How to Use this Document

The purpose of this document is to provide practical advice on designing, implementing, and evaluating innovation challenge contests for health. The introduction provides a brief outline, then each stage of challenge contest is described in detail. We also include a checklist, by stage of contest, for organizing contests.

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Executive Summary

Under specific conditions, a group of diverse individuals can solve problems that individuals alone are unable to solve. Innovation challenge contests have an open call to solicit new ideas, images, or strategies from the public. Many challenge contests have focused on improving health, but there is little guidance for organizing health contests. The purpose of this good practice document is to provide practical advice on designing, implementing, and evaluating challenge contests for health. In designing this document, we organized a global challenge contest to solicit descriptions of contests for health. Independent judges evaluated each contest on pre-specified criteria. Overall, we received descriptions of 70 challenge contests. Twenty (29%) descriptions received a mean score of 7/10 or greater and received a commendation. This document provides detailed information about the “how” of challenge contests for program managers, researchers, and policy-makers. We describe challenge contests for health, examine each stage, consider evaluation methods, and suggest what is needed to organize a challenge contest for health.
The value of challenges in health and health research

Expert-driven approaches have not been successful in decreasing HIV incidence among young girls and women in sub-Saharan Africa. Confronting this problem, the DREAMS Challenge issued an open call for novel ideas to prevent HIV among young girls and adolescents in sub-Saharan Africa.¹ The contest captured over 500 ideas and 55 were selected for further support and implementation. Most of the implemented ideas were from community-based organizations. This illustrates crowdsourcing which allows a group to solve a problem; solutions are then shared with the public.² By tapping into the vast wealth of public creativity, crowdsourcing shifts traditionally individual tasks to large groups through challenge contests, hackathons, and other methods.³ This document focuses on health challenge contests in which the public responds to an open call for suggestions. The organization of such contests involves six stages: organizing a steering committee, soliciting entries, promoting the contest, judging entries, recognizing excellent entries, and sharing entries.

Challenge contests are increasingly used to improve public health. Contests have been used to develop more locally-responsive sexual health messages and create participatory services for accelerating emergency responses.³ A systematic review of crowdsourcing contests identified two overarching categories: a) process-oriented contests focused on community mobilization and mass engagement in a health topic; and b) outcome-oriented contests focused on creating high-quality outputs.⁴ Challenge contests may help to generate more creative and locally tailored health services. Furthermore, by including the public at multiple stages (for instance, on steering committees, judging panels, and as contributors), challenge contests provide an opportunity for
increasing health equity and community engagement. Finally, a small but growing literature demonstrates the effectiveness of challenge contests to improve health.\textsuperscript{4}

However, there have been few resources describing the methodology of challenge contests for health. Methods are important because this field is relatively new and there have been many divergent approaches to organizing contests. This methods and good practice document provides a guide for organizers considering crowdsourcing contests to improve health.

**Developing this document using a challenge contest**

Challenge contests draw on the wisdom of local communities. Recognizing the value of community insights in challenge contests, we issued an open call for individuals and groups to submit descriptions of challenge contests for health. A multi-sectoral steering group distributed the call for entries using email, social media, and in-person events. Individuals who organized or evaluated contests provided a brief (500 word) description. A total of 70 entries were received in response to the call. Each entry was evaluated independently by two individuals for eligibility, and then all eligible entries were evaluated by members of a judging committee. Each entry was scored from 1-10 based on the following criteria: description of the challenge contest, public health effectiveness or impact, capacity to promote equity and inclusiveness, and potential for learning. A brief description of commended entries is within Table 1 and exceptional case studies are embedded within boxes (Box 1, Box 2).
The following sections are organized around five central questions: (1) Why use challenge contests for health? (2) How are challenge contests for health conducted? (3) What are risks associated with challenge contests? (4) How are challenge contests evaluated? (5) What is needed to organize a challenge contest?

