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# Community engagement and chronic viral hepatitis public health interventions: a systematic review, meta-analysis, and complementary crowdsourcing open call

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## Summary

Background Chronic viral hepatitis causes a high burden of morbidity and mortality, especially in low- and middleincome countries (LMICs). While community engagement, which involves stakeholders in addressing health-related issues, has shown promise to enhance hepatitis outcomes, evidence on its impact remains limited. To summarize the current state of knowledge on this topic we performed a systematic review and a crowdsourcing open call.

Methods A parallel mixed-methods approach was used in this study. The systematic review included publications that evaluated a community-engaged intervention, reported chronic viral hepatitis outcomes, included a comparator group, and were published in English up to 12 March 2025. A random-effects model was used to pool the overall effect of the community-engaged interventions on hepatitis outcomes. To ensure innovative ideas from LMICs were included, we organized a complementary crowdsourcing open call using the WHO/TDR practical guide. Thematic analysis identified key themes in the crowdsourced submissions.

Findings 35 studies were included in the systematic review, and 28 crowdsourced submissions were analyzed. In both the systematic review and open call, community-engaged interventions included peer-based interventions, community health workers, interactive educational programs, and patient advocacy. The meta-analysis, predominantly of studies from high-income countries, found community-engaged interventions significantly improved HBV vaccine completion (RR 1.59, 95% CI 1.15–2.19;  $I^2 = 88.10\%$ ), HBV/HCV test uptake (RR 2.33, 95% CI 1.78–3.06;  $I^2 = 99.10\%$ ), HBV and HCV linkage to chronic viral hepatitis care (RR 1.96, 95% CI 1.46–2.64;  $I^2 = 96.20\%$ ), HBV/HCV treatment adherence (RR 1.14, 95% CI 1.03–1.27;  $I^2 = 0\%$ ), and HCV sustained virologic response (RR 1.50, 95% CI 1.23–1.83;  $I^2 = 93.90\%$ ). Open call submissions, largely from LMICs, highlighted community-led interventions where patients led community-based organizations to advocate for improved access to hepatitis care.

Interpretation Findings underscored the importance of community engagement in chronic viral hepatitis service delivery across the care continuum. Implementing community-engaged interventions can enhance chronic viral hepatitis elimination efforts.

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Keywords: Community engagement; Viral hepatitis; Care continuum; Crowdsourcing open call

#### **Research in context**

#### Evidence before this study

Community engagement has shown potential to improve hepatitis-related outcome and reduce health inequities. A PubMed search conducted in March 2025 using the terms "hepatitis", "community OR grassroots OR local OR peer OR advocate OR engaged", and "interventions OR trial OR campaign" revealed no existing reviews evaluating how community-engaged interventions impact the hepatitis care continuum. Although several high-quality original RCTs from high-income countries (HICs) have been conducted over the past decade, no systematic review or meta-analysis assessed the effectiveness of community-engaged interventions across the full hepatitis care continuum. Additionally, few studies have been conducted in low- and middle-income countries (LMICs) which bear a disproportionate share of the global hepatitis burden.

#### Added value of this study

This review indicated that community-engaged interventions significantly improved HBV vaccine completion, HBV/HCV test

## Introduction

Hepatitis B virus (HBV) and hepatitis C virus (HCV) are significant contributors to global morbidity and mortality, causing an estimated 1.4 million deaths annually due to cirrhosis and liver cancer.<sup>1</sup> While low- and middle-income countries (LMICs) bear the highest burden of chronic viral hepatitis, most documented interventions have primarily focused on high-income countries (HICs).<sup>2-4</sup> The underutilization of public health interventions for chronic viral hepatitis in LMICs, along with the absence of national hepatitis elimination strategies, exacerbates inequities between LMICs and HICs.<sup>56</sup> One way to decrease hepatitis inequities is through robust community engagement.

Community engagement is the process of fostering relationships that allow stakeholders to collaborate in addressing health-related issues and promoting wellbeing.<sup>7</sup> This approach is crucial to addressing public health challenges such as chronic viral hepatitis where limited public understanding and stigma are significant barriers.8-11 Community-engaged interventions involve soliciting input and feedback from individuals living with chronic viral hepatitis and other stakeholders to design and implement public health strategies. By incorporating community perspectives, these interventions are more relevant to the people affected, increase accountability, and enhance dissemination.9 The influence of social determinants on the uptake of services for chronic viral hepatitis further underscores the need for community engagement.<sup>12-14</sup> Strategies uptake, HBV/HCV linkage to care, HBV/HCV treatment adherence, and HCV sustained virologic response. The systematic review, primarily composed of studies from HICs, identified patient-centered community-engaged interventions, with peer support and community-driven education as key components. The open call, predominantly featuring submissions from LMICs, emphasized communityled interventions where patients played an active role in leading community-based organizations (CBOs) to advocate for improved access to hepatitis care.

#### Implications of all the available evidence

Our findings underscore the global potential of communityengaged interventions to enhance hepatitis care and outcomes. Implementing such strategies is crucial for advancing global efforts to eliminate chronic viral hepatitis and address disparities in care access, particularly in LMICs.

such as peer support, involvement of community workers or lay health workers, crowdsourcing, and interactive group efforts have demonstrated their potential in improving chronic viral hepatitis services.<sup>15-19</sup> WHO emphasizes the crucial role of civil society and populations affected by hepatitis in fostering community engagement to eliminate chronic viral hepatitis.<sup>20</sup> However, many national hepatitis programs neglect community engagement, and community led services, and existing narrative reviews on chronic viral hepatitis have not captured the process or effect of communityengaged interventions on chronic viral hepatitis outcomes.<sup>21,22</sup> We conducted a systematic review to address this gap in the literature.

