital platforms in both health promotion and misinformation dissemination.

Strengths and limitations

Strengths include comprehensive search strategy across multiple databases and grey literature sources; inclusion of diverse study designs enabling synthesis of both effect estimates and contextual insights; dual independent screening, data extraction, and quality appraisal with good inter-rater reliability ($\kappa=0.78-0.85$); and PROSPERO registration promoting transparency.

Clade-specific transferability constraints apply. The majority of included studies reflect the 2022 multi-country Clade IIb outbreak, characterized by human-to-human transmission predominantly through sexual networks in urban GBMSM communities. RCCE evidence derived from this context may not generalize straightforwardly to Clade I endemic settings in Central Africa, where transmission dynamics include zoonotic spillover, household and paediatric transmission, and different community perceptions and health-seeking behaviours. Effective RCCE approaches for Clade IIb sexual-network contexts may require fundamental adaptation for Clade I community settings. Future research should evaluate RCCE interventions specifically in Clade I endemic regions.

The exclusion of non-English publications potentially introduces language bias. This has specific implications for the African evidence gap: French-language literature from the Democratic Republic of Congo, Cameroon, and other

Francophone endemic settings may contain formative or intervention evidence that was not captured, potentially biasing the review towards English-publishing countries and underrepresenting high-burden Francophone Africa.

Predominance of cross-sectional studies limiting causal inferences; small number of intervention evaluations precluding meta-analysis; and publication bias, which cannot be excluded. All eight intervention evaluations reported positive effects, and formal statistical assessment (e.g., funnel plot or Egger's test) was not feasible with only eight studies. Studies with null or negative findings may remain unpublished, which may overestimate the effectiveness of RCCE interventions in this review. Readers should therefore interpret the positive findings with caution.

Additional limitations include geographical concentration in high-income countries limiting generalizability to low-resource settings and potential omission of recent publications given the rapidly evolving outbreak landscape. Quality varied across studies, with 57.1% rated high quality, 39.3% moderate, and 3.6% low; findings from lower-quality studies were interpreted with caution.

Conclusions

This systematic review provides comprehensive evidence synthesis on RCCE during mpox outbreaks, revealing both promising findings and critical gaps. While eight intervention studies reported positive effects on knowledge, risk perception, preventive behaviours, and trust, the evidence base remains thin and methodologically weak. Substantial knowledge gaps, misinformation prevalence, stigma impact, and barriers to healthcare seeking and vaccination highlight urgent RCCE strengthening needs. Enablers identified, tailored communication, trusted messengers, community participation, multi-channel approaches, proactive infodemic management, provide a roadmap for more effective interventions.

The geographical concentration of research in high-income countries and predominance of formative over evaluative studies underscore the need for sustained investment in RCCE evidence generation, particularly in low-income and conflict-affected settings. Future research must prioritize rigorous intervention evaluations, better reporting, and locally led studies generating contextually relevant evidence. As mpox continues threatening global health security with evolving epidemiology and potential for future outbreaks, the lessons from this review should inform evidence-based, equity-oriented, community-centred RCCE interventions that reach those most in need.

What is Already Known About this Topic

- RCCE is a fundamental pillar of outbreak response, requiring both accurate information dissemination and meaningful community collaboration to create acceptable health guidance.
- Emerging infectious diseases generate infodemics with rapid misinformation spread, and mpox outbreaks experienced substantial stigmatization and targeted misinformation affecting GBMSM communities.
- Mpox-related stigma mirrors HIV-era patterns, with anticipated discrimination leading many to delay testing or vaccination, while knowledge gaps persist across diverse populations globally.
- Vaccination willingness varies dramatically across contexts (81.5% among Dutch MSM versus 28.8% in Palestine), with conspiracy beliefs significantly undermining acceptance.
- During the 2022 outbreak, widespread behavioural adaptations occurred among at-risk populations, demonstrating capacity for rapid community-driven risk reduction.

What This Study Adds

- This first systematic review on mpox RCCE reveals a critical evidence imbalance: only 9.5% of 84 included studies evaluated implemented interventions, while 90.5% were formative research, highlighting the urgent need for rigorous intervention science in outbreak contexts.
- The eight identified intervention evaluations spanning community education, media campaigns, radio jingles, and community-led health promotion all reported positive effects on knowledge, risk perception, case detection, and trust, providing proof-of-concept that RCCE interventions can work when properly implemented.
- Synthesis identifies consistent, actionable enablers of effectiveness: tailored communication, trusted messengers (community organizations, peer networks), community participation in design, multi-channel approaches, and proactive infodemic management with social listening.
- The review documents pervasive, modifiable barriers requiring targeted intervention: stigma discouraging healthcare seeking, conspiracy beliefs eroding trust, low risk perception causing disengagement, and inadequate engagement of vulnerable groups including people experiencing homelessness and ethnic minorities.

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Authors' Contributions

AUA: Conceptualization, Methodology, Supervision, Project administration, writing original draft, Writing – review editing, Validation. PDM: Conceptualization, Methodology, Formal analysis, Data curation, Visualization, writing original draft, Writing review editing, Validation. VN, MAU: Investigation, Data curation, Writing review editing, Validation. HB, OOO: Investigation, Data curation, Visualization, Writing review editing.

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The authors of this work declare no competing interests.

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