1. Why use challenge contests for health?

Challenge contests used to improve health have many advantages, including leveraging networks, sharing data, and expanding community engagement (Figure 1). Additionally, challenge contests often save money compared to conventional public health approaches. Biologists at the University of Washington hosted an open contest to map the structure of an HIV protein that had troubled experts for over a decade and had cost millions in scientific research grants. In just 10 days, gamers were able to successfully decipher the structure of the retroviral protease. Similarly, two randomized controlled trials in China demonstrated that a crowdsourcing approach cost substantially less than a social marketing approach for developing sexual health messaging. Crowdsourcing can also be effective at leveraging networks. In the field of brain imaging, which is notorious for its costliness and the limited data-sharing within the field, over 100 researchers collaborated and pooled data for the first time; in doing so, they identified genes responsible for brain size and memory. These entries helped Enigma, the largest collaboration of brain researchers around the world, receive $32 million in funding from the National Institutes of Health. Finally, challenge contests have the potential to bring together otherwise disparate communities, actively engaging key sectors of the population who may not always be heard. For example, to inform global HIV policy, UNAIDS used challenges through social media platforms to solicit opinions from youth around the world. This youth feedback
ultimately shaped global HIV policy. In addition, youth were empowered and more engaged in the process of policy development.11

2. How are challenge contests for health conducted?

Conducting a successful crowdsourcing contest can be broken down into a six-stage process (Figure 2): 1) assessing the appropriateness of a challenge contest, 2) organizing a community steering committee, 3) engaging the community to contribute, 4) receiving and evaluating entries, 5) recognizing finalists, and 6) sharing solutions and implementing ideas. A checklist of essential elements at each stage are provided in Supplementary Data 1.

a. Assessing appropriateness of challenge contests

Considering whether a challenge contest is an appropriate method for solving a task is an important first step. James Surowiecki suggested that four elements are needed for crowds to be wise: diversity of opinions (each participant bases his or her opinion on private information); independence of ideas (opinions are formed separately from others); decentralization of information (specialists are from a variety of fields); a mechanism exists for aggregating private judgments into a collective decision.3 Settings in which each of these four elements are present would be more appropriate for a challenge contest. In addition, questions about feasibility and purpose should be considered. For example, what is the objective – a small ask (such as a logo or simple design) or a large one (such as a new technology)? Who is the target crowd? Whose voices need to be heard? Challenge contests may be particularly useful in settings where social
or behavioral health elements are important. Our global contest suggests greater experience with challenge contests related to hepatitis and HIV (Table 1).

b. Organizing a community steering committee

Once the suitability of a challenge contest has been established, a steering committee should be organized. This committee, which would provide leadership and guidance, could include local community members, health professionals, community-based organization (CBO) leaders, or private sector leaders. Importantly, committee members should not all be from the same field or contribute a similar knowledge base. Furthermore, including individuals with direct, personal experience with the problem (such as patients or at-risk groups) on the steering committee is essential. An individual with experience organizing contests can facilitate the planning process.

The steering committee will establish contest rules and create a call for entries. Examples of call for entries from selected crowdsourcing contests are included as Supplementary Data 2. The steering committee decides the contest rules, including the overall purpose and criteria for evaluating entries. Contest rules should delineate entry requirements, such as word limits or video file size limits. However, the steering committee should be careful not to give examples of successful entries or topic ideas, as doing so often undermines the creativity of submissions and results in entries that are similar to the example provided. Selecting an appropriate prize structure is important for spurring participation. Commendations and mentorship opportunities are often more valued than cash prizes (Figure 4). Along with listing the contest rules, the steering committee should also produce a detailed call for entries that clearly describes the selection
criteria and the contest timeline. A brief (2-3 minute) video can be useful for clarifying the rules and expectations of the contest.

c. Engaging the community to contribute

Most people are unfamiliar with challenge contests and will need a clear description of the purpose, expectations, and rules. Promoting the contest through engagement is critical to clarifying these aspects and mobilizing communities. The process of community engagement typically involves the development of a social media announcement and in-person activities. In-person activities – such as didactics at local universities or feedback sessions for individuals developing entries – are essential for many challenge contests, and particularly for process-oriented contests.