LMICs are inadequately represented in previous studies, and the few studies also provide very limited insight into practices at LMICs.23-26 This deficiency suggests missed opportunities to document and leverage community-driven efforts in LMICs for chronic viral hepatitis elimination. To address this, we conducted a global crowdsourcing open call in partnership with the World Hepatitis Alliance (WHA), aiming to capture community-led initiatives specifically from LMICs. Crowdsourcing is an effective strategy that promotes public participation and solicits communityled solutions to address public health issues.27 This approach involves collecting ideas from individuals or groups to contribute to problem-solving, and then shares results within the community. Compared to conventional top-down approaches, crowdsourcing can

identify cost-effective, locally appropriate and trusted community health campaigns.<sup>21,28–33</sup> This approach complements our systematic review, to solicit community-led efforts and programs with a focus on LMICs.

### Methods

The study utilized a parallel mixed-methods approach. The qualitative analysis identified and described relevant community-engaged interventions. The quantitative meta-analysis summarized the impact of communityengaged interventions on outcomes across the chronic viral hepatitis care continuum.

## Systematic review and meta-analysis

The systematic review was performed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist.<sup>34</sup> We identified studies published between 1 January 2010 and 15 June 2023, with an update on 12 March 2025, that evaluated community-engaged interventions to improve outcomes related to chronic viral hepatitis. Keyword searches were conducted in the following databases: PubMed, Web of Science, Scopus, Embase (Ovid), CINAHL (EBSCO), and Wiley Cochrane Library. Gray literature and conference abstracts were also searched. The protocol for the systematic review was registered on Open Science Framework (OSF) with registration number OSF.IO/3MSBJ. The search algorithm is shown in Appendix S1 and keywords are listed in Appendix S2.

Six researchers (KW, HC, DE, EK, YL, DW) independently screened identified literature following PRISMA guidelines. Each article was screened independently by two reviewers, and any disagreements were resolved through discussion. Studies featuring community-engaged interventions, targeting chronic viral hepatitis outcomes, along with a comparator group, and published in English were included in the systematic review and meta-analysis (Appendix S3). We extracted the following data from each included manuscript: author names, publication year, title, study design, study setting, focus population, type of intervention, focus diseases (i.e., HBV vs HCV), study outcomes across the continuum, study sample size, and the number of events. The data was extracted in parallel by authors RS and YL and reviewed by DW. Risk of bias was assessed using the Cochrane Risk of Bias Tool for interventional studies35 and the Newcastle-Ottawa Scale (NOS) for observational studies.<sup>36</sup> Two reviewers (HC and YL) independently assessed risk of bias. Disagreements were resolved by discussing with the senior author (DW).

To evaluate the level of community-engagement for each intervention, we adapted a scale based on the WHO Community Engagement Guide<sup>7</sup> and USA Health and Human Services report.<sup>37</sup> Community engagement was categorized into five sequential levels: inform, consult, involve, collaborate, and empower (Appendix S4). "Inform" and "consult" were considered lower-level engagement because in these two categories community members provide no or minimal input and are generally passive participants. "Involve", "collaborate", and "empower" were considered higher-level engagement because in these three categories community members are more actively engaged, contributing to intervention development and provided with opportunities for co-leadership.

We conducted a meta-analysis to estimate pooled risk ratios (RRs) and 95% confidence intervals (CIs) for various outcomes associated with community-engaged interventions compared to control conditions. Analyses were performed using a random-effects model. Statistical heterogeneity was assessed using Cochran's Q test and Higgins'  $I^2$  statistic. The denominators for each outcome were based on the total number of analyzed participants. For studies with multiple communityengaged interventions, intervention data were extracted separately, and engagement levels were redefined according to Appendix S4. If the intervention groups in one paper were reclassified as the same level of engagement, we combined the intervention groups of the study into a single group.<sup>38</sup> Table 1 provides definitions of chronic viral hepatitis care outcomes. The certainty of evidence across outcomes was determined using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) approach.<sup>39</sup>

We explored heterogeneity by subgroup analyses of different study designs, focus populations, and focus diseases. Publication bias was assessed using Egger's test and funnel plots, and trim and fill analysis was used to explore the impact of publication bias. Additionally, we used the leave-one-out method (each study was sequentially removed from the analysis to evaluate its impact on the overall results) in sensitivity analyses. A significance level of 0.05 was used for all analyses, which were performed using Stata (version SE 15.0).

## Open call

The open call was organized through a collaboration between our group at the London School of Hygiene and Tropical Medicine (LSHTM) and the WHA. Following the WHO/TDR practical guide,<sup>27</sup> we implemented the global open call in the following steps: 1) we convened a multisectoral steering committee to review and finalize the call for submissions; 2) promoted and engaged the public to contribute; 3) evaluated submissions received based on pre-specified criteria; and 4) recognized finalists and shared the solutions with the broader public. The call was promoted through social media, Hep Voice magazine, and personal/professional networks. Submissions were sought from individuals with personal experience of chronic viral hepatitis and community-engaged groups in LMICs. Submissions in

Outcomes <sup>a</sup>	Definition in the included studies					
Vaccination rate	Completed a series of three HBV vaccinations and this were followed up for series completion over 12 months after their first HepB vaccine dose. This outcome was assessed by the vaccine tracking system or EPI-issued (or another health facility-issued) vaccination card.					
Testing uptake	Self-reported or confirmed with electronic records of receipt of HBV/HCV testing at 1–6 months follow-up. When both HBV and HCV testing data were reported, the extracted data were calculated as having either HBV or HCV screening.					
Linkage to care	WHO recommended that linkage to care is defined as the duration of time starting with diagnosis and ending with enrollment in care or treatment. In the included studies, this is defined as: a engagement with clinical hepatitis services i.e., three engagements within 6 months of the first booked clinical appointment; b. participants who received therapy or initiated treatment for HBV/HCV between 3 months and 12 months follow-up.					
Treatment adherence	Adherence is defined by the WHO as "the extent to which a person's behavior—taking medication, following a diet, and/or executing lifestyle changes— corresponds with agreed recommendations from a health care provider". Daily adherence was extracted, which means participants received credit if doses were taken on the specified day.					
Sustained virologic response	SVR was defined as an undetectable HCV RNA at 12 or more weeks after completion of treatment. The denominator of SVR is the number of analyzed participants rather than the number of accepting treatment participants in each group.					
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HBV = hepatitis B virus. HCV = hepatitis C virus. EPI = Expanded Programme on Immunization. SVR = sustained virologic response. <sup>a</sup>The outcomes of the included studies were reclassified according to the WHO definition and the definition's descriptions in the papers.

