







Crowdfunding for health research: a qualitative evidence synthesis and a pilot programme

Eneyi Edith Kpokiri ¹, Clarisse Sri-Pathmanathan,¹ Priyanka Shrestha,^{1,2} Sana Navaid,³ Teerawat Wiwatpanit,⁴ Asha Wijegunawardana,⁵ Mahmud Ali Umar ⁶, Debra Jackson ⁷, Jackeline Alger ^{8,9}, Meghan A Bohren ¹⁰, Mia Hoole,¹¹ Meredith Labarda,¹² Noel Juban,¹² Pascal Launois,¹³ Weiming Tang,¹⁴ Beatrice Halpaap,¹³ Joseph D Tucker ^{1,15}

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EEK and CS-P contributed equally.

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For numbered affiliations see end of article.

Correspondence to

Dr Eneyi Edith Kpokiri;
eneyi.kpokiri@lshtm.ac.uk

ABSTRACT

Background Many low-income and middle-income country (LMIC) researchers have disadvantages when applying for research grants. Crowdfunding may help LMIC researchers to fund their research. Crowdfunding organises large groups of people to make small contributions to support a research study. This manuscript synthesises global qualitative evidence and describes a Special Programme for Research and Training in Tropical Diseases (TDR) crowdfunding pilot for LMIC researchers.

Methods Our global systematic review and qualitative evidence synthesis searched six databases for qualitative data. We used a thematic synthesis approach and assessed our findings using the GRADE-CERQual approach. Building on the review findings, we organised a crowdfunding pilot to support LMIC researchers and use crowdfunding. The pilot provided an opportunity to assess the feasibility of crowdfunding for infectious diseases of poverty research in resource-constrained settings.

Results Nine studies were included in the qualitative evidence synthesis. We identified seven findings which we organised into three broad domains: public engagement strategies, correlates of crowdfunding success and risks and mitigation strategies. Our pilot data suggest that crowdfunding is feasible in diverse LMIC settings. Three researchers launched crowdfunding campaigns, met their goals and received substantial monetary (raising a total of US\$26 546 across all three campaigns) and non-monetary contributions. Two researchers are still preparing for the campaign launch due to COVID-19-related difficulties.

Conclusion Public engagement provides a foundation for effective crowdfunding for health research. Our evidence synthesis and pilot data provide practical strategies for LMIC researchers to engage the public and use crowdfunding. A practical guide was created to facilitate these activities across multiple settings.

INTRODUCTION

Crowdfunding engages large groups of people who make small contributions to support a research study.¹ It provides a method for researchers to engage with the

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Crowdfunding has been used to fund health causes, technology start-ups, creative projects, and more recently, scientific research. Although crowdfunding has been used for research funding in high-income settings, there is less evidence about its feasibility in low-income and middle-income country (LMIC) settings. In addition, previous reviews of crowdfunding have not focused on public engagement strategies that may be important for developing effective crowdfunding campaigns.

WHAT THIS STUDY ADDS

⇒ Our pilot programme shows that crowdfunding is a feasible option for LMIC researchers and public engagement is key for crowdfunding success as it creates opportunities for the public to contribute to and be involved with the research. The qualitative evidence synthesis suggests that early-career researchers, proof-of-concept and pilot research studies may be particularly well suited to crowdfunding.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ There are specific risks involved with crowdfunding for health research, while we highlighted some mitigation strategies for these risks, there is need for more peer-reviewed evidence on effective strategies to address these risks and the extent to which crowdfunding can support democratisation of research.

public to spur interest and cultivate local partnerships.² Crowdfunding provides a way for communities and stakeholders to invest in locally relevant topics and directly contribute to scientific research. Crowdfunding has been used to support research studies in many high-income countries (HICs),^{3–5} but is rarely used in low-income and middle-income countries (LMICs).⁶

LMIC researchers are often disadvantaged in applying for research grants compared with their HIC counterparts due to power asymmetries within global health.⁷ A telling example of this is the imbalance in authorship within high-impact global health journals across the world.^{8 9} Another example is the 'brain drain' of LMIC expertise and the disproportionate funding allocated to HIC researchers compared with their LMIC counterparts.^{10 11} International donors have supported the research efforts in LMICs,^{12 13} which potentially leads to donor-driven research agendas, with a disregard for local needs, knowledge and languages.^{14 15} One way to expand LMIC-based research funding is crowdfunding, a process in which researchers engage with their communities and raise funds at the local and international level in order to conduct meaningful research. More local funding for research is one step to disrupting the unequal relationships observed within global health and may contribute to creating networks within the Global South, thereby increasing LMIC ownership.¹⁴ In addition, local researchers working in their own communities may have a greater likelihood of securing research funding relevant to addressing local priorities. Crowdfunding presents a potential opportunity to democratise, decentralise and decolonise health research, and to build health networks between like-minded researchers and their communities. There is also a need to explore the associated risks of crowdfunding health research.

