Beyond Individual Media Literacy: A Scoping Review of Social, Cultural, and Platform-Level Approaches to Digital Misinformation Resilience

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ABSTRACT

Background: Digital misinformation is frequently addressed through education that targets individual media literacy, yet online information is produced and interpreted within relationships, cultural contexts, and platform systems. This article develops a multilevel framing of misinformation resilience and maps the initial evidence supporting it.

Methods: An exploratory evidence chart was prepared from a supplied bibliographic reference summary and a previously constructed four-table extraction. Forty-four distinct records were purposively organized into four domains, with eleven references per domain. Abstract-supported evidence was compared narratively using the scoping-review question and Population–Concept–Context framework. The material does not constitute a completed systematic search, full-text eligibility assessment, or PRISMA-ScR included-study set.

Results: Individually focused records examine discernment, prebunking, accuracy judgments, and sharing intentions, while revealing that outcomes are not interchangeable and may depend on available information quality. Social and community records address relational trust, collaborative verification, social norms, and locally credible intermediaries. Culturally situated research emphasizes linguistic adaptation, unequal access, identity, and the contextual relevance of literacy interventions. Platform and institutional studies address algorithmic information environments, credibility labels, moderation, public-health communication, and governance responsibilities. Across domains, theoretical propositions, measured outcomes, and implementation evidence are heterogeneous.

Discussion: The four domains show why misinformation resilience cannot be inferred from a single individual accuracy metric. They also reveal the need to distinguish constructive skepticism from generalized mistrust, individual intentions from observed communication practices, and culturally adapted interventions from universalized program designs.

Conclusion: A multilevel evidence taxonomy can organize future interdisciplinary work on misinformation resilience. A fully reproducible scoping review with formal screening and full-text charting remains necessary before drawing field-level distributions or stronger conclusions.

Keywords: digital misinformation; media literacy; social trust; cultural context; platform governance

INTRODUCTION

The circulation of misleading information through digital media raises a distinctive problem for contemporary communication research: people encounter claims not in isolation but through social relationships, curated feeds, institutional communications, and communities of interpretation. Social platforms facilitate rapid

recirculation while obscuring the provenance, incentives, and contextual meaning of messages. Work on the misinformation–disinformation distinction draws attention to intent, but the intentions of individual sharers are often difficult to establish from trace data alone (Humprecht, 2025). A useful scoping review must therefore examine what people are able to evaluate, what they actually do when communicating with others, and what resources their environments make available.

Media and information literacy have become central responses to these challenges. The conventional repertoire includes questioning sources, recognizing persuasive techniques, checking external information, and withholding unreliable claims. Educational initiatives now range from classroom media-production projects to browser-based inoculation games, short videos, and community literacy programs. A cross-study meta-analysis reported improvements in misinformation-related outcomes across 49 experiments, although effects varied by outcome and study characteristics (Huang et al., 2024). The growing evidence base warrants mapping precisely because the presence of measurable effects in selected settings does not establish that the same approach reaches all groups or remains effective across the diverse contexts of digital life.

An individual-level approach has important practical advantages: literacy competencies can be taught, assessed, and evaluated in relatively controlled conditions. Nonetheless, the object of intervention is often a person's response to an isolated headline rather than the extended social process by which information acquires authority. A review of misinformation interventions identified this individualistic tendency and argued that it neglects the social contexts and systemic consequences through which misinformation operates (Aghajari et al., 2023). The implication is not that education should be abandoned. Rather, its explanatory and practical scope may be incomplete when the influence of communities, institutions, and platforms is left unexamined.

Even seemingly straightforward verification behaviors can produce counterintuitive results. Across experiments, participants searching online to evaluate false news sometimes encountered low-quality corroborating information and consequently rated the claims as more credible (Aslett et al., 2024). This finding complicates an assumption implicit in many literacy programs: increased effort or information seeking does not guarantee improved accuracy. The information environment and quality of available evidence matter. In another line of work, reflection on how strategic disinformation framing influences audience cynicism suggests that efforts to cultivate skepticism can have consequences beyond the intended evaluation of a specific claim (Angwald & Wagnsson, 2024). Together, these concerns call for conceptual precision about what counts as resilience.

We use 'digital misinformation resilience' as an umbrella analytic concept rather than a validated unitary psychological trait. It may refer to discernment, reduced acceptance of misleading claims, more discriminating sharing, informed verification, collective correction, or capacities of organizations and platforms to provide trustworthy information. These dimensions differ both conceptually and methodologically. Sharing intention, for example, should not be treated as equivalent to observed sharing behavior; short-term change in perceived accuracy is not equivalent to durable community trust. A review emphasizing resilience needs to make such differences explicit instead of aggregating heterogeneous endpoints under a single favorable label.

Social relationships also influence whether dubious content is received, challenged, or passed along. Collaborative fact-checking among culturally diverse pairs illustrates that identity-relevant information changes people's decisions to investigate and the standards of credibility applied during deliberation (Gottlieb et al., 2023). Research on urban and rural young voters in Nigeria associates misinformation engagement with different platforms and socially recognized sources of authority, offering a reminder that exposure and susceptibility are not interchangeable processes (Azeez et al., 2026). These studies direct attention toward interactions among messengers, recipients, audiences, and gatekeepers rather than treating users as interchangeable units.

Communities may be sources of vulnerability and resources for verification simultaneously. Public discussion in politically volatile environments can encourage selective trust, yet local knowledge and relational credibility can also support the interpretation of uncertain information. A comparative qualitative study of Lebanon and Iraq frames verification as situated collective judgment rather than merely a technical correction of falsehoods (Elmasry, 2026). Community-based work in disaster risk management similarly emphasizes local capacity,

trusted messengers, and communication infrastructures alongside information-verification training (Cuadra & Cotoron, 2025). These accounts expand the scope of resilience from individual discernment to socially sustained practices.

Culture and inequality further complicate any universal model of digital literacy. Research with Sama Indigenous students describes the use of cultural practices and communal resilience when assessing misinformation (Abdulbarie et al., 2026). Work with Koya communities in India identifies linguistic, educational, and infrastructural considerations for meaningful digital engagement (Achanta & Ali, 2026). An African digital media literacy research agenda argues that media practices must be understood in relation to place-specific political arrangements and material access (Boshoff & Fafowora, 2024). Taken together, these sources suggest that intervention transferability is a substantive research question, not a conclusion that can be presumed from positive outcomes obtained in one setting.