Table 1: The definition of outcomes in the meta-analysis section.

text, image, audio, video, or infographics were accepted between 15 January 2021 and 30 April 2021. Guidelines for each format were provided. Priority was given to affected individuals and advocates involved in ongoing or completed community-engaged interventions, and submissions were accepted in six United Nations (UN) languages. More details about the open call can be found in Appendix S5.

A diverse judging panel was formed, consisting of 10 (5 males and 5 females) individuals from various regions. The judges included patients, advocates in hepatitis health services, experts in public health research, health communication, hepatitis prevention and control, health system and policy research, infectious diseases clinicians, policy makers, and crowdsourcing experts. Judges recused themselves from reviewing submissions in which there was a perceived or actual financial, commercial, or related conflict of interest. Non-English submissions were assessed by native languagespeaking judges. Each submission was reviewed by at least three independent individuals. Submissions were screened for eligibility (DW and JDT) and submissions irrelevant to the topic were excluded for further judging. The judging panel then evaluated eligible submissions based on four criteria from the judging rubric using a 1-10 scale: capacity for impact, relevance, feasibility, and elaboration (Appendix S5). Semi-finalists with an overall mean score above 7.0 received feedback to strengthen their submissions. If participants consented, revised submissions were shared on the NOhep website.40 Cash prizes were awarded to the top 10 submissions. Exceptional submissions led to workshops in three selected countries/regions, advocating policy changes. We organized three regional workshops in the Africa region, Bangladesh, and the Philippines as well as at one World Hepatitis Summit satellite event where finalists were invited to share their experiences to spur policy change.

The demographic and characteristics of participants and submissions were analyzed and presented quantitatively using descriptive frequencies. All semifinalist submissions were translated into English language and coded inductively, with similar codes merged to form themes. Community-engaged interventions were thematically summarized. Results are presented according to the different stages of the chronic viral hepatitis care continuum.

#### **Ethics statement**

This systematic review and meta-analysis utilized publicly available, de-identified data; therefore, ethical approval was not required. The open call received ethical approval from the LSHTM Ethics Committee (Approval Ref: 17819). Informed consent was obtained from all open call participants prior to sharing their submissions.

#### Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

#### Results

## Systematic review and open call

Characteristics of included studies in the systematic review Our research identified 16,031 titles, of which 35 met criteria for inclusion in the systematic review (Fig. 1). Among the included studies, 25 were randomized clinical trials, two were nonrandomized interventional studies, and eight were observational studies with a comparison (Table 2). 29 (82.9%) were conducted in HICs: 21 in the United States, two in Canada, and one each in the United Kingdom, Australia, Norway, Italy, France, and Spain, respectively (Table 2). Six (16.7%) were conducted in middle-income countries: five in China and one in Pakistan. No studies identified through the systematic review were conducted in lowincome countries. Study sample size ranged from 10



Fig. 1: Steps of citation screening flow diagram.

to 25,960. The risk of bias of included studies is presented in Appendix S6.

The focus populations involved in included studies were people who use drugs (n = 11), people who have immigrated to a high-income country (n = 10), men who have sex with men (MSM; n = 3), mothers of children aged 12–23 months (n = 1), people born between 1945 and 1965 (n = 1), men experiencing homelessness (n = 2), people living with chronic HCV (n = 1), pregnant women diagnosed with HBV (n = 1), people with diabetes (n = 1), and general primary care patients (n = 4).

Characteristics of the submissions in the open call

We received a total of 119 submissions, of which 34 were excluded because they were not relevant to chronic viral hepatitis (n = 30) or in a UN language (n = 4). The 85 eligible submissions were from 27 countries, 75.3% (64/85) of which were from middle-income countries and 17.6% (15/85) of which were from low-income countries. There were 16 submissions from 10 African countries: Egypt, Sudan, Nigeria, Benin, Cameroon, Congo, Democratic Republic of the Congo, Uganda, Burundi, and Tanzania. 28 submissions (34.1%) were