We organised a TDR Global open call and pilot programme to support selected LMIC researchers with their own crowdfunding for research campaigns. TDR, the Special Programme for Research and Training in Tropical Diseases is based at the WHO and is cosponsored by the UNICEF, the United Nations Development Programme, the World Bank and WHO. TDR Global is the part of TDR focused on public engagement and supports global research efforts on infectious diseases of poverty. This manuscript synthesises global qualitative evidence on crowdfunding using a systematic review and describes a TDR pilot focused on public engagement and crowdfunding led by LMIC health researchers. The overall aim is to expand the literature by summarising the available evidence on crowdfunding for research and by assessing its feasibility in LMIC settings.

METHODS

A systematic review and qualitative evidence synthesis

The purpose of this review was to systematically identify and synthesise evidence on crowdfunding for health research, including barriers, facilitators and implications for policy and practice.¹⁶ We followed the Cochrane handbook for conducting systematic reviews and used the 2020 PRISMA guidance.^{17 18 19}

We searched PubMed, EMBASE, Web of Science, Scopus, Global Health and Google Scholar. We used the key terms [Crowdfunding or public-funded or public contribution] OR AND [Research]. We also searched

registers for grey literature including theses and dissertations, article preprints, conference proceedings, and the reference lists of relevant manuscripts. Search outputs from the databases were combined and deduplicated.

Search outputs were screened by title, then abstract and finally full text. Our inclusion criteria were limited to studies reporting crowdfunding in health research and published in English, between 1 January 2000 and 23 March 2021. The search was updated on 22 September 2021 (online supplemental appendix I). We employed a qualitative evidence synthesis which only examines qualitative data. Qualitative data can examine the social context of crowdfunding, including facilitators and barriers of crowdfunding. Second, qualitative data can be useful in understanding how crowdfunding may influence intersectional issues related to gender, early career research status, and related issues. Third, qualitative studies are important for assessing values, preferences and implementation. As a result, we included studies with primary qualitative data, on crowdfunding for research, in the English language and published in the last decade. We excluded studies with purely quantitative data, editorials, opinion pieces, practical guides and reviews. Studies on crowdfunding for other reasons other than research, published over 10 years ago or in a language other than English were also excluded. Two independent reviewers (EEEE and CS) screened studies for inclusion and disagreements were resolved through consensus-based discussion with the wider team. EEEK and CS extracted relevant data, including study objectives, participants, study setting, study design, data collection methods, qualitative themes, main study findings and where possible, correlates of crowdfunding success. We also independently assessed methodological limitations using the Critical Appraisal Skills Programme tool with a checklist for each study, including validity, relevance, adequacy, methodological limitations and risk of bias.²⁰

We used a thematic synthesis approach²¹ for data analysis, which involved familiarisation with the data, coding the primary studies, developing themes and using these themes to generate further understanding and hypotheses. We used the GRADE-CERQual (Confidence in the Evidence from Reviews of Qualitative research) approach to assess confidence in each qualitative review finding, based on four key components: methodological limitations, coherence of the review finding, adequacy of the data, and relevance of the included studies to the review question.²²⁻²⁷ After assessing each of these components, we made an overall judgement on the confidence we had in each review finding (high, moderate, low or very low). The CERQual approach has been applied to qualitative and mixed methods systematic reviews in a number of WHO global guidelines because it provides high levels of transparency and precision.²²

The pilot programme

Building on the themes identified in the qualitative evidence synthesis, we developed a crowdfunding pilot



Figure 1 Stages of the TDR Global Pilot Programme focused on public engagement and crowdfunding led by low-income and-middle-income countries (LMICs) health researchers. (TDR is the UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases).

programme in partnership with TDR Global. The main objective of this pilot programme was to test the effectiveness of crowdfunding as a means to finance health research in LMICs. The pilot took place in three stages: an open call to solicit LMIC researchers interested in crowdfunding; a capacity building workshop; the launch of a crowdfunding campaign with mentorship and support for finalists (figure 1).

The open call

The crowdsourcing open call was designed using the framework provided by the TDR/Social Entrepreneurship to Spur Health (SESH)/Social Innovation in Health Initiative (SIHI) Practical Guide on Crowdsourcing in Health and Health Research.²⁸

Our open call was conducted in five steps, including convening a steering committee, promoting community participation and engagement, receiving and judging contributions, recognising the finalists and implementing solutions. Detailed information on the process of these stages is described in online supplemental appendix II. We invited stakeholders in crowdfunding to join the steering committee. The crowdfunding call had 15 confirmed steering committee members (9 women and 6 men). All members of the steering committee had LMIC experience in crowdfunding for research or public engagement. The steering committee met monthly via a 1-hour videoconference to provide guidance on the open call. The open call accepted submissions over 6 weeks. We promoted the call for submissions using infographics shared on social media channels and emails. At the end of the call, all submissions were screened for eligibility by the research team and eligible entries were sent to judges. We invited independent judges from the WHO TDR Global network to review submissions. Criteria for evaluation included compelling science, capacity for public engagement and personal connection to the infectious disease topic. Emerging finalists were provided feedback and supported with capacity building trainings to launch their crowdfunding campaign. We define a finalist submission as one that achieves a mean score of

7 or above out 10 after screening and judging process. A total of 592 people volunteered to serve as judges and 47 were selected to review submissions. We selected volunteer judges based on TDR Global membership and LMIC research experience.