In-person events build trust in the contest, clarify the format, and encourage individuals to submit.

d. Receiving and evaluating entries

After the submission deadline has passed, entries will be evaluated. For contests with mass engagement (e.g., greater than 200 entries), the judging process can be conducted in three phases: eligibility screening, crowd judging, and panel judging (Figure 3). In phase 1, at least two independent judges examine all entries and assess for eligibility. These judges evaluate each entry based on pre-specified criteria. In phase 2, the crowd judging phase, a group of laypeople evaluates each entry. This could be limited to individuals with the disease or another key stakeholder group present in large numbers. Crowd judges should be diverse; empirical experience suggests that self-exclusion of individuals with conflicts of interest is feasible.
Finally, in phase 3, a panel of experts and non-experts individually judges each remaining entry. This panel can consist of the community steering community in addition to additional key stakeholders. Each entry should be evaluated independently by at least two, and preferably three, judges. While this framework is preferred for a rigorous evaluation process, if fewer than 200 entries are received, a two-phase process consisting of eligibility screening and panel judging may suffice.

e. Recognizing finalists

Once entries have been ranked based on the panel judge scores, a qualitative summary consisting of feedback and comments of the finalists should be collated and presented to the larger steering committee. Ultimately, the steering committee will make the final selections, notifying each participant about the decision regarding their submission and making a public announcement of the selected submissions. Social media networks and other networks can celebrate finalists. To encourage future participation, terms such as “winner” and “losers” should be avoided. Delayed announcements should also be avoided.

f. Sharing solutions and implementing ideas

Often overlooked after the official contest has ended, sharing solutions with local or national agencies and implementing exceptional ideas within communities is vital. Finalist submissions should be archived online and entries should be distributed through networks as widely as possible. Best practices and key takeaways can be presented at academic conferences, forums, and other public platforms. Some contests are designed to directly inform health guidelines. For
example, a hepatitis testing innovation contest solicited descriptions of case studies that were then included as best practice cases in the 2017 World Health Organization Hepatitis Testing Guidelines. For other contests, the goals can include actionable plans to be locally implemented.

3. What are risks associated with challenge contests?

Although the potential advantages of contests are many, there are also risks associated with challenge contests, and pitfalls can occur at any of the six stages. For example, avoid only using a single platform for distribution, limiting the contest to a specific group of people, restricting the submission period for entries to a short time period, or having a call for entries around a holiday. Examples of notable failures of challenge contests at different stages of a contest are provided in Figure 5. From failing to organize a steering community to poor implementation of a great idea, there are numerous reasons why crowdsourcing contests could fail to reach their goals. The following section describes how four crowdsourcing health contests failed and presents potential risk mitigation strategies.

In the Durex Condom Contest, Durex organized a contest where couples could obtain emergency contraception in a rush delivery service. In a Facebook campaign called “SOS Condoms,” users voted on the city in which they would like the service to be made available. Internet pranksters chose Batman, the capital of a conservative Muslim province in southeast Turkey, over cities such as Singapore, Paris, and London. Contest organizers could have mitigated the risk of this
online contest by forming a steering committee responsible for screening cities and making final decisions.

In 2012, a ban on circumcision in Germany angered Jewish and Muslim communities, as well as the German Medical Association, the nation’s primary medical association. A political group organized a contest to solicit opinions on this topic within a large region. Failure to engage communities in Germany led to the blistering criticism that came with this decision.

In 2016, an online contest to name a British polar research vessel in honor of David Attenborough, the British public overwhelmingly suggested Boaty McBoatface. One year later, in November 2017, a Sydney ferry was named Ferry McFerryface after local officials hosted a public contest to determine naming. In both instances, failure to develop an appropriate judging framework led to the dilemma of choosing between embarrassment and adherence to stipulated rules.