Study (Year)	Level of engagement	Study design	Setting	Population	Community-engaged intervention	Intervention in control group	Type of hepatitis focused	Study outcomes across the continuum	Sample size
Owais et al. (2011) <sup>41</sup>	Lower level engagement (Inform)	Randomized clinical Trial (RCT)	Pakistan	Mothers of children aged 12-23 months	Three targeted pictorial messages regarding vaccines administered by trained community health workers (CHWs)	General health promotion messages available from federal agencies	HBV	Vaccine	178 in control 179 in intervention
Taylor et al. (2013) <sup>42</sup>	Lower level engagement (Inform)	RCT	USA	People who have immigrated to a high-income country	Educational flipchart, motivational Khmer language DVD delivered by lay health workers (LHWs)	The intervention focused on physical activity	HBV	Testing	104 in control 95 in intervention
Bastani et al. (2015) <sup>43</sup>	Lower level engagement (Inform)	Cluster- Randomized clinical Trial (CRCT)	USA	People who have immigrated to a high-income country	Single-session small-group discussion on liver cancer and HBV testing in church	The intervention focused on nutrition and physical activity	HBV	Testing	580 in control 543 in intervention
Ward et al. (2019) <sup>44</sup>	Lower level engagement (Consult)	RCT	USA	People who use drugs (people lived with HIV who use drugs)	Usual care (UC) involving clinical visits and calls delivered by a nurse-led multidisciplinary team plus Peer mentoring	UC	HCV	Linkage-to- care & SVR	36 in control 54 in intervention
Nyamathi et al. (2015) <sup>45</sup>	Higher level engagement (Involve)	RCT	USA	Homeless men	Intensive peer coaching and nurse case management (description of the three groups)	UC intervention received the encouragement by a nurse to complete the three-series HAV/HBV vaccine	HBV	Vaccine	114 in control 231 in intervention
Juon et al. (2016) <sup>46</sup>	Higher level engagement (Involve)	RCT	USA	People who have immigrated to a high-income country	A list of resources by mails for where to get free vaccinations as well as reminder calls for vaccinations from trained LHWs	Received only list of resources by mail	HBV	Vaccine	87 in control 100 in intervention
Ma et al. (2017) <sup>47</sup>	Higher level engagement (Involve)	CRCT	USA	People who have immigrated to a high-income country	Interactive group education, patient navigation, and the engagement of health care providers, church leadership, and church members in the medical field	General cancer education and preventive care	HBV	Testing	1193 in control 1061 in intervention
Ma et al. (2017) <sup>15</sup>	Higher level engagement (Involve)	CRCT	USA	People who have immigrated to a high-income country	Interactive group education, navigation services, and the engagement of community leadership and health care providers in advocacy and referrals	General cancer education and preventive care	HBV	Testing & Vaccine	Testing: 714 in control and 916 in intervention Vaccine: 17 in control and 332 in intervention
Akiyama et al. (2019) <sup>48</sup>	Higher level engagement (Involve)	RCT	USA	People who use drugs	Education, psychosocial support from peers and providers	Self-administered individual treatment (SIT) intervention, all medications were self-administered at home	HCV	Treatment adherence & SVR	51 in control 99 in intervention
Fitzpatrick et al. (2019) <sup>49</sup>	Higher level engagement (Involve)	RCT	China	Men who have sex with men	Community co-developed intervention and sharing/ forwarding materials	The standard healthcare services without any promotional materials and only received the baseline and follow-up surveys	HBV/HCV	Testing	243 in control 227 in intervention
Broad et al. (2020) <sup>50</sup>	Higher level engagement (Involve)	RCT	Canada	People who use drugs	Peer outreach workers with lived experience of HCV, educate and deliver point- of-care testing	UC	HCV	linkage to care	185 in control 195 in intervention
Chen et al. (2013) <sup>51</sup>	Higher level engagement (Collaborate)	RCT	USA	People who have immigrated to a high-income country	LHW intervention for testing promotion designed by Hmong leaders and researchers	Nutrition and physical activity educational sessions	HBV	Testing	112 in control 105 in intervention
							(T	able 2 continu	ues on next page)

Study (Year)	Level of engagement	Study design	Setting	Population	Community-engaged intervention	Intervention in control group	Type of hepatitis focused	Study outcomes across the continuum	Sample size
(Continued fro	m previous pac	ie)							
Stagg et al. (2019) <sup>16</sup>	Higher level engagement (Collaborate)	RCT	UK	Chronic hepatitis C patients	One-to-one manner peer advocation: provided personalized support to help clients attend appointments and adhere to treatment. Advocates built trust, maintained regular contact, addressed barriers, offered practical assistance, and connected clients to additional services	Standard of care, their test results, and notification of their study participation were sent to their primary care practitioner	HCV	Linkage-to- care	38 in control 58 in intervention
Hochstatter et al. (2021) <sup>52</sup>	Higher level engagement (Involve)	RCT	USA	People who use drugs (Opioid drug users)	Medications for addiction treatment plus educational information, private messages, and a public discussion forum	Medications for addiction treatment	HCV	Testing	179 in control 185 in intervention
Litaker et al. (2021) <sup>53</sup>	Higher level engagement (Involve)	Cross- sectional study	USA	People born between 1945 and 1965	Outreach, education, and incentive	No education, outreach, or incentive	HCV	Testing	795 in control 840 in intervention
Martro et al. (2022) <sup>54</sup>	Higher level engagement (Involve)	Observational	Spain	People who have immigrated to a high-income country	Education, screening, and simplified access to treatment	UC	HCV	Testing	25,455 in control 505 in intervention
Norton et al. (2021) <sup>55</sup>	Higher level engagement (Collaborate)	Prospective cohort study	USA	People who use drugs	Directly observed therapy, Group treatment	SIT	HCV	SVR & Treatment adherence	33 in control 28 in intervention
Chu et al. (2022) <sup>56</sup>	Lower level engagement (Consult)	Cross- sectional study	USA	People who have immigrated to a high-income country	Multimedia campaign, educational information, screening	Standard of care	HBV	Testing	809 in control 857 in intervention
Eckhardt et al. (2022) <sup>57</sup>	Higher level engagement (Involve)	RCT	USA	People who use drugs	Simplified access to treatment, prevention	UC	HCV	Linkage-to- care & SVR	83 in control 82 in intervention
Fadnes et al. (2021) <sup>58</sup>	Higher level engagement (Involve)	RCT	Norway	People who use drugs	Integrated treatment, testing, counseling	Standard treatment	HCV	Linkage-to- care & SVR	150 in control 148 in intervention
Khalili et al. (2022) <sup>59</sup>	Lower level engagement (Consult)	CRCT	USA	People who have immigrated to a high-income country	A hepatitis app providing interactive video education combined with a printout (Provider Alert) and a Provider Panel Notification. The intervention was developed following consultation with community members and community-based organizations (CBOs)	A mobile application delivering nutrition and physical activity education and a Provider Panel Notification	HBV	Testing	132 in control 228 in intervention
Berenbrok et al. (2023) <sup>60</sup>	Higher level engagement (Involve)	Non- randomized controlled cluster trial	USA	Diabetic	Pharmacist-led motivational interviewing intervention: patient education through a conversation to recommend HBV vaccination and provision of education materials	General information on immunizations	HBV	Vaccine	3640 in control 1569 in intervention
Wong et al. (2022) <sup>61</sup>	Higher level engagement (Involve)	RCT	China	General primary care patients	Promotion of HBV, HCV testing using digital tools	The standard healthcare services without any promotional materials	HBV/HCV (T	Testing & linkage to care able 2 contine	332 in control 310 in intervention ues on next page)