The relevance of culture is not confined to broad comparisons between countries. Experiences of discrimination, unequal access to credible institutions, language differences, and divergent relationships with authority can influence how an intervention is interpreted. Culturally tailored approaches involving communities of color show why the form, examples, and messenger of an educational program are part of its intervention logic (Lee et al., 2025). Critical media literacy scholarship further advocates approaches that recognize identity and civic participation instead of reducing engagement to detecting errors in discrete posts (Mirra et al., 2021). A multilevel perspective must therefore avoid treating 'culture' as a residual demographic variable.

The digital platform is also more than a neutral channel through which individuals exercise skill. Algorithmic amplification, recommendation structures, platform interface cues, reporting mechanisms, and moderation systems shape both encounters with misinformation and opportunities for response. Research on coordinated inauthentic news sites in Singapore describes how sites imitating independent outlets can be combined with social amplification to produce an appearance of legitimacy (Ang & Leong, 2025). Analysis of visual truth labels in Spanish and Portuguese fact-checking platforms shows that seemingly small design choices can shape how categories of credibility are presented to the public (Gomes-Gonçalves & Sánchez-Gey-valenzuela, 2026). These cases illustrate why institutional and platform design belong in an evidence map of resilience.

Meanwhile, the governance of online information is becoming more complex as generative artificial intelligence enables synthetic and highly scalable content production. A review of generative artificial intelligence and misinformation in education mapped both opportunities for identifying misconceptions and risks of reproducing inaccurate content (Fulsher et al., 2026). An ethical and technical review similarly discusses the dual role of automated systems in misinformation production and detection (AbuJarour et al., 2024). These developments require scrutiny of accountability and transparency, rather than assuming that individual users can independently compensate for every technological change.

Existing evidence syntheses provide valuable foundations but leave different questions open. A scoping review of adult mis/disinformation literacy interventions describes varied educational formats and unresolved debates about authority and programming outside formal education (Boler et al., 2025). Another review of health and science misinformation interventions identified substantial attention to corrective approaches and cognitive outcomes (Heley et al., 2025). A university-focused review found diversity in theoretical frameworks and evaluation practices (Etesse et al., 2025). These contributions help explain why a broader map of relationships among individual, community, cultural, and platform levels may complement, rather than repeat, narrower effectiveness or population-specific reviews.

This article addresses the question: how has digital misinformation resilience been conceptualized, investigated, and supported across individual, social, cultural, institutional, and platform-level contexts, and what gaps characterize the available evidence? Its objectives are to chart research constructs and approaches, distinguish studied outcomes, characterize multilevel practices, and identify where forms of resilience remain underexamined. The proposed contribution is a four-domain interpretive taxonomy connecting cognitive competencies, socially distributed verification, culturally situated participation, and institutional or platform responses. The present manuscript uses a transparent, preliminary chart of 44 records from an uploaded

bibliographic collection; it does not claim to report a completed systematic search and full-text selection process. That limitation is integral to interpreting the findings, not an afterthought.

METHODS

Review design and present evidence stage

The review question and interpretive framework were developed using a scoping-review orientation that prioritizes breadth, conceptual clarification, and mapping of evidence types. Foundational scoping-study methodology establishes the value of reviewing how a research area has been studied rather than limiting synthesis to a narrowly specified intervention effect (Arksey & O'Malley, 2005). Later methodological refinements emphasize transparent selection, iterative data charting, and the distinction between a map of evidence and an effectiveness synthesis (Levac et al., 2010). JBI guidance supports Population–Concept–Context (PCC) framing and explicit alignment among the review question, eligibility criteria, and search design (Peters et al., 2020). PRISMA-ScR provides the appropriate reporting framework for the eventually completed review (Tricco et al., 2018).

The evidence available for this manuscript consists of a user-supplied reference-summary file, a prior charting exercise, and an associated literature-statement bank. No independently executed, reproducible multibase search log or study-level full-text eligibility decisions accompanied the material. Consequently, the analytic status of the findings is a preliminary, abstract-supported evidence map, not a finalized PRISMA-ScR included-study synthesis. Statements describing a future comprehensive review are identified below as intended protocol steps rather than retrospective descriptions of work performed.

Review question, PCC and eligibility framework

The population domain encompasses digital-media users, communities, social groups, educators, civil-society actors, information professionals, and institutions participating in responses to online misinformation. The concept includes media and information literacy, discernment, verification, fact-checking, inoculation, collective resilience, culturally adapted responses, and platform or organizational governance. Context refers to digitally mediated information environments, including social networks, messaging services, online communities, platform-mediated news, and digital health or civic communication.

For a completed review, eligible records should substantively investigate how misinformation or disinformation is encountered, evaluated, shared, corrected, resisted, or governed in digital settings. Quantitative, qualitative, mixed-method, and analytically substantive conceptual studies may all contribute to conceptual mapping, with study type recorded and distinguished. Purely technical classifier benchmarks lacking human, institutional, or governance relevance, generic digital-literacy reports without misinformation relevance, administrative corrections, and duplicate records should be excluded. The working period is 2020–2026; the 2005, 2010, 2018, and 2020 methodological sources remain eligible as background but are not part of the charted substantive sample. Language and document-type restrictions must be finalized before a comprehensive screening exercise.

Information sources and planned search strategy

The supplied reference summary contains citations described as indexed in Scopus and accompanying abstracts. The earlier reference audit reported 290 bibliographic entries, including 288 with abstracts and two without abstracts, and found no repeated DOI or exact normalized-citation matches using its stated rules. These are counts within the supplied file, not an estimate of all studies identified through a newly executed database search. No dated retrieval history, complete search string, database export files, or search result logs were available to independently reconstruct identification.

A reproducible completion search should query Scopus and Web of Science Core Collection, supplemented where feasible by databases relevant to communication and social science. A candidate Scopus query is TITLE-ABS-KEY(("misinformation" OR "disinformation" OR "fake news") AND ("media literacy" OR

"information literacy" OR "fact-checking" OR "prebunking" OR "inoculation" OR "resilience") AND ("social media" OR "online platform*" OR "digital communication" OR "digital media")). Social, cultural, and governance dimensions should be added through supplementary searches rather than required as a restrictive third concept in every search. Exact database syntax, run dates, limits, supplementary citation searches, and counts should be deposited with the final protocol and manuscript.