Capacity building

The finalists were recognised through a TDR announcement and supported to attend a capacity-building workshop in Geneva. The one and half-day workshop included 1:1 mentoring from TDR Global members, presentations on crowdfunding (online supplemental appendix III), and group discussions about how to enhance public engagement and crowdfunding in LMICs. After the workshop, a monthly working group composed of finalists and mentors reported on crowdfunding progress.

Campaign launch

Three finalists launched crowdfunding campaigns. They used multiple public engagement strategies to solicit both monetary and non-monetary contributions for their research projects. At the end of their campaigns, all three finalists exceeded their target amounts and raised between US\$7000 and US\$11 000.

Patient public engagement

This study was carried out as a systematic review and pilot programme. No patients were involved. The systematic review made use of publicly available research on crowdfunding for research. Our pilot programme commenced as a crowdsourcing open call to the public soliciting LMIC researchers with interest to crowdfund for their research projects. Selected finalists in the pilot programme launched their campaigns and promoted widely for public input and contributions. A working group and end-user group, with professional and practical experience with crowdfunding for health research, were invited to comment on several drafts of this manuscript. In the final stages, a TDR Global external peer review was completed and six LMIC-based peer reviewers also provided feedback. A practical guide was developed

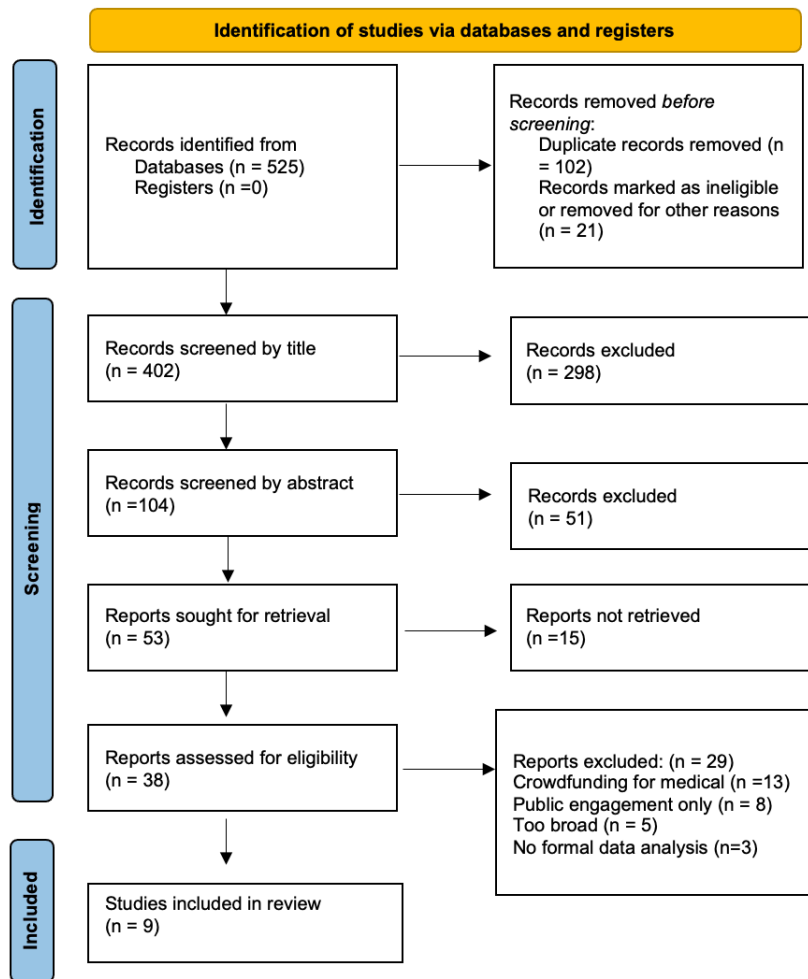


Figure 2 PRISMA flow diagram showing selection of studies on crowdfunding for health research. PRISMA, Preferred Reporting Items for Systematic reviews and Meta Analysis.

by the same authors alongside this systematic review, using an adapted Delphi method to enable co-creation. It is available online, open to the public and provides practical advice on how to organise public engagement and crowdfunding for health research, using evidence from this review.¹

RESULTS

Qualitative evidence synthesis

This qualitative evidence synthesis summarises evidence from published literature on facilitators and barriers of crowdfunding for research. Our initial electronic searches yielded 498 citations after deduplication (figure 2). We assessed articles through title screening, abstract and finally through full-text screening. After exclusions, six papers from the database search met our inclusion criteria. An additional three studies were retrieved from reference lists and a grey literature search. Of the nine included studies, seven focused on HICs and two included global data, including from LMICs. The characteristics of included studies and their main findings are provided in

online supplemental appendix IV. Seven studies reported on data from one country and two reported on data from multiple countries. Four studies were qualitative studies and five were mixed methods. Full details of the critical appraisal checklists completed for each study is available in online supplemental appendix V.

Of the nine included papers, six explored the processes and factors that were associated with successful crowdfunding campaigns (table 1).^{29–33} Three articles assessed the feasibility of conducting crowdfunding for health and/or scientific research.^{34–36} We identified seven findings which we organised into three broad domains: public engagement strategies, correlates of crowdfunding success, and risks and mitigation strategies. Of the seven findings, five were graded as moderate confidence and two were graded as low confidence using the GRADE-CERQual approach (table 2).