Study (Year)	Level of engagement	Study design	Setting	Population	Community-engaged intervention	Intervention in control group	Type of hepatitis focused	Study outcomes across the	Sample size
(Continued fro	m previous pac	ie)							
Xiao et al. (2021) <sup>62</sup>	Higher level engagement (Involve)	RCT "pilot study"	Australia	People who have immigrated to a high-income country	CBOs supported recruitment of participants, community outreach through multi- lingual fieldworkers, online advertisement through university student noticeboard, WeChat and a Chinese language radio broadcast Intervention: Education package (comprised of a leaflet and in-person one-on-one educational session)	Liver cancer prevention information	HBV	Testing	15 in control 18 in intervention
Talal et al. (2024) <sup>63</sup>	Higher level engagement (Involve)	CRCT	USA	People who use drugs	Facilitated telemedicine integrated into opioid treatment programs (OTPs): case managers into OTPs to facilitate HCV care, build trust, coordinate telemedicine visits, manage medication delivery, address barriers, ensure personalized support, promote health education, and engage stakeholders to enhance treatment adherence and outcomes	Standard-of-care off-site referral	HCV	Linkage-to- care & SVR	312 in control 290 in intervention
Zheng et al. (2023) <sup>64</sup>	Lower level engagement (consult)	Observational	China	General primary care patients	A multidisciplinary approach involved standardized hepatitis C screening, diagnosis, referral, and follow-up. Public health doctors provided treatment recommendations, and offered patient and contact education via health prescriptions and offline lectures	UC	НСV	Linkage-to- care	1013 in control 293 in intervention
McGaffey et al. (2024) <sup>65</sup>	Higher level engagement (involve)	Observational	USA	General primary care patients	Going (Anti) Viral intervention: The intervention engaged patients through accessible testing and vaccination, educational materials like posters and fliers, and interactive activities (e.g., poster contests, coloring projects). Patients became campaign advocates while benefiting from electronic health record prompts, provider recommendations, and motivational incentives like lotteries and rewards, fostering active participation in their healthcare	UC	HCV	Testing	3218 in control 2928 in intervention
							(T	able 2 continu	ues on next page)

Study (Year)	Level of engagement	Study design	Setting	Population	Community-engaged intervention	Intervention in control group	Type of hepatitis focused	Study outcomes across the continuum	Sample size
(Continued fro	m previous pag	le)							
Nyamathi et al. (2023) <sup>66</sup>	Higher level engagement (Involve)	CRCT	USA	Homeless men	Nurse/CHW-led HCV intervention: CHWs provided education, stigma reduction, and support for stable housing, substance use treatment, and healthcare access. They assist with problem-solving, referrals, and gender-sensitive discussions. Patients receive incentives, fostering engagement in treatment, risk reduction, and long- term stability	Clinic-based standard of care	нсv	SVR	6 in control 4 in intervention
Ogliastro et al. (2024) <sup>67</sup>	Lower level engagement (Consult)	Retrospective cohort study	Italy	Men who have sex with men	Counseling Intervention: Patients received personalized counseling from qualified staff on vaccination benefits and risks, using active listening and informed decision- making principles	UC	HBV	Vaccine	330 in control 330 in intervention
Roux et al. (2016) <sup>68</sup>	Higher level engagement (Collaborate)	Non- randomized clustering design	France	People who use drugs	Community-Based Educational Intervention: non-governmental organization (NGO) staff and volunteers led participant-centered sessions on HIV and HCV risk reduction, focusing on safer injection practices. Through observation, analysis, and education, they provided personalized advice	Standard harm reduction centers	HCV	Testing	127 in control 144 in intervention
Seaman et al. (2024) <sup>69</sup>	Higher level engagement (Involve)	RCT	USA	People who use drugs	Peer-assisted telemedicine HCV treatment: insurance enrollment, telemedicine access, medication delivery, adherence, culturally sensitive care, same-day appointments, peer communication	Enhanced usual care: Referred participants to local HCV services, including prescribers, care coordinators, and other local peers for support	HCV	Linkage-to- care & SVR	103 in control 100 in intervention
Stewart et al. (2023) <sup>70</sup>	Higher level engagement (Collaborate)	Observational	Canada	General primary care patients	Electronic medical record decision-support tool with input from stakeholders. CHWs reached out to HCV- positive patients, providing education on treatment, and continuously refining the intervention based on feedback from both staff and patients	UC	HCV	Linkage-to- care & SVR	536 in control 531 in intervention
Zhang et al. (2025) <sup>71</sup>	Higher level engagement (Collaborate)	RCT	China	Pregnant women diagnosed with HBV	Nursing-Sensitive Approach: Communication, adapting health education plans based on patients' feedback, education through online platforms, sharing health info, videos, and success stories, and interdepartmental collaboration	No application of nursing- sensitive quality indicators	HBV	Treatment adherence	40 in control 40 in intervention
							Τ)	able 2 continu	ues on next page)

Study (Year)	Level of engagement	Study design	Setting	Population	Community-engaged intervention	Intervention in control group	Type of hepatitis focused	Study outcomes across the continuum	Sample size
(Continued from	m previous pag	e)							
Zhang et al. (2023) <sup>72</sup>	Higher level engagement (Involve)	CRCT	China	Men who have sex with men	Pay-it-forward: incentives, health education (community-led capacity- building sessions), and public health messaging (sharing real-world pay-it- forward stories)	Standard of care	HBV & HCV	Testing	162 in control 160 in intervention
Litwin et al. (2022) <sup>73</sup>	Higher level engagement (Collaborate)	RCT	USA	People who use drugs	Patient navigation: Navigators provided at least four encounters, offering health education, overcoming barriers, and providing psychosocial support	Modified directly observed therapy: daily observed treatment at OTPs and participants recorded medication intake using the emocha app, with videos uploaded daily for staff review at community health centers	HCV	SVR	376 in control 379 in intervention

Table 2: Characteristic of included studies of the systematic review and meta-analysis (n = 35).

selected as semi-finalists with a score of  $\geq$ 7.0. Semifinalist submissions were from 13 countries, 85% of which were LMICs. Appendix S7 shows the distribution of mean scores. Appendix S8 summarizes characteristics of submissions to the open call.