Record management, screening and charting

The prior charting exercise purposively placed 44 distinct citations into four prespecified domains, with 11 entries in each. It checked the supplied dataset by normalized DOI and citation matching and reported zero repeated placements across Tables 1–4. Selection for thematic representativeness is not equivalent to prespecified title/abstract screening followed by full-text eligibility evaluation. The 44 charted citations therefore include original studies, evidence syntheses, conceptual papers, chapters, and policy-oriented texts; they are described as charted records rather than uniformly as empirical studies.

The completed scoping review should preserve original record identifiers, deduplicate across databases, pilot eligibility judgments, conduct independent title/abstract and full-text screening, reconcile disagreements, record full-text exclusion reasons, and show a PRISMA-ScR flow diagram populated only with actual counts. A pilot-tested extraction matrix should capture bibliographic metadata, country, population, platform, study design, theoretical lens, resilience definition, social level, strategy, indicator, reported result, and source limitation. Critical appraisal is optional and would require a distinct prespecified rationale. Neither risk-of-bias judgments nor pooled comparative effectiveness estimates are inferred from the present abstracts.

Synthesis approach and claim boundaries

The current synthesis uses the four domains established in the outline: individual cognitive resilience, social trust and collective verification, cultural contexts and inclusion, and governance or multilevel responses. Charted records receive one principal table assignment to make the exploratory accounting transparent; substantively, a source may address more than one level. The narrative interprets the type and scope of evidence as described in the abstract and avoids converting an author's conclusion into an independently validated effect estimate.

Because the dataset does not represent a completed systematic selection, the equal distribution of 11 references per domain must not be interpreted as a field-level prevalence distribution. Similarly, the 246 source records not charted in the exploratory tables were not necessarily excluded for ineligibility; many were simply not selected for this initial thematic map. Distinctions among belief, discernment, sharing intention, observed behavior, and structural capacity are retained. The resulting framework is an organizing hypothesis for a later fully screened review, not a tested causal model.

Theoretical Background

From individual literacy to multilevel resilience

A multilevel account begins by separating the unit of analysis from the object of intervention. Individual literacy concerns what a user knows, believes, notices, and does while evaluating information. Social resilience concerns interactions and norms through which information is interpreted and circulated; cultural resilience concerns identities, histories, languages, and material conditions shaping those interactions; institutional resilience concerns the design and accountability of systems that create or regulate information environments. These dimensions may reinforce or constrain one another, but their relationship cannot be assumed to be additive.

Individual cognitive approaches commonly target recognition of manipulative techniques, critical reasoning, source evaluation, and accuracy judgments. Inoculation theory treats advance exposure to weakened deceptive tactics as an opportunity to build resistance before encountering more persuasive messages. Cross-cultural work using prebunking interventions offers evidence of improvements in selected manipulation-recognition

outcomes (Basol et al., 2021). An intervention developed for Indonesian adults using simulated WhatsApp conversations additionally reported changes in motivation and perceived social norms, while some self-efficacy effects were not sustained at follow-up (Becker et al., 2025). The distinction illustrates that a program can affect social expectations even when the primary delivery format targets individuals.

The limits of individual literacy are conceptual as well as practical. Searching for verification evidence requires both motivation and access to a trustworthy information environment; an apparently competent act of searching may expose a user to low-quality corroboration (Aslett et al., 2024). Research on reasoning tools similarly suggests that support for argument evaluation should not be reduced to simplistic true-versus-false labeling (Musi et al., 2023). Educational programs should thus be situated in a wider infrastructure of accessible, credible evidence and clear opportunities for justified doubt.

At the interpersonal and community level, resilience may reside in shared practices, norms of responsible forwarding, social correction, and locally legitimate expertise. An intervention-oriented review argues that social drivers of misinformation require explicit attention alongside individual belief correction (Aghajari et al., 2023). Research on community-oriented library programming points to the potential roles of trusted information intermediaries who can translate literacy into accessible public services (Young et al., 2021). Community influence may also generate vulnerability when authorities or familiar contacts circulate unreliable claims, which means collective mechanisms should not be treated as uniformly protective.

Cultural, structural and institutional dimensions

A situated literacy perspective asks who is able to participate, whose knowledge counts as credible, and what forms of communication are locally appropriate. Accounts from Indigenous learners and culturally diverse communities demonstrate that common competence checklists may miss linguistic accessibility, relational obligations, and histories of institutional exclusion (Abdulbarie et al., 2026). In research on Koya communities, safe digital participation is associated with access to locally intelligible training and institutional support rather than technical skill alone (Achanta & Ali, 2026). Such sources motivate a concept of resilience sensitive to material and symbolic inequalities.

Sociocultural variation also affects how interventions should be adapted. A comparison of locally designed and imported prebunking games in Indonesia and the United States found different patterns of discernment outcomes across settings (Facciani et al., 2026). Community-tailored literacy studies report the importance of audience-relevant materials and delivery (Lee et al., 2025). Rather than making culture a generic moderator, the evidence map should distinguish studies that theorize culture, those that measure specific dimensions, and those that use country solely as a sampling label.

Institutional and platform conditions shape which messages are encountered and what opportunities for correction are visible. The debate about algorithmic curation concerns both distributional power and the accessibility of reliable evidence. Critical work on platform governance and synthetic content notes that changes in verification systems, moderation policy, and algorithmic control reallocate responsibility among users, platforms, states, and professional intermediaries (Garajamirli, 2025). A comparative analysis of fact-checker labels shows how classification design provides a visible interface between expert evaluation and everyday interpretation (Gomes-Gonçalves & Sánchez-Gey-valenzuela, 2026). These are not equivalent to proven effects on long-term resilience, but they constitute relevant loci of institutional action.

A governance-focused interpretation must also preserve freedom-of-expression and trust concerns. Critiques of mass-society framing suggest that treating the public solely as manipulable can understate social and political conditions surrounding misinformation (Christensen, 2022). Work on strategic epistemology warns that repeated emphasis on covert manipulation can cultivate broad distrust toward media rather than calibrated critical scrutiny (Angwald & Wagnsson, 2024). Hence, resilience should not be operationalized simply as maximal skepticism; a more defensible construct incorporates the capacity to evaluate evidence proportionately and to maintain warranted relationships of trust.

Evolution of approaches and unresolved debates

The literature describes an expanded portfolio of responses rather than a single linear progression. Correction and debunking remain prominent in reviews of health and science misinformation initiatives, whereas education, prebunking, participatory design, and gamified learning represent distinct intervention families (Heley et al., 2025). An adult-focused scoping review documents diverse instructional formats, from courses to games and visual resources, alongside debate over checklists, emotion, and the politics of authority (Boler et al., 2025). These differences matter because educational exposure, sustained skills, and collective response are different kinds of evidence.