Public engagement strategies

Strong public engagement (eg, networking and disseminating appealing, clear, and locally relevant information)

Table 1 Summary of included studies and quality assessment

Author	Study aim	Method QUAL or MM	Study design	Data collection method	Country/region or context/setting	Sample size	Primary or secondary data
1 Sharma <i>et al</i> ³⁵	To explore the feasibility of using crowdfunding for randomised clinical trial (RCT) funding	QUAL	Simplified content analysis of online crowdfunding campaign data	Data scraping from online sources	English crowdfunding websites	20	Secondary data from multiple crowdfunding campaigns
2 Aleksina <i>et al</i> ³⁰	Correlates of crowdfunding success for projects hosted by Consano.org and Experiment.com	MM	Standardised content analysis of online crowdfunding campaign data using mixed methods including OLS regression	Data scraping from online sources	North America only	109	Secondary data from multiple crowdfunding campaigns
3 Krittanawong <i>et al</i> ³⁶	To explore the feasibility of using crowdfunding for the support of cardiovascular research	QUAL	Simplified content analysis	Data scraping from online sources	Top online crowdfunding websites in English (based on site volume)	34	Secondary data from multiple crowdfunding campaigns
4 Dragojlovic and Lynd, 2014 ³⁴	To explore the feasibility of using crowdfunding for oncology research and rare diseases	MM	Simplified content analysis of online crowdfunding campaign data	Data scraping from online sources	North America and Europe	125	Secondary data from multiple crowdfunding campaigns
5 Ortiz <i>et al</i> ³¹	Crowdfunding pilot to fund 6 whole exome sequencing research and data analysis	Pilot, MM	Crowdfunding pilot, mixed-methods analysis of successful crowdfunding campaign metrics and survey data	1. Data scraping from three online platforms 2. Postcampaign survey among participants and donors.	North America only	9	Primary data from crowdfunding campaign creators
6 Byrnes <i>et al</i> ²	'SciFund' crowdfunding pilot to fund various types of scientific research	Pilot, MM	Crowdfunding pilot and mixed methods analysis of crowdfunding campaign metrics and survey data	1. Data scraping from Rocket Hub and other online sources 2. Postcampaign survey among pilot participants	North America only	47,49 and 22	Primary data from crowdfunding campaign creators
7 Saueremann <i>et al</i> ³²	Correlates of crowdfunding success for projects hosted on Experiment.com	QUAL	Standardised content analysis of online crowdfunding campaign data and modelling using OLS regression	Data scraping from online sources	Global (but 89% of Experiment.com campaigns are US based)	725	Secondary data from multiple crowdfunding campaigns
8 Dragojlovic and Lynd, 2016 ²⁹	Stated preferences of donors in crowdfunding projects	QUAL	Qualitative analysis of survey data	Survey among crowdfunding donors	North America only	814	Primary data from backers
9 Schafer <i>et al</i> ³³	Correlates of crowdfunding success for projects on English and German-language platforms	MM	Standardised content analysis of online data and logistic regression, guided by four theoretical frameworks	Data scraping from online sources	Global	371	Secondary data from multiple crowdfunding campaigns

Primary data—from a creator/organiser; Secondary data—analysis of multiple campaigns (interpretation of primary data). MM, Mixed methods; QUAL, Qualitative study.

Table 2 Evidence profile and assessment of confidence in the review findings as per GRADE-CERQual methodology

	Review finding	Studies contributing to the finding	Methodological limitations	Coherence	Adequacy	Relevance	CERQual assessment of confidence in the evidence	Explanation of CERQual assessment
1	 <p>Strong public engagement (eg, networking and disseminating appealing, clear, and locally relevant information) facilitated crowdfunding for research.</p>	2, 3, 5, 6, 7, 8, 9	Moderate methodological limitations due to limited reflexivity, lack of transparency on recruitment strategy, and unclear ethical considerations Two studies (5 and 6) lacked formal qualitative analysis	Minor concerns about coherence	Minor concerns regarding adequacy due to contributions from seven studies with moderately thick data.	Minor concerns about relevance, although six studies presented data from high income countries. Only one study (9) presents globally acquired data	Moderate confidence	Minor concerns over coherence, adequacy, and relevance. Moderate methodological limitations.
2	 <p>Crowdfunding expanded bidirectional communication between researchers and the public. It opened a channel between researchers and the public, and increased the public's trust, awareness, and understanding of science.</p>	5, 6, 7, 9	Serious methodological limitations (two studies with no or minor concerns (7,9) and two studies (5,6) with severe concerns following incomplete analysis on a very small sample)	Moderate concerns about coherence due to study findings based on insufficiently analysed data	Serious concerns about adequacy due to weak and at times incomplete analysis presented in 2 out of 4 studies contributing to this review finding.	Minor concerns about relevance, with three studies mainly focused on crowdfunding and research success, one study focused on selected platforms from high income countries alone	Low confidence	Due to minor concerns about relevance, Moderate concerns about coherence and Serious concerns about adequacy and methodological limitations
3	 <p>Correlates of funding success included lower funding targets, researcher endorsements, the offer of rewards, testimonials, and input from known NGOs. Projects were also more successful if they were hosted on scientific crowdfunding platforms.</p>	2, 7, 9	Minor methodological limitations, robust qualitative analysis presented from all three studies. Strong methodology presented with four conceptual frameworks in one study (9)	Moderate concerns about coherence, because one study finding (9) contradicts another (2)	Moderate concerns regarding adequacy The findings from two studies (2,9) are limited to one platform	Minor concerns about relevance All studies focused on success indicators for crowdfunding	Moderate confidence	Minor concerns for methodological limitations and moderate concerns for coherence and adequacy
4	 <p>Students, early career researchers, and people using innovative methods were more likely to meet their crowdfunding goals and benefit more from the process.</p>	3, 4, 7, 9	Moderate methodological limitations due to lack of reflexivity (4, 7, 9); unclear recruitment strategy and limited data analysis (3)	Minor concerns about coherence	Moderate concerns about adequacy Due to three contributing studies with thick data (4, 7, 9) and one study with moderately thick data	Moderate concerns about relevance All studies are relevant, but three contributing studies are only focused on high-income contexts	Moderate confidence	Minor concerns regarding coherence. Moderate concerns regarding adequacy, relevance and methodological limitations.