The 28 semi-finalist submissions were submitted by people living with HBV (n = 16), their family members (n = 1), friends and colleagues or by community organizations actively providing hepatitis services (n = 15). It is important to note that some affected individuals also led community organizations, resulting in an overlap between categories. Certain populations were also highlighted in the submissions as in need of prioritization: babies born to mothers living with HBV infection (n = 3), persons exposed to non-sterile needles (n = 5), individuals living in communal or incarcerated settings (n = 1), and persons co-infected with chronic viral hepatitis and other infectious diseases (n = 3).

Interventions identified in the systematic review and open call The community engagement strategies identified from the systematic review and the open call illustrated comprehensive approaches across the hepatitis care continuum (Table 3).

In the systematic review, several interventions were identified along the continuum of hepatitis care. For testing and linkage to care, multidisciplinary teams, especially peer support workers, acted as patient liaisons,<sup>15,47,63,64</sup> helping individuals navigate treatment and stay engaged with care. Community-driven educational materials, created or modified with community input<sup>15,47,59,65,68,70,72</sup> using accessible language and culturally appropriate content<sup>42,46,47,69</sup> and were delivered

through both digital and in-person engagement activities.56 Community leaders played a key role in enhancing the reach of these programs.<sup>15,47</sup> Regarding treatment adherence, peer education or group treatment provided information and support to patients.48,55 Additionally, the nursing-sensitive approach, which involved regular communication, online education, and sharing success stories, was identified as key in promoting treatment adherence.71 For viral suppression and posttreatment follow-up, interventions incorporated mobile phone communication44,52 with peer supporters and provided incentives44,53,66 to encourage appointment attendance. Community health workers also played a key role, with strategies such as Syringe Service Programs (SSPs) engaging people who inject drugs and offering flexible appointment scheduling.57,69 Other interventions included the formation of multidisciplinary teams, including psychologists for mental health support,44,58 and the promotion of shared decision-making, allowing patients to choose their treatment plans in collaboration with healthcare providers.55 Case managers or navigators addressed barriers, ensured personalized support, and promoted health education.63,73

In the open call submissions, community-based organizations (CBOs) played a major role in addressing barriers to hepatitis care.<sup>40</sup> For testing and linkage to care, The CBOs led a variety of interventions, including hepatitis testing awareness campaigns, improving information accessibility, and initiatives to combat misinformation and stigma against individuals living with hepatitis. Additionally, CBOs provided emotional support, legal aid, and initiated and implemented

Hepatitis care continuum	Community-engaged interventions from the systematic review	Community-engaged interventions from open call
Testing and linkage-to-care	<ul> <li>Patient-led care pathways and multidisciplinary teams (especially peer support workers) to act as patient liaisons for service delivery</li> <li>Educational materials created or modified by and with community members</li> <li>Accessible language and culturally appropriate materials</li> <li>Digital and in person engagement activities</li> <li>Community leaders' role to improve the reach of hepatitis testing programs</li> </ul>	<ul> <li>Efforts to reduce perceived obstacles to testing and promote entry into care continuum</li> <li>Enhancing Information accessibility about testing services and providing reliable information</li> <li>Tackling misinformation about viral hepatitis including that from medical providers (Yiyou Charity Liver Center in China)</li> <li>Stigma reduction and tackling discrimination against people living with hepatitis</li> <li>Pioneering hepatitis testing awareness campaigns (Yiyou Charity Liver Center in China)</li> <li>Initiation and implementation of hepatitis screening, testing, referral, and treatment programmes for priority populations (CoNE in India)</li> <li>Providing emotional support and legal aid (Delhi Network of Positive People in India)</li> </ul>
Treatment and adherence	<ul> <li>Peer support workers or mentors helped improve access to treatment and treatment adherence</li> <li>Peer education or group treatment on treatment and adherence</li> <li>Nursing-sensitive approach involving regular communication, education, and stories sharing</li> </ul>	<ul> <li>Provision of affordable/free consultations and medications (Zakat Fund of National Liver Foundation, Bangladesh)</li> <li>Ensure access to HBV and HCV treatments during emergencies like the COVID-19 pandemic (CoNE)</li> <li>Advocate and initiation of awareness campaigns on treatment options and resources</li> <li>Engaging with government and health authorities to fund hepatitis treatments and encourage newly diagnosed patients to seek care</li> </ul>
Viral suppression/ cure and aftermath	<ul> <li>Using mobile phones for communicating with peer supporters before, during, and after treatment</li> <li>Participants received incentives designed to reinforce visit attendance behaviors and were not based on pill count or HCV RNA response</li> <li>Utilizing syringe service programs as potential sites for community-based treatment because of high levels of engagement with people who inject drugs</li> <li>Relying on flexible appointment scheduling and a supportive harm reduction framework</li> <li>Integrated treatment is provided through multi-disciplinary teams including psychologists for providing mental health treatment (psychosocial approaches)</li> <li>Patients with providers, chose which intervention to receive (shared decision-making)</li> <li>Case managers and navigators delivered health education, addressed barriers, and offered psychosocial support</li> </ul>	<ul> <li>Their advocacy efforts included creating partnerships with the government and other stakeholders, working as peer counselors and participating in awareness raising campaigns</li> <li>Patients became advocates for hepatitis elimination through establishing community-based organizations and lending their voices to give others hope</li> <li>Leading the advocacy efforts for the establishment of the National Control Programs against Viral Hepatitis (solidarity action of youth for community development in Democratic Republic of the Congo)</li> <li>Promoting the abolition of HBV check program for school admissions and entry physical examination for HBV for employment (Yiyou CFharity Liver Center in China)</li> </ul>
HBV = hepatitis B vi	irus. HCV = hepatitis C virus. CoNE = Community Network for Empowerment.	
Table 3: Commun	ity-engaged intervention from systematic review and open call across he	patitis care continuum.

hepatitis screening, testing, referral, and treatment programs, particularly for priority populations. These efforts were often driven by local advocacy strategies and initiatives. In terms of treatment adherence, CBOs focused on raising awareness about available treatment options for viral hepatitis, offering subsidized or free hepatitis care services in local communities, and engaging with governments and health authorities to secure funding and promote hepatitis care initiatives. These organizations also worked to ensure continued access to HBV and HCV treatments, particularly during emergencies such as the COVID-19 pandemic. Regarding viral suppression and post-treatment followup, personal stories and voices from individuals who had been cured of hepatitis were shared to inspire hope for cure or viral suppression. Peer counselors were also actively involved in awareness-raising campaigns, and people living with chronic viral hepatitis themselves became advocates by establishing CBOs, partnering with stakeholders, and mobilizing resources for hepatitis elimination. These advocates also worked to ensure patients' rights to equal access to care, treatment and work.