Generative artificial intelligence introduces an additional layer of sociotechnical uncertainty: systems may assist verification while also generating misleading materials or making origins harder to interpret. Educational research now asks whether to use these tools to identify misconceptions, inoculate audiences, or redesign learning environments (Fulsher et al., 2026). Design-oriented experimentation with a Socratic chatbot similarly raises the question of whether asking users to reason through evidence supports learning in settings where users often seek immediate answers (De Vooght et al., 2025). Neither technology availability nor prototype acceptability should be mistaken for a verified reduction in misinformation harms.

An evidence map therefore needs a vocabulary separating mechanisms, outcomes, and scales. Discernment and belief are individual cognitive outcomes; interpersonal correction and actual forwarding concern communication practices; trust and collective verification concern relationships; accessibility and platform accountability concern structural capacities. Social epistemology and cultural theory can help articulate connections without implying that one level explains all others. The four-domain taxonomy used in this manuscript is deliberately provisional. It will be strengthened only if comprehensive screening, context-sensitive extraction, and comparison of contradictory findings support its boundaries and relationships.

RESULTS

The four domains below organize 44 uniquely charted reference-summary records. Each domain contains eleven purposively selected sources for an initial map, not a frequency estimate of all eligible studies. Tables 1–4 reproduce the prior source-linked charting and should not be read as a completed inclusion roster.

Individual Media Literacy and Cognitive Resilience

The first charted domain comprises eleven records, spanning controlled interventions, pilots, reasoning-oriented design studies, and evidence syntheses. Across these sources, 'resilience' is variously associated with recognition of manipulative techniques, credibility judgments, willingness to share claims, and more general confidence in evaluating information. Because the sources report different populations and endpoints, their findings should not be interpreted as estimates of a common effect. The evidence instead illustrates the importance of recording the precise outcome and the circumstances under which it was measured.

Prebunking studies supply a prominent intervention family. Across two experimental studies involving three languages, a browser-game approach and infographics were associated with improvements in selected manipulation-recognition and confidence measures, with short-term persistence reported for some outcomes (Basol et al., 2021). A cross-cultural account of the Bad News game likewise reports increased recognition of deception strategies after inoculation-oriented exposure (Roozenbeek et al., 2020). These studies are informative about short-term individual processing; they do not establish that entire communities will become resilient or that behavior remains changed without subsequent support.

The Indonesian literature introduces more context-sensitive designs. An online video intervention reported lower intentions to share false headlines than controls in its study population (Ford et al., 2023). An earlier Indonesian pilot similarly reported encouraging changes in misinformation identification, although its limited scope restricts broad generalization (Thomas et al., 2022). A WhatsApp-style gamified intervention showed improvements in motivation and perceived norms, but a temporary increase in self-efficacy had diminished by

a later assessment (Becker et al., 2025). These records illustrate why an intervention may be promising on one indicator and inconclusive on another.

Cultural transfer of a learning resource cannot be assumed. A comparison of Gali Fakta and Harmony Square reported different patterns of sharing and accuracy discernment across Indonesian and United States samples (Facciani et al., 2026). This finding motivates attention to the fit between scenario design, language, audience experience, and platform practices. The prior synthesis of university interventions also found heterogeneous educational approaches, variable theoretical grounding, and inconsistent evaluation methods (Etesse et al., 2025). Consequently, apparent agreement among intervention studies may conceal fundamentally different intended learning mechanisms.

Two broader reviews characterize the limits of the experimental evidence. A meta-analysis of media literacy interventions reported positive average outcomes but differentiated effects on misinformation belief, discernment, and sharing measures (Huang et al., 2024). A health and science scoping review observed the prominence of short-term online experiments and cognitive endpoints relative to enduring behavioral assessment (Heley et al., 2025). Methodologically, such reviews should be used as higher-level context; their constituent primary studies should not be double counted when later eligibility screening identifies overlapping records.

Finally, verification itself can be counterproductive under specific search conditions. Experimental work found that searching the web to investigate false claims could expose users to low-quality corroboration and increase perceived truthfulness (Aslett et al., 2024). A human–computer interaction study of reason-checking fallacious claims represents an alternative orientation toward argument quality and reflective evaluation rather than simple recognition cues (Musi et al., 2023). Taken together, this domain maps a rich intervention repertoire but also a persistent need to distinguish teachable competencies from the realities of information environments and sustained communication practices.

Table 1. Individual literacy and cognitive resilience

Source / year	Study context or type	Abstract-supported evidence / charted contribution
(Aslett et al., 2024)	Five experiments; online search and misinformation	Searching to check false stories sometimes raised their perceived truthfulness when low-quality results appeared.
(Basol et al., 2021)	Two experimental studies; three languages	Prebunking games and infographics improved reported ability to recognize manipulation; study reported short-term persistence for selected effects.
(Becker et al., 2025)	Indonesia; 504 adults; WhatsApp-style game	Gamified prebunking improved motivation and perceived norms; self-efficacy gains were not sustained at two weeks.
(Etesse et al., 2025)	Scoping review; 27 university interventions	Maps theory, educational formats and evaluation; reports weak standardization of measures and theoretical fragmentation.
(Facciani et al., 2026)	Indonesia / United States; comparative games	Culturally tailored Gali Fakta improved sharing discernment in Indonesia; transfer of Harmony Square was limited there.

(Ford et al., 2023)	Indonesia; online intervention; n=656	Short-video media literacy intervention reduced intentions to share false headlines relative to controls.
(Heley et al., 2025)	Scoping review; 115 publications / 148 studies	Health/science mitigation work emphasized cognitive outcomes and short-term online experiments over behavioral follow-up.
(Huang et al., 2024)	Meta-analysis; 49 studies; N=81,155	Synthesizes effects of media literacy interventions on belief, discernment and sharing; outcome heterogeneity is material.
(Musi et al., 2023)	Educational reasoning tools / critical thinking	Describes reasoning-based resources to identify fallacious misinformation arguments; not evidence of broad population effectiveness.
(Roozenbeek et al., 2020)	Cross-cultural online game intervention	Bad News inoculation game reported improved resistance to common manipulation tactics.
(Thomas et al., 2022)	Indonesia; pilot intervention	Online educational content associated with greater identification of misinformation; pilot scope limits inference.