Continued

Table 2 Continued

	Review finding	Studies contributing to the finding	Methodological limitations	Coherence	Adequacy	Relevance	CERQual assessment of confidence in the evidence	Explanation of CERQual assessment
5	 <p>Early-stage, proof-of-concept, pilot research and other smaller scale research projects were more suited to crowdfunding.</p>	1, 2, 3, 4, 5, 6, 7	Moderate methodological limitations (two studies with no concerns (4,7) one study with minor concerns, 2 studies with moderate concerns due to small sample size and one study with severe concerns following incomplete analysis on a very small sample)	Minor concerns about coherence	Moderate concerns about adequacy due to low sample size from two studies (1,7) with moderately thick data from four studies (1,2,3,4) and thin data from one study	Minor concerns about relevance as all study mainly focus on crowdfunding for health research and related medical disease. Findings mainly are from high income settings with relevance in other settings.	Moderate confidence	Moderate level of confidence due to minor concerns about relevance and coherence and moderate concerns about adequacy and methodological limitations
6	 <p>There are concerns regarding the ethics and risks of crowdfunding. Evidence suggests there was a lack of standardised peer review to ensure projects are ethically sound, valuable and of high scientific quality</p>	2, 3, 6, 7, 9	Moderate methodological limitations Severe concerns for one study (6) due to a lack of formal qualitative analysis. Moderate or minor concerns for the other studies due to recruitment strategy ambiguity and limited reflexivity (2, 3, 7, 9)	Minor concerns about coherence	Moderate concerns about adequacy Due to three contributing studies with moderately thick data (2, 3, 7, 9) and one study with thin data (6)	Moderate concerns about relevance due to evidence from limited contexts, with data mainly from high-income settings.	Moderate confidence	Minor concerns regarding coherence. Moderate concerns regarding adequacy, relevance, and methodological limitations.
7	 <p>The risks associated with crowdfunding may be mitigated by involving expert reviewers to assess quality, developing partnerships with Non-Governmental Organisations (NGOs), universities and other institutions and by seeking mentorship from senior researchers</p>	3, 4, 6, 7	Moderate methodological limitations due to limited reflexivity and a lack of formal data analysis in one study (6)	Moderate concerns about coherence due to gaps in the data that could specifically back this finding	Moderate concerns about adequacy three contributing studies with moderately thick data	Moderate concerns about relevance due to data coming only from high-income settings.	Low confidence	Moderate concerns regarding methodology, coherence, adequacy, and relevance.

facilitated crowdfunding for research (Moderate confidence).^{2 29–33 36}

We define public engagement in research as two-way communication between the researcher and the public for mutual benefit. Evidence showed that networking skills and the ability to share a campaign among personal, professional and social media networks were strongly associated with achieving crowdfunding campaign goals. Using multiple communication channels, including social media, blogs, direct contact, email, newspaper, community radio, in-person events and conferences was also recommended. Using simple messages delivered by image or video increased donations: four studies suggested that campaigns with videos were more likely to succeed and were preferred by potential backers.^{31–33 36} They also found that keeping the audience updated through regular communication during and after the campaign led to more pledges and higher odds of success.^{31 32} Four studies found that researchers who partnered with non-governmental organisations, universities or foundations enhanced their public engagement achievements.^{29–31 34}

Crowdfunding expanded bidirectional communication between researchers and the public. This channel between researchers and the public increased the public's trust, awareness, and understanding of science (low confidence).^{2 31–33}

One study found that feedback mechanisms, particularly two-way feedback between the backers and the researcher, significantly increased crowdfunding success.³³ Evidence showed that crowdfunding can also help to bridge the gap between society and science by promoting public understanding of science through accessible resources.^{2 31–33}

Correlates of crowdfunding success

Correlates of funding success included lower funding targets, researcher endorsements, the offer of rewards to backers, and testimonials and input from known NGOs. Projects were also more successful if they were hosted on scientific crowdfunding platforms (Moderate confidence).^{30 32 33}

In addition to public engagement and communication strategies, certain factors were associated with crowdfunding success. One study found that campaigns hosted on specialised scientific crowdfunding platforms were more likely to reach their goals compared with campaigns on general interest crowdfunding platforms.³⁰ Projects that offered rewards (eg, small gifts to backers) had higher odds of achieving their goals.³² The evidence on researcher endorsements is mixed. One study found that researcher endorsements by other professionals increased funding success,³² but another found that research quality signals (highest academic title, scientific awards and the complexity and length of project description) had no effect on funding success.³³ Similarly, endorsements and the sponsorship of platforms by established journals were not correlated with funding success.