Finally, Google Flu Trends is a case in which vulnerability to overfitting to seasonal terms unrelated to the flu led to an ill-performing algorithm. Ultimately, low accuracy and poor predictive ability resulted in Google shutting down the project. Greater transparency and collaboration between public and private institutions may have resulted in better models. Currently, such models are being explored by the US Centers for Disease Control in its annual “Predict the Influenza Season Challenge,” a public contest that encourages researchers from
around the world to predict timing, peak, and intensity of a flu season using social media and routine surveillance systems data.\textsuperscript{19}

4. **In what settings should we use challenge contests?**

Challenge contests can be used in several different settings, including strategic policy planning, formative research, community engagement, and intervention development. Policy-makers can use challenge contests to solicit diverse community opinions about potential future local, regional, or national health policies.\textsuperscript{20} Contests have identified case studies of successful programs that merit greater resources and scale-up.\textsuperscript{15} From a research perspective, challenge contests can be used as formative work to better understand social and behavioral contexts related to health.\textsuperscript{13} Contests have also been used to enhance community engagement related to ongoing or planned clinical trials.\textsuperscript{21} Finally, challenge contests can create components of a public health intervention, including logos, images, and strategies.\textsuperscript{8,22}

5. **How are challenge contests evaluated?**

Several methods exist for evaluating challenge contests. Randomized controlled trials (RCTs) are the gold standard for evaluating the effectiveness of a contest. Several RCTs have evaluated the effectiveness of challenge contests, including in condom use promotion, HIV testing, and out-of-hospital cardiopulmonary resuscitation.\textsuperscript{8,16,22,23} However, RCTs generally require a substantial amount of time and resources. Qualitative research methodologies have the advantage of greater adaptability and responsiveness to local contexts and may incorporate structured interviews to obtain greater detail from participants.\textsuperscript{13} Additionally, social media analyses may complement
qualitative methods and are particularly suitable when contests are conducted online and data can be obtained from social media platforms.\textsuperscript{21}

Measuring the extent of community engagement may also be important for challenge contests, as it may produce data on the distribution and views of the contest announcement. In addition, the socio-demographic, geographic, and gender diversity of participants can be examined.

6. What is needed to organize a challenge contest?

Contests can be organized with minimal resources in many settings. Our challenge contest experience and other evidence suggests that the following components are needed – human personnel, diverse networks, and champions of the cause. First, a contest coordinator can help to achieve the administrative and logistical needs of the contest. While many companies provide similar services online, hiring a company is not essential for organizing a contest. We recommend involving a part-time communications staff or event organizer who is already familiar with the cause of the challenge. Second, diverse networks are important for creating a strong steering committee, widely distributing the call for entries, and sharing solutions. This includes health-focused individuals in the public sector, but also a wider range of fields (education, communications, computer science) and sectors (community-based organizations, government, private sector). Third, including champions of the cause is important. Champions are individuals who deeply believe in the cause. Champions can nurture trust in the contest and serve as core members of the steering committee.
Conclusion

Challenge contests are simple, inclusive, and inexpensive ways to solicit community feedback on health. This document should not be used as a rigid guidebook, but rather as a set of principles to inspire further contests. Supplemental Data 3 provides an annotated bibliography of references related to challenge contests for health. Only through iterative implementation will the science and practice of crowdsourcing for health improve.

Acknowledgements

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Box 1. HepTestContest: An Innovation Contest to Solicit Descriptions of Hepatitis B and C Testing

Social Entrepreneurship for Sexual Health (SESH) is a partnership between the University of North Carolina – Project China and the Southern Medical University Dermatology Hospital in Guangzhou, China that designs more creative, equitable, and effective health services through crowdsourcing contests. The purpose of the HepTest Contest was to identify descriptions of hepatitis B and C approaches to support local programs and inform the WHO 2017 Hepatitis Testing Guidelines. The contest was organized in partnership with the WHO, hepatitis community-based organizations, public health authorities, communications experts, and implementers. The call for entries was distributed in all six languages of the WHO.