Note. Abstract-supported charting only; mixed empirical and non-empirical evidence. Thematic assignment is non-exclusive conceptually but counted once per source.

Social Trust, Community Practices, and Collective Verification

The second domain contains eleven works addressing social norms, group identity, interpersonal interaction, relational trust, professional intermediaries, and collective response. Their shared contribution is to reposition credibility as a judgment made within social environments rather than solely within an individual's cognition. A review of interventions argues that the narrow focus on a single claim and the individual user's response obscures community factors and systemic processes (Aghajari et al., 2023). A conceptual analysis of strategic framing additionally cautions that anti-disinformation messaging may shape broader skepticism and public trust in unintended ways (Angwald & Wagnsson, 2024). Neither source should be treated as a primary causal estimate of collective resilience.

Direct work on collaborative verification provides more specific evidence about process. In paired online fact-checking sessions, the salience of cultural identity influenced decisions to verify and the standards invoked during deliberation (Gottlieb et al., 2023). Comparative qualitative work in Lebanon and Iraq describes verification as distributed across relationships and locally situated judgment under uncertainty (Elmasry, 2026). These studies point to social epistemic processes that are difficult to capture through a single accuracy score: whose testimony is trusted, how competing interpretations are negotiated, and when correction is considered safe or legitimate.

The interaction of platform choice and community authority appears in politically sensitive contexts. A mixed-method study of Nigerian youths documented variation between urban and rural information channels and the credibility assigned to messages passed through local leaders (Azeez et al., 2026). Ethiopian research described selective trust mechanisms in which social media sharing and intergroup tensions were closely connected (Haile, 2024). A qualitative examination of religious hoaxes in Indonesia identified misleading frames and potentially divisive narratives, emphasizing the relevance of interfaith dialogue and media literacy

(Fathurrohman et al., 2024). These studies support attention to different social settings but do not justify direct causal attribution from exposure to political or violent outcomes.

Community-based countermeasures are represented through applied and professional settings. Disaster-risk literature emphasizes local communication infrastructure, training, and trusted intermediaries when misleading information circulates during emergencies (Cuadra & Cotoron, 2025). Community focus groups in the United States call attention to the information concerns and intervention preferences expressed by different populations rather than a single universal message strategy (Lee et al., 2023). A participatory study involving multilingual information environments explores trusted relationships and shared resources for managing problematic content (Nguyen et al., 2026). Their variation in approach underscores that 'community intervention' is not a single reproducible treatment.

Institutions capable of maintaining relationships with local audiences may provide additional support. A research agenda on library misinformation programming identifies librarians and libraries as possible sites for public learning and emphasizes unresolved implementation questions (Young et al., 2021). This is an institutional proposition, not evidence that a particular library model has already been proven effective. Overall, the domain shows conceptual and empirical examples of collective verification, but few of the charted abstracts supply measures of persistent social norms or directly observed community-scale correction practices. That gap remains a research priority.

Table 2. Social trust and collective verification

Source / year	Study context or type	Abstract-supported evidence / charted contribution
(Aghajari et al., 2023)	Review of misinformation interventions	Argues that individual-item and individual-action interventions underweight social norms and structural drivers.
(Angwald & Wagnsson, 2024)	Conceptual analysis of strategic frames	Warns that disinformation framing may promote public cynicism and strategic media interpretation.
(Azeez et al., 2026)	Nigeria; mixed-method survey/focus groups	Urban and rural youths differed in platform use and community-authority influences on misinformation interpretation.
(Cuadra & Cotoron, 2025)	Community disaster risk management; integrative review	Identifies local training, trusted messengers and communication channels as approaches to false disaster information.
(Elmasry, 2026)	Lebanon and Iraq; comparative qualitative cases	Frames verification as relational trust, collective judgment and local interpretive work under uncertainty.
(Fathurrohman et al., 2024)	Indonesia; qualitative religious-hoax cases	Reports misleading frames and social-polarization risks; discusses literacy and interfaith dialogue.
(Gottlieb et al., 2023)	Eight adult pairs; collaborative fact-checking	Cultural identity salience shaped fact-checking practices and credibility standards in joint deliberations.

(Haile, 2024)	Ethiopia; survey n=412 + interviews n=35	Finds selective trust and social media sharing intertwined in conflict-related information environments.
(Lee et al., 2023)	United States; focus groups with four communities	Community-led perspectives identify context-sensitive misinformation exposures and intervention preferences.
(Nguyen et al., 2026)	Multilingual communities; participatory design	Explores collective memory and trusted relationships for navigating problematic multilingual information.
(Young et al., 2021)	Libraries; practitioner-facing literature	Discusses libraries' role in public misinformation education and gaps in implementation knowledge.

Note. Abstract-supported charting only; mixed empirical and non-empirical evidence. Thematic assignment is non-exclusive conceptually but counted once per source.

Cultural Contexts, Inequality, and Digital Inclusion

The third domain includes eleven records in which cultural identity, language, marginalization, region, or digital inequality are prominent. These records do not treat geographic diversity as a purely descriptive characteristic. Several argue that the effectiveness and meaning of literacy depend on material access and locally legitimate communication practices. A research agenda developed around African media literacy calls for close attention to social, political, and infrastructural conditions (Boshoff & Fafowora, 2024). A Senegalese interview study likewise shows that understandings of media literacy and responsibility for delivering it are socially and institutionally situated (Diop et al., 2025).

Studies of Indigenous communities make the contrast especially clear. A phenomenological account of Sama students describes the use of communal and cultural resources when evaluating potentially misleading information (Abdulbarie et al., 2026). Qualitative research among Koya communities identifies the need for linguistically appropriate instruction and locally accessible support for secure digital-media use (Achanta & Ali, 2026). Neither study provides a generalizable numerical estimate of digital resilience across Indigenous populations; both illustrate why imported literacy models require contextual scrutiny.

Evidence on historically marginalized groups suggests that engagement can vary not only by digital access but also by the knowledge and skills already used in everyday life. A diary study of adolescents reported racial–ethnic variation in daily critical digital literacy practices, complicating narratives that describe minority groups principally in deficit terms (Epps et al., 2025). Culturally tailored literacy interventions with communities of color similarly provide examples of adapting the intervention's framing and delivery to participants' experiences (Lee et al., 2025). The educational argument for culturally relevant media literacy challenges curricula organized solely around detecting 'fake' items (Mirra et al., 2021).