In a survey of stated preferences, one study found that researcher reputation is important to backers.²⁹

Students, early career researchers and people using innovative methods were more likely to meet their crowdfunding goals and benefit from the process. (Moderate confidence)^{32–34 36}

Four studies found that students, early career researchers, and people with innovative studies were more likely to meet their campaign goals and benefit from the process.^{32–34 36} Early career researchers were defined as people within ten years of a terminal degree and it was found they had higher rates of achieving financial crowdfunding goals. Although established researchers have larger research networks, crowdfunding engages broader audiences, therefore, traditional markers of quality, such as prior publications and researcher reputation, may not be so important. Three studies found that project risk was not associated with lower odds of success.^{2 32 33} However, one study found that some donors remained risk-averse and that innovative projects were modestly less successful.³⁰

Early-stage, proof-of-concept, pilot research and other smaller scale research projects were more suited to crowdfunding. (Moderate confidence)^{2 30–32 34–36}

Seven studies showed that crowdfunding may be an effective option to rapidly raise funds for research projects.^{2 30–32 34–36} Studies suggested that crowdfunding may be especially useful for pilot, phase one clinical trials, or early-stage proof-of-concept research because campaigns with smaller targets were usually more successful.^{29 35} Crowdfunding could complement or extend an existing research project. Alternatively, crowdfunding could support pilot studies, in sight of later applying to larger funding grants.³⁶ One study on crowdfunding for clinical trials found that 95% of campaigns used a flexible model where researchers kept all the funds raised.³⁵ These flexible models enabled researchers to get started on projects regardless of whether they reached their target, in contrast to all-or-nothing models, making crowdfunding a useful source of 'seed money'. Two studies found crowdfunding is an effective way to support drug development on cancer, rare diseases, neglected tropical diseases and infectious diseases of poverty.^{31 34}

Risks and mitigation strategies

There were concerns regarding the ethics and potential risks of crowdfunding. Evidence suggested there was a lack of standardised peer review to ensure projects are ethically sound, valuable and of high scientific quality. (Moderate confidence)^{2 30 32 33 36}

Five studies found that crowdfunding for scientific research was based on the public's judgement and may thus promote research that is low-value, ethically unsound or not methodologically rigorous.^{2 30 32 33 36} Additional limitations of crowdfunding include the inability to monitor research funding allocation postcampaign and to sanction fraud and falsification.

Table 3 Details of finalist projects for public engagement and crowdfunding in the TDR Global open call and pilot programme

S/N	Country-disease	Project aim	Gender	Public engagement strategies in preparation for campaign launch	Amount asked/ amount raised	Number of backers/ mean donation	Non-monetary support
1	Sri Lanka-Leishmaniasis	To facilitate sand fly vector and leishmaniasis disease control via instructions and improving access	F	Video pitch, students and social media, diaspora citizens, Emails	US\$5650/US\$7244	89 backers/US\$81	Video editing support from university, translation support, communications help from students
2	Thailand-Zika Virus	To neutralise and block Zika transmission from mother to child during pregnancy	M	Video pitch, social media posts, alumni networks, Spanish translation	US\$8000/US\$8180	102 backers/US\$82	Video design and editing support from research institute
3	Nigeria-Urogenital Schistosomiasis	To implement effective strategies to reduce the urogenital schistosomiasis disease in dam-site communities	M	Video pitch, radio announcement, local presentations, community leaders, citizens in diaspora, clean water foundations	US\$9485/US\$11122	100 backers/US\$111.2	Communications support from the university and technical support from public sector groups
4	Guatemala-Cutaneous leishmaniasis	To reduce time for diagnosis and treatment of cutaneous leishmaniasis using a community operated mobile clinic with an artificial intelligence system	F	Video pitch, personal stories, promotion with students, social media posts			Preparing for crowdfunding campaign*
5	Mozambique-Tuberculosis	Towards tuberculosis elimination through shorter preventive therapy, employing community health workers to increase patient access and treatment uptake	M	Video pitch and social media posts			Preparing for crowdfunding campaign*

*Not launched a crowdfunding campaign yet.

The risks associated with crowdfunding may be mitigated by involving expert reviewers to assess quality, developing partnerships with NGOs, universities, and other institutions, and seeking mentorship from senior researchers. (low confidence)^{2 32 34 36}

Two studies found an internal peer review system could be a solution to promoting high-quality research related to crowdfunding.^{32 36} Some platforms required approval from ethical committees prior to launching their campaign, but these requirements varied.³² Seeking mentorship and partnering with NGOs specialised in marketing and fundraising helped researchers.³⁴ They could facilitate efficient research administration and facilitate payment collection.