In summary, the systematic review primarily highlighted patient-centered activities, with peer support and community-driven education playing a prominent role in enhancing engagement with hepatitis services. In contrast, the open call submissions emphasized community-led interventions, where patients themselves played a more active role, leading CBOs and advocating locally to improve access to hepatitis care and services.

#### Level of engagement

Among the 35 publications identified in the systematic review, community-engaged interventions varied significantly in terms of level of community engagement. None of the identified interventions reached "empower", the highest level of engagement. Seven studies reached the level of "collaborate" as community members worked alongside researchers and healthcare workers in the design, development, and implementation processes to enhance hepatitis testing and awareness.<sup>16,51,55,68,70,71,73</sup> Twenty studies reached the level of "involve" as study participants were directly involved in counseling or treatment discussions through two-way interaction with an educator, counselor or a multidisciplinary team.<sup>15,45-50,52-54,57,58,60-63,65,66,69,72</sup> Five studies reached the "consult" level, where researchers gathered information or feedback from the community without establishing two-way interactions.<sup>44,56,59,64,67</sup> Three studies were classified as "inform" because they only informed participants about intervention contents without direct engagement of participants.<sup>41–43</sup> The open call identified many empowerment level engagement efforts, with a focus on LMICs, because community leadership and advocacy were the main approaches at the grassroots level.

### Meta analysis

Community-engaged interventions significantly improved HBV vaccine completion (RR 1.59, 95% CI 1.15–2.19;  $I^2 = 88.10\%$ ; 4 RCTs and 2 non-RCTs, 7107 participants), HBV/HCV test uptake (RR 2.33, 95% CI 1.78–3.06;  $I^2 = 99.10\%$ ; 11 RCTs and 5 non-RCTs, 43,292 participants), linkage-to-care (RR 1.96, 95% CI 1.46-2.64; I<sup>2</sup> = 96.20%; 8 RCTs and 2 non-RCTs, 4849 participants), HBV/HCV treatment adherence (RR 1.14, 95% CI 1.03–1.27; *I*<sup>2</sup> = 0%; 2 RCTs and 1 non-RCT; 291 participants), and sustained virologic response (SVR) to HCV treatment (RR 1.50, 95% CI 1.23–1.83;  $I^2 = 93.90\%$ ; 8 RCTs and 2 non-RCTs, 3401 participants) compared to control groups (Fig. 2). Publication bias was observed in studies where HBV vaccine completion was an outcome and trim-and-fill analysis showed that three potentially missing studies were imputed to address asymmetry in the funnel plot (Appendices S9 and S10).

Lower-level community-engaged interventions did not increase HBV vaccine completion (RR 1.22, 95% CI 0.93–1.58;  $I^2 = 81.00\%$ ; 1 RCT and 1 non-RCT, 1017 participants), linkage-to-care (RR 1.77, 95% CI 0.92-3.39;  $I^2 = 95.60\%$ ; 1 RCT and 1 non-RCT, 1396 participants) or HCV treatment SVR (RR 1.24, 95% CI 0.92-1.68; 1 RCT, 90 participants) (Fig. 2). Higher level engagement was significantly associated with a better HCV treatment SVR outcome (RR 1.54, 95% CI 1.25–1.90;  $I^2 = 94.60\%$ ; 7 RCTs and 2 non-RCTs, 3311 participants). The forest plots depicting various outcomes can be found in Appendix S9, with the GRADE assessments for each outcome available in Appendix S11. Furthermore, the sensitivity analysis demonstrated that the RR results for various outcomes were robust, except for the treatment adherence (Appendix S12).

The subgroup meta-analysis (Appendix S11) showed community-engaged interventions improved chronic virus outcome across HBV vaccine completion rate, HBV/HCV test uptake, linkage-to-care, HBV/HCV treatment adherence, and HCV SVR in the RCT studies. Community-engaged interventions also demonstrated significant improvements in HBV test uptake and HBV treatment adherence. For linkage-to-care, a positive effect was observed when the focus was on HCV and people who use drugs.

	Number of Studies	Intervention n/N	Control n/N	RR (95%CI	P value	I <sup>2</sup>	
Outcomes				I			
HBV vaccination							
Lower level engagement	2	294/509	247/508	⊧ <b></b>	1.22(0.93,1.58)	0.147	81.00%
Higher level engagement	t 4	569/2232	102/3858		3.12(1.15,8.49)	0.025	91.80%
Overall	6	863/2741	349/4366	·	1.59(1.15,2.19)	0.005	88.10%
HBV/HCV testing							
Lower level engagement	4	854/1723	584/1625		3.05(1.24,7.48)	0.015	95.50%
Higher level engagement	12	4099/7399	14504/32545	II	2.22(1.60,3.07)	< 0.001	99.30%
Overall	16	4953/9122	15088/34170	·∎i	2.33(1.78,3.06)	< 0.001	99.10%
HBV/HCV Linkage-to-co	are						
Lower level engagement	2	305/347	393/1049	↓ <b></b>	1.77(0.92,3.39)	0.088	95.60%
Higher level engagement	t 8	996/1714	641/1739	⊢ <b>_</b> i	2.03(1.46,2.64)	< 0.001	94.50%
Overall	10	1301/2061	1034/2788	⊢ <b>-</b> i	1.96(1.46,2.64)	< 0.001	96.20%
HBV/HCV Treatment ad	herence						
Lower level engagement	0	/	/		/	/	/
Higher level engagement	t 3	143/167	95/124	► <b>™</b> H	1.14(1.03,1.27)	0.016	0.00%
Overall	3	143/167	95/124	F <b>■</b> -I	1.14(1.03,1.27)	0.016	0.00%
HCV Sustained virologic	response						
Lower level engagement	1	41/54	22/36	H	1.24(0.92,1.68)	0.157	/
Higher level engagement	t 9	1221/1661	843/1650	<b>■</b> i	1.54(1.25,1.90)	< 0.001	94.60%
Overall	10	1262/1715	865/1686		1.50(1.23,1.83)	< 0.001	93.90%
			0.5	10 20 40 80			