Structural barriers vary by setting. A survey of rural residents in Bangladesh, India, and Pakistan found substantial uncertainty about misinformation and difficulties assessing credibility (Gala et al., 2025). A Central Asian study of deep-mediation competencies and artificial-intelligence-assisted verification readiness highlighted variation across generations and countries in access and media-related knowledge (Ibrayeva et al., 2026). Together, these abstracts caution against presuming that the same interface, training strategy, or verification recommendation is feasible across environments.

Some sources address particularly consequential social harms. Research involving xenophobic online narratives in South Africa observed a relationship between exposure and resentment but did not establish a strong correlation with actual violence, making the distinction between attitudes and actions essential (Fokou et al., 2024). An Athens-based account of using comics for media literacy among marginalized groups describes alternative pedagogical formats potentially capable of crossing language and cultural barriers (Tsene,

2022). Both broaden the scope of what constitutes relevant evidence: resilience may be implicated in social belonging, civic judgment, and accessible learning design, even when the study does not quantify an intervention effect.

The central interpretive finding of this domain is therefore not that certain cultures are intrinsically more resilient. Rather, the charted sources portray culture and inclusion as configurations of opportunity, authority, language, experience, and access. More comparative studies are needed to determine which contextual features are directly measured and which are invoked rhetorically. For a full review, the charting form should code whether the study theorizes culture, incorporates a validated cultural measure, or merely identifies the site of data collection.

Table 3. ***Cultural context, inequality, and digital inclusion***

Source / year	Study context or type	Abstract-supported evidence / charted contribution
(Abdulbarie et al., 2026)	Sama Indigenous students; phenomenology; n=12	Participants drew on communal practices and cultural resources to evaluate online information.
(Achanta & Ali, 2026)	Koya Indigenous communities, India; qualitative	Documents culturally and linguistically specific barriers to safe digital-media use and literacy training.
(Boshoff & Fafowora, 2024)	Africa; special-issue research agenda	Argues media literacy is situated in political, cultural and infrastructural conditions.
(Diop et al., 2025)	Senegal; 22 media-professional interviews	Explores local understandings of media literacy and roles of schools, media and community leaders.
(Epps et al., 2025)	United States; seven-day adolescent diary study	Reports racial-ethnic differences in everyday enactment of critical race digital literacy skills.
(Fokou et al., 2024)	South Africa; online data and group discussions	Links exposure to xenophobic online narratives with resentment but not clearly with violent action.
(Gala et al., 2025)	Bangladesh, India and Pakistan; rural survey n=400	Documents perceived misinformation and difficulty verifying information across rural settings.
(Ibrayeva et al., 2026)	Kazakhstan, Tajikistan and Uzbekistan; n=3,000	Maps variation in deep mediatization and AI-assisted verification readiness across age and access groups.
(Lee et al., 2025)	United States; interventions with communities of color	Assesses culturally responsive media-literacy interventions in four racialized communities.
(Mirra et al., 2021)	Conceptual pedagogical article; United States	Advocates culturally relevant media literacy beyond binary fake/real classification.

(Tsene, 2022)	Athens; comics library / marginalized groups	Describes comics as an accessible media-literacy pedagogy across language and cultural barriers.

Note. Abstract-supported charting only; mixed empirical and non-empirical evidence. Thematic assignment is non-exclusive conceptually but counted once per source.

Platform Governance and Multilevel Intervention Frameworks

The fourth domain comprises eleven records concerning digital infrastructures, content verification interfaces, professional responsibility, regulation, and coordinated strategies. An investigation of networks of inauthentic news sites in Singapore illustrates how websites that appear independent may be linked through common operators or dissemination practices, creating a potential platform-mediated credibility problem (Ang & Leong, 2025). Educational scholarship argues that curricula must address the organizational power of digital platforms and the cultures of algorithmic distribution, not only the skills needed to produce media content (Dezuanni, 2021). These sources imply a shift from a narrow user-error model to an account that includes communication infrastructures.

Conceptual analysis also broadens the object of concern. A paper on the aesthetics of algorithmic disinformation frames misleading communication in terms of the organization of public attention and proposes aesthetic literacy, journalistic depth, and transparency as responses (Ferreira, 2025). Platform-governance work discusses synthetic content, fact-checking changes, deepfake risks, and evolving community-note mechanisms (Garajamirli, 2025). Such texts offer useful categories for data charting but do not establish which regulatory architecture delivers the greatest protection.

Interface design supplies a more directly observable form of institutional intervention. A comparative content analysis of fact-checking labels in Spain and Portugal identified differences in visual and semantic classifications used to communicate the status of disputed information (Gomes-Gonçalves & Sánchez-Gey-valenzuela, 2026). Research on the collateral consequences of debunking vaccine misinformation raises concern about the possible trade-offs between correction and trust (Krause et al., 2023). An analysis of mistrust and media literacy additionally challenges simplistic assumptions that greater skepticism always reflects better critical thinking (Park et al., 2026). Across these studies, the distinction between calibrated evaluation and generalized distrust remains fundamental.

Governance responds to different kinds of risk. Comparative work on health-risk communication in Brazil and Germany examines approaches to artificial-intelligence-linked information disorder (Monari & Ott, 2026). A public-health volume addresses the need to organize infodemic monitoring and communication as institutional practices (Purnat et al., 2023). A study of disinformation regulation in the Andean Community examines public judgments about regulatory responses, highlighting the importance of political acceptability and legitimacy (Suing, 2024). These sources point to important questions about authority, accountability, and implementation, not to a definitive governance model.

A professional training case from the Estonian defense context describes media literacy and psychological resilience education aimed at hostile information influence (Ventsel et al., 2024). Alongside the records on curricula, health communication, and platform verification systems, it illustrates that resilience initiatives can involve coordinated actors and institutional capacity. However, none of the four domains can by itself demonstrate how system-level arrangements translate into community-wide reductions in misinformation harms. The value of the proposed taxonomy lies in making those missing connections visible: individual skills require credible informational resources; collective verification depends on social legitimacy; cultural inclusion shapes access; and platforms set part of the opportunity structure for all three.