Pilot programme

The open call received 121 unique submissions from researchers based in 37 LMICs. The judging process was conducted in three phases. In the first phase, all 121

entries were screened for eligibility using predefined criteria, including a clear description of the scientific question and hypothesis, significance of the project and relevance to the public. Submissions were not screened based on their location or research project topic. This initial screening yielded 66 eligible entries. All eligible entries were then reviewed by judges and assigned scores. Entries that achieved a mean score of 7 and above out of 10 and were recognised as finalists. With resources available, the pilot programme was initially designed to support only three finalists' submission in their campaign launch but after screening and judging following a high number of high quality entries, five finalist submissions were selected to receive support. The five finalists were from Guatemala, Mozambique, Nigeria, Sri Lanka and Thailand (table 3). All described social innovations in health and focused on infectious diseases of poverty.

Box 1 Practical recommendations for implementing crowdfunding for research*

1. Public engagement is an important component for conducting a successful crowdfunding for research campaign.
2. Bidirectional communication may increase the number of crowdfunding donations and enhance the public's trust and understanding of science.
3. Young scholars and early-career researchers may consider crowdfunding for their research.
4. Smaller crowdfunded grants can top up existing research funding or fund early-stage research that can then be used to apply to public research grants.
5. Partnerships with experts can provide some feedback and improve the rigour of research prior to launching a crowdfunding campaign.
6. Seeking formal organisational approvals and ethical committee reviews can increase the likelihood of success.
7. To increase donations, campaigns should include quality signals, such as endorsements and testimonials, offer rewards, partner with known NGOs and aim for a realistic funding target.

*A practical guide was developed alongside this review. Researchers interested in strategies and tools to optimise their crowdfunding campaigns can access this guide. <https://crowdfundinghealth.org/>.

All five finalists used the tools of public engagement to develop campaign videos for their research project and benefitted from substantial non-monetary support (table 3). In-kind contributions included assistance with developing and editing short videos from their universities, student support on social media, and scientific mentorship from TDR Global members. Among the five finalists, three had launched their crowdfunding campaigns as at the time of writing this report. Two finalists had faced some delays due to administrative challenges and personal circumstances compounded by the COVID-19-related closures. All three that launched employed intensive public engagement strategies and used existing networks to drive and publicise their campaign. At the end of the campaign promotions, they all exceeded their original financial crowdfunding goals (table 3).

The pilot programme identified some practical recommendations for implementing a crowdfunding campaign (box 1). It also identified potential risks and risk mitigation strategies (online supplemental appendix VI). Potential risks of crowdfunding included fraud and deception, misinformation, unfair allocation of funds and lack of public interest in the project. Strategies to mitigate these risks included obtaining ethical approvals and support from local experts, clear communication throughout the campaign, sharing project results using open-access tools, transparent engagement through videos and personal stories, and partnerships with universities or community-based organisations.

DISCUSSION

This paper expands the literature by summarising the qualitative evidence available on crowdfunding for health

research and by assessing its feasibility in LMIC settings. Most of the evidence collected in our review has come from HIC settings.^{35 37–39} The pilot programme complements this by demonstrating that LMIC researchers can benefit from the monetary and non-monetary support that crowdfunding provides. Crowdfunding could also be a powerful tool to decentralise and democratise research funding in resource-constrained settings.

Both the systematic review and pilot programme highlight that public engagement is essential for crowdfunding. Previous studies have shown that public engagement generates interest, which in turn leads to backers offering to help with projects and providing feedback.⁴⁰ Public engagement skills may help to translate scientific concepts into more easily understood messages.⁴⁰ Active engagement with the public during the campaign across a wide range of mediums (lab notes, email updates, online webinars) can increase fundraising success.³² Although all three pilot programme finalists who launched their campaign had limited social media experience, they were successful in developing effective digital engagement strategies. These three finalists used videos as part of their campaigns—this may have enhanced the public's trust in their projects, thus contributing to their crowdfunding success, consistent with evidence on the importance of videos in science communication.⁴¹ The finalists received training on storytelling, and they found that using personal stories from affected community members made their video pitches more meaningful and inclusive. This is consistent with fundraising literature demonstrating that personal stories can be a useful tool to seek funding from donors for non-profit causes.^{42 43}

Our systematic review shows that early-stage investigators and research studies with innovative methods were likely to reach crowdfunding goals. The public may place less emphasis on previous research experience compared with other research grant funding application processes.^{30 33} Therefore, campaigns with a broad engaged audience and efficient public engagement strategies alone can be successful in funding innovative research. In addition, we found that crowdfunding is useful for early-stage research and can then be used as preliminary data for larger grants.