Fig. 2: Effectiveness of community-engaged interventions on HBV vaccination, HBV/HCV testing, HBV/HCV linkage to care, HBV/HCV treatment adherence, and HCV sustained virologic response (SVR).

## Discussion

In this study, we conducted a systematic review and leveraged a crowdsourcing initiative to identify community-engaged interventions for chronic viral hepatitis. We aimed to uncover both documented strategies and grassroots efforts not yet captured in the literature.

The systematic review and meta-analyses found that community-engaged public health interventions were associated with higher rates of HBV vaccination, HBV/ HCV test uptake, linkage to chronic viral hepatitis care, HBV/HCV treatment adherence, and HCV SVR. Notably, most original studies were from high-income countries, and that community-engaged interventions significantly enhanced the uptake of hepatitis care services, particularly in vaccination and testing. However, the impact of community-engaged intervention on treatment adherence was not stable according to the sensitivity analysis, likely due to the limited number of studies addressing this outcome.48,55,71 The trim-and-fill analysis suggested a potential overestimation of the community engagement impact on HBV vaccination uptake due to publication bias, highlighting the need for more comprehensive and unbiased research. Several interventions concentrated on the initial stages of hepatitis care, specifically testing and linkage to care, showing improvements in early uptake of health services. These findings highlight that community-engaged hepatitis intervention efforts facilitate earlier entry into the care continuum.61

In contrast to the systematic review data most of which represented HIC settings, the open call described interventions mostly from LMICs. Both sources highlighted the peer support, and culturally appropriate communication, emphasizing the role of community leaders and advocates in enhancing the reach and effectiveness of hepatitis programs. However, interventions identified in the systematic review were largely engaging patients in health research activities. Conversely, the open call identified advocacy activities, with community members leading initiatives to engage government and health authorities to create patient demand and generate hepatitis-focused health programs in LMICs, but these initiatives are rarely scientifically evaluated or documented. Future targeted crowdsourcing initiatives should prioritize collecting project data with measurable outcomes, and studies assessing the effectiveness of these initiatives are needed, particularly in LMICs.

We identified significant gaps and opportunities in community engagement efforts across the chronic viral hepatitis care continuum. In testing and linkage to care, while existing literature focuses on community engagement for education and service delivery, the open call identified diverse community-led initiatives in lowresource settings addressing awareness, misinformation, stigma reduction, and emotional and legal support. Community-led efforts to enhance testing and linkage to care in LMICs remain underrepresented in academic literature,<sup>26</sup> indicating missed opportunities to empower communities. Regarding treatment adherence, research has primarily cantered on using peer health workers to improve service access. However, grassroots communities in LMICs are vital in tackling structural challenges, such as initiating new services, securing government funding, and maintaining treatment during emergencies. For viral suppression and post-treatment follow-up, evidence indicates that higher levels of community-engaged interventions can improve SVR and cure rates. Grassroots initiatives aimed at raising public awareness and addressing stigma are prevalent in LMICs, yet more robust evaluation and documentation of these efforts are needed and recommended.

Our study has several strengths. First, it employs a mixed-methods approach, which combines quantitative and qualitative data to provide a more comprehensive understanding of the community-engaged interventions and advocacy efforts to eliminate the hepatitis. Second, the study uniquely integrates findings from published studies with complementary data from an open call, enabling broader stakeholder participation and the inclusion of diverse perspectives. This study also has limitations. First, systematic review data were largely from HICs, and the open call submissions were mainly from LMICs. However, the combined data provides complementary insights on community-engaged interventions for hepatitis care across settings with diverse resources and healthcare infrastructure. Second, the review identified heterogeneity in hepatitis care interventions and outcome measures, but our evidence synthesis provided information about the impact of community-engaged interventions on hepatitis care outcomes stratified by community engagement levels. Third, publication bias was detected in the HBV vaccination uptake outcome, and the trim-and-fill analysis indicated that the impact of community engagement may have been overestimated, underscoring the importance of addressing bias in future research.

In conclusion, our systematic review and open call submissions both demonstrate that communityengaged interventions and local advocacy strategies significantly enhanced chronic viral hepatitis care across the continuum, from testing to treatment and suppression or cure. This has implications for practice and policies providing evidence that community-engaged strategies can be implemented to support effective delivery of chronic viral hepatitis care services, especially in resource limited settings, and highlighting the need for supportive policies to aid implementation. Importantly, Asia and Africa-regions bearing the highest burden of chronic viral hepatitis infection and liver disease-require more tailored interventions to meet local needs in hepatitis service delivery. Additionally, more research is needed to examine impact and sustainability of the strategies in LMICs.

#### Contributors

DW conceived the idea. YL, EK, DE, HC, KW, RS, and DW conducted systematic review and meta-analysis. HC, DW, JDT, and EK managed the open call process. YL, EK, DE, and HC wrote the draft. TF, JDT, PCM, DKA, YZ, and all other co-authors provided constructive feedback on the manuscript. All authors reviewed and approved the final version of the manuscript. All authors had full access to all the data in the study and had final responsibility for the decision to submit for publication. YL, EK, and DW directly accessed and verified the data reported in this manuscript.

#### Data sharing statement

The data supporting this article are included within the article itself and in the Supplementary Material.

#### Declaration of interests

The authors declare no conflicts of interest.

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#### Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.eclinm.2025.103234.

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