Table 4. ***Platform governance and multilevel responses***

Source / year	Study context or type	Abstract-supported evidence / charted contribution
(Ang & Leong, 2025)	Singapore; open-source network investigation	Maps coordinated inauthentic sites and argues for public warnings, literacy and governance responses.
(Dezuanni, 2021)	Australia; media-arts curriculum analysis	Argues curricula must address platform power, algorithmic culture and misinformation.
(Ferreira, 2025)	Portugal; conceptual analysis with cases	Frames disinformation as algorithmically organized public experience; proposes aesthetic literacy and transparency.
(Garajamirli, 2025)	Platform governance; policy analysis	Reviews deepfakes and evolving moderation, fact-checking and community-note mechanisms.
(Gomes-Gonçalves & Sánchez-Gey-valenzuela, 2026)	Spain and Portugal; 823 fact-checks	Visual verification labels varied in graphic and semantic features across fact-checking platforms.
(Krause et al., 2023)	Misinformation correction; conceptual/empirical work	Highlights unintended trust-related consequences of corrective messages in polarized environments.
(Monari & Ott, 2026)	Brazil and Germany; comparative governance	Compares governance responses to AI-influenced health information disorders.
(Park et al., 2026)	Australia; investigation of mistrust and media literacy	Examines the distinction between critical skepticism and generalized mistrust in assessing information.
(Purnat et al., 2023)	Infodemic management; edited public-health book	Describes institutional and coordinated public-health approaches to misinformation management.
(Suing, 2024)	Andean Community; survey-based regulation perspectives	Studies public preferences and concerns around government regulation of disinformation.
(Ventsel et al., 2024)	Hostile information influence; resilience/training	Discusses media and psychological resilience training against hostile information operations.

Note. Abstract-supported charting only; mixed empirical and non-empirical evidence. Thematic assignment is non-exclusive conceptually but counted once per source.

DISCUSSION

The preliminary evidence map points toward a substantive reframing of digital misinformation resilience. Its contribution is not a demonstration that individual media literacy has failed; rather, it shows why an

exclusively individual frame cannot capture the full range of communication processes represented in the charted literature. Controlled interventions measure skills and responses in ways that enable comparison, whereas community, cultural, and governance research addresses questions that are often harder to isolate experimentally. The multilevel taxonomy permits these research traditions to be examined together without treating their evidence as interchangeable. A communication-ecosystem perspective likewise emphasizes that relationships among institutions, information practices, and public learning are central to media literacy (McDougall, 2025).

The distinction among cognitive discernment, skeptical attitudes, and sharing behavior is pivotal. An experimental result showing improved identification of misleading claims is informative but does not establish that users will refrain from forwarding information in a familiar social network. Path-analytic work on literacy and skepticism has linked higher literacy with corrective behavior without finding an equivalent relationship for cautious sharing, underscoring the need to separate these outcomes (Xiao & Yang, 2024). An educational activity designed around applying media literacy concepts can make learning objectives observable, yet those educational tasks should not be mistaken for naturalistic measures of communication (McGowan-Kirsch & Quinlivan, 2023). Future evidence charts should distinguish post-intervention quizzes, simulated sharing tasks, trace-observed behavior, and follow-up assessments.

A second issue is that verification relies on social and material resources. Findings in which online search increases perceived truthfulness under low-quality search conditions are not an argument against verification; they demonstrate that its consequences are conditional on the quality of the environment (Aslett et al., 2024). Science education scholarship makes a parallel distinction between specialist expertise and the civic competencies needed to judge the credibility of scientific claims as a nonexpert (Pimentel & Osborne, 2025). Both lines suggest that teaching people to 'do their own research' is incomplete without guidance about source hierarchy, institutional transparency, and situations in which confidence should appropriately remain low.

A further distinction concerns whether verification is evaluated as an action or as an epistemically successful process. The act of searching can be observed, but the accessibility, quality, and social legitimacy of the evidence retrieved are not attributes of the user alone. An improved research design would therefore measure search behavior alongside source quality and post-search accuracy, rather than treating more verification activity as an unqualified indicator of resilience (Aslett et al., 2024).

The relevant literature also challenges a binary opposition between unquestioning trust and total skepticism. Skeptical reasoning can help detect manipulation, but pervasive distrust can undermine confidence in legitimate communication. Conceptual work on news literacy and collective flourishing argues for responsibility and participatory structures rather than an exclusive concentration on isolated individual correction (Medina, 2025). Research on trust-building and polarization similarly proposes approaches directed at disagreement and social relations rather than only falsifiable statements (Nakade & G. R. Wippell, 2025). These contributions suggest that trust should be treated as calibrated and relational, not simply high or low on a standardized psychological scale.

The importance of community authority is evident across politically and socially sensitive cases. In Indonesia, comparative analysis of electoral misinformation describes the interplay of youth identity, platform visibility, and political narrative formation (Sihidi, 2026). An Indonesian defense-policy study similarly situates disinformation amid institutional confidence and political communication (Sarjito & Lelyana, 2025). Neither source establishes that all socially trusted messengers are beneficial; the same relational mechanisms that make a correction credible may also lend authority to misleading material. A useful multilevel model must therefore accommodate both protective and harmful uses of collective trust, including how power and inequality determine whose correction is heard.

Cross-cultural adaptation is one of the clearest points at which levels intersect. The Indonesian comparison of prebunking games indicates that differences in engagement and design fit may matter across contexts (Facciani et al., 2026). A review of Indonesian child and adolescent interventions reports continuing tension between protection-focused literacy and more empowering approaches (Prestianta & Rouf, 2026). Research on adolescents in different racialized communities also shows that critical practices may already be deeply

embedded in daily digital life, challenging deficit-oriented intervention assumptions (Epps et al., 2025). These observations motivate co-design, more detailed context reporting, and careful comparison of theoretically relevant local characteristics rather than crude country labels.

The review further identifies a methodological tension: even when culture is invoked in conclusions, it may not be operationalized with measures that allow comparison. A study could be conducted in a non-Western setting while retaining scenarios, scoring rubrics, and theories developed elsewhere without adaptation. Conversely, a locally designed program may include attention to language, interpersonal trust, community role models, and platform usage but measure only individual accuracy. An intersectional discussion of artificial-intelligence-generated visual disinformation highlights that technological disadvantages can intersect with demographic and access inequalities (Putri, 2026). Evaluating resilience across groups requires examining both exposure conditions and the equity of access to verification.