Our pilot programme data demonstrate that crowdfunding is feasible in diverse LMIC settings. Evidence suggests there are barriers to seeking traditional research funding for many LMIC researchers, including fewer institutional research resources, less experience with research grants and racism in science.^{44 45} One previously mentioned example is authorship and the fact that LMIC researchers who have worked in international partnerships are less likely to be first or corresponding authors.⁴⁶ This likely disadvantages LMIC researchers when applying for grants as authorship in publications is often a marker of researcher reputation and signals productivity.⁴⁷ Crowdfunding may be a useful tool for LMIC researchers to directly obtain support for research with less reliance on external

donors or HIC researchers. It can also be argued that because crowdfunded research is often more grassroots and community based, it may be more ethical and have a more enduring positive impact.⁴⁸

Our data from the pilot programme identified strategies to mitigate ethical issues associated with crowdfunding. We found mentorship from local experts could alleviate some of the concerns raised about the limited peer review of crowdfunded health research projects. During the pilot, our TDR Global team was involved in building local partnerships and mentorship opportunities to mitigate this risk. Additional risk mitigation strategies include obtaining ethical committee review approval prior to launch, ensuring transparency throughout the campaign, and the use of open-access tools to disseminate findings. Finalists were also encouraged to build south–south partnerships and seek support from colleagues who were not part of the research team. This finding is consistent with other literature showing that south–south collaboration can improve research quality.⁴⁹

Our study has several limitations. First, we identified only few studies with qualitative data for inclusion, however, further qualitative research looking at crowdfunding metrics would greatly enrich the literature on this topic. Second, the studies identified from the qualitative evidence synthesis were disproportionately from HICs and only included articles in the English language. There were however data from some LMICs and the pilot programme did provide detailed complementary information on the feasibility of crowdfunding in LMIC settings. Finally, previous studies have shown that charitable crowdfunding is greatly influenced by social capital, and that this can increase inequities.⁵⁰ However, social capital can be built through effective public engagement before and during campaign launch.⁵¹ In addition, crowdfunding for health research benefits a wider community of people and may not be subject to the same dynamics as charitable crowdfunding for individuals (ie, medical bills) and private projects. Further research is needed to assess this particular phenomenon as crowdfunding for health research expands.

This research has implications for research and policy. Our pilot demonstrates that crowdfunding is feasible to support infectious disease research in LMICs. Public engagement can build horizontal local partnerships, contributing to empowering local funding sources for global health research. From a policy perspective, crowdfunding has not been widely used to support research studies and few platforms focus on scientific and health research, with even fewer crowdfunding platforms based in LMICs as opposed to HICs. In addition, because previous research suggests that charitable crowdfunding may exacerbate social inequalities, more research is needed to analyse this phenomenon in the setting of crowdfunding for scientific research. Global health institutions and

universities should help LMIC researchers to consider crowdfunding their research.^{2 34} Our WHO-TDR practical guide provides additional guidance¹ and helps to expand the uptake of crowdfunding for research. While our initial pilot was organised and supported by TDR Global, further institutional support will be essential for building capacity related to public engagement and crowdfunding.

Our data demonstrate that crowdfunding is an alternative option to support research in LMIC settings and it may be particularly well-suited to early-stage work led by early-career researchers. Crowdfunding could be a useful incremental step to decentralise research funding and reorient some of the core underlying principles that underpin global health funding. However, there is a need to build on this finding by testing the approach in multi-site studies and exploring strategies to mitigate some of the risks to build trust and confidence.

Author affiliations

¹Department of Clinical Research, London School of Hygiene and Tropical Medicine, London, UK

²Department of Global Health, University of Washington, Seattle, Washington State, USA

³Department of Nutrition, Gillings School of Global Public Health, University of North Carolina System, Chapel Hill, North Carolina, USA

⁴National Science and Technology Development Agency, Khlong Luang, Thailand

⁵Department of Bioprocess Technology, Rajarata University of Sri Lanka, Mihintale, Sri Lanka

⁶Department of Biology, Kano University of Science and Technology, Wudil, Kano State, Nigeria

⁷Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London, UK

⁸Department of Clinical Laboratory, Hospital Escuela; Faculty of Medical Sciences, Universidad Nacional Autónoma de Honduras, Tegucigalpa, Honduras

⁹Instituto de Enfermedades Infecciosas Parasitología Antonio Vidal, Tegucigalpa, Honduras

¹⁰Centre for Health Equity, University of Melbourne School of Population and Global Health, Melbourne, Victoria, Australia

¹¹Because Stories, Johannesburg, South Africa

¹²Department of Medicine, University of the Philippines Manila School of Health Sciences, Palo, Philippines

¹³Special Programme for Research & Training in Tropical Diseases (TDR), World Health Organization, Geneva, Switzerland

¹⁴School of Public Health, Southern Medical University, Guangzhou, China

¹⁵Institute for Global Health and Infectious Diseases, School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

Twitter Eneyi Edith Kpokiri @ekpoks, Teerawat Wawatpanit @Twiwatpanit594, Mahmud Ali Umar @bnaigarko, Beatrice Halpaap @BeatriceHalpaap and Joseph D Tucker @JosephTucker

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ORCID iDs

Eneyi Edith Kpokiri <http://orcid.org/0000-0003-1180-1439>

Mahmud Ali Umar <http://orcid.org/0000-0001-9215-0222>

Debra Jackson <http://orcid.org/0000-0003-3307-632X>

Jackeline Alger <http://orcid.org/0000-0001-9244-0668>

Meghan A Bohren <http://orcid.org/0000-0002-4179-4682>

Joseph D Tucker <http://orcid.org/0000-0003-2804-1181>

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