Platform governance adds another layer of responsibility and possible unintended consequence. Fact-check labels, moderation standards, community notes, and synthetic-content detection each act on different stages of the misinformation process. The available platform-oriented sources should therefore be classified by governance mechanism, actor, target, and evaluation endpoint, rather than as a single category of 'technical solutions.' Work on democratic competence and media education suggests that civic and institutional arrangements condition whether the public can respond meaningfully to information disorder (Kolb & Pietzonka, 2025). A review of algorithmically mediated information challenges reinforces the need for transparency and accountable design, while offering no automatic proof of efficacy from technical sophistication alone (Thinnakkakath, 2026).

Intervention design could also benefit from an explicit theory of coordinated action. Rather than assuming that individual training, trusted messengers, and platform labeling are mutually reinforcing, future research can specify possible interactions: education may increase willingness to verify, a community network may improve access to reliable expertise, and a platform may make that expertise more discoverable. Theories of socially situated education and proposals for participatory governance offer conceptual resources for describing such connections (Pérez et al., 2025). A study of professional and institutional strategies against misinformation provides a reminder that intervention roles, organizational capacity, and accountability must be charted alongside individual learning outcomes (Matejova et al., 2025). Empirical tests of coordination, however, remain distinct from descriptions of its desirability.

An actionable multilevel research agenda should specify coordination between actors instead of simply naming multiple intervention sites. Comparative studies could contrast individual literacy education with programs integrating peer discussion, trusted local intermediaries, and platform-level source cues, while independently measuring discernment, observed forwarding, and institutional trust. Such designs would test whether gains in one domain are sustained or constrained by conditions in another (Aghajari et al., 2023).

The synthesis also has implications for knowledge production. Intervention studies may privilege populations readily reached through online experiments, whereas culturally embedded studies offer rich contextual detail but may have small samples and different standards of transferability. A cross-national evidence base should include language accessibility, community participation, and transparent descriptions of political context. Reviews of media and information literacy in different regions illustrate how the concentration of scholarly output can itself reproduce geographic blind spots (Pestano-López, 2026). Work with Arabic-speaking communities underscores the importance of linguistic and audience-specific engagement when circulating health information (Vasiliadis et al., 2025). These are reasons to diversify evidence, not to assume that all findings from underrepresented settings point in the same direction.

The strongest immediate practical implication is to match interventions and measures to the level of the problem. Educators can distinguish critical reasoning from habitual skepticism; libraries and community groups can support collaborative verification; health communicators can address language and historical trust; platforms can improve provenance information and transparency; regulators can consider legitimacy and proportionality. Professional literacies that account for misinformation in engineering and design education illustrate the relevance of sociotechnical responsibility beyond journalism and civic classes (Pérez et al., 2025).

Critical work on educational frameworks also calls for attention to ethical reasoning and institutional responsibilities rather than only information-recognition tasks (Ivan, 2025).

These implications must be calibrated to the status of the current evidence. Forty-four records were purposively charted from an existing reference summary, with equal domain allocations and without systematic full-text eligibility screening. The sources mix empirical studies with reviews, chapters, and conceptual proposals, so the tables neither provide denominator-based field prevalence estimates nor support pooled intervention comparisons. The reported source-file count is an audit of that bibliography, not a defensible PRISMA identification total. No cross-database deduplication, formal screening agreement assessment, critical appraisal, or effect-size aggregation was performed in this manuscript. A completed scoping review should screen comprehensively, preserve a reproducible decision trail, and test the stability of thematic boundaries as newly eligible studies are mapped.

The conceptual contribution remains defensible at the level supported by the evidence: digital misinformation resilience is represented in literature through heterogeneous practices and capacities, and the four-domain map offers a transparent structure for examining them. Research on collective virtues and participatory news literacy provides one path for specifying the normative aims of such a framework (Medina, 2025). Equally, work on online harms among young adults cautions that misinformation intersects with other forms of digital vulnerability that are not neatly separated by disciplinary boundaries (Zhang et al., 2026). The subsequent research agenda should combine sustained behavior measures, comparison of intervention transfer across contexts, study of collective verification, and analysis of institutional accountability while avoiding premature declarations of one universally effective resilience model.

CONCLUSION

The preliminary evidence map portrays digital misinformation resilience as a set of related but non-equivalent capacities distributed across individuals, social relationships, cultural settings, and institutions. Individually focused interventions address discernment, reasoning, and sharing intentions; social and community research examines trusted messengers, collaborative verification, and the norms through which claims acquire credibility. Culturally situated studies emphasize language, history, inequality, and forms of participation that may not be represented by generic literacy measures. Platform and governance scholarship highlights the information infrastructures within which these competencies and practices operate.

The proposed four-domain taxonomy helps clarify what different studies mean by resilience and which outcomes they actually investigate. It avoids treating a short-term change in accuracy judgment as equivalent to real-world behavior, community-level trust, or system-level capacity. The charted examples also indicate that socially embedded practices can reinforce as well as impede accurate communication, making contextual interpretation necessary.

For future research, the priorities are comprehensive and transparent screening; consistent operational definitions; longitudinal measures of observed sharing and correction; analysis of culturally adapted interventions; and empirical investigation of coordinated community and platform approaches. The current 44-record map is an exploratory chart based primarily on abstracts. It is neither the final included-study set of a completed scoping review nor a basis for population-wide prevalence or comparative effectiveness claims.

The broader contribution is a research architecture for integrating previously separated domains of digital communication scholarship. A completed review using this architecture could inform interventions that combine individual competence with trustworthy relationships, equitable access, and institutional accountability.

ETHICAL APPROVAL AND CONSENT

This manuscript synthesizes published research summaries and does not report newly collected human-participant or animal data; separate primary-research ethics approval is therefore not applicable.

Protocol and registration

No registered protocol identifier was supplied. A comprehensive search, independent screening, full-text eligibility assessment, and PRISMA-ScR flow diagram are required before a completed scoping review can be claimed.

DATA AVAILABILITY

The analysis uses a supplied bibliographic summary (290 references) and a preliminary chart of 44 records across four tables. A shareable extraction and screening dataset, with provenance and exclusion decisions, must be deposited or linked before submission.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest, financial or non-financial, that could have influenced the conduct, analysis, interpretation, or reporting of this study.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization, research design, methodology, literature search strategy, data collection, screening, data extraction, evidence synthesis, manuscript drafting, and project administration.

Author 2: Methodological supervision, literature screening, data validation, interpretation of findings, critical review and editing of the manuscript, and quality assurance.

Both authors contributed to the development of the manuscript, reviewed its intellectual content, and approved the final version for publication. Both authors agree to be accountable for the integrity and accuracy of the work.

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