The contest received 64 entries from 27 countries. A total of 16 (25%) submissions were deemed of sufficient quality to be included directly in the WHO 2017 Hepatitis Testing Guidelines. Five contest participants were invited and supported to present their cases at international conferences on liver disease. The entries covered testing in different populations, including primary care patients (n = 5), people who inject drugs (PWID) (n = 4), pregnant women (n = 4), general populations (n = 4), high-risk groups (n = 3), relatives of people living with hepatitis B and C (n = 2), migrants (n = 2), incarcerated individuals (n = 2), workers (n = 2), and emergency department patients (n = 2). A variety of different testing delivery approaches were employed, including integrated HIV-hepatitis testing (n = 12); integrated testing with harm reduction and addiction services (n = 9); use of electronic medical records to support targeted testing (n = 8); decentralization (n = 8); and task shifting (n = 7).

The contest promoted equity through a diverse steering committee, extensive promotion, simplified submission requirements, and standardized judging. People living with hepatitis were included on the steering committee and throughout each stage of the contest. Promotion efforts were coordinated through the steering committee in order to ensure broad geographic participation. Social media metrics from the contest website provided real-time feedback to the steering committee on participation. Finally, we distributed a scoring rubric to judges and had each submission evaluated by all judges. This innovation contest provided a wide range of lessons about designing, implementing, and evaluating contests. In terms of design, the contest was implemented over a four-month period with limited resources. This suggests the broad applicability of the contest design. From an implementation perspective, the use of social media analytics helped to focus promotion through networks in regions with fewer website viewers. From an evaluation perspective, the standard deviation around mean submission scores was low, suggesting that panel judging is effective. Finally, this contest demonstrates that global contests to solicit case studies may be useful to inform the development of global guidelines.

Box 2. CAMTech: Consortium of Affordable Medical Technologies

CAMTech is a global network of academic, clinical, corporate, government and non-profit partners that use hackathons and related activities to drive health innovation. A hackathon is a two-day event that brings together engineers, clinicians, entrepreneurs, and end-users to develop disruptive health innovations. Over five years, CAMTech has organized 17 hackathons and convened a global network of 4,377 innovators, 831 innovations, and 659 mentors. An analysis of the first 12 hackathons found that hackathon ideas resulted in 22 patents and 15 companies. Approximately 30% of teams that met at hackathons continued to work on other health challenges afterwards, building local capacity.

CAMTech-X was launched as an innovation contest consisting of three stages: five simultaneous hackathons, a 100-day post-hackathon Demo Day, and acceleration support for the winning team. The CAMTech-X hackathon served as an open-innovation platform to co-create innovations over 48-hours. Over 500 engineers, clinicians, entrepreneurs, designers and public health innovators convened to respond to one of the most pressing public health challenges in India: improving healthcare access for the urban poor. Exceptional teams, representing the best innovations from each of the five sites, received mentorship through the CAMTech network and an opportunity to present innovations at the CAMTech-X Demo Day. Teams that were not selected were still eligible to apply to participate in Demo Day through a 100-day post-hackathon contest. Teams were given an incentive of having excellent ideas being presented to partners and investors on Demo Day. Ultimately, CAMTech awarded a cash prize and six months of acceleration support through the CAMTech Accelerator Program to RespirAid, a low-cost mechanical ventilation assistance device. The accelerator program provides teams with coaching, project management services to assist in product development and commercialization efforts, marketing and publicity. With the support of CAMTech activities, RespirAid has conducted feasibility studies, raised further funds, and launched a company.

Challenge contests like CAMTech-X, along with funding and acceleration support, yield innovations designed for commercialization and impact. CAMTech has held challenges in Uganda, India, and other locations.

<table>
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<tr>
<th>Study Title</th>
<th>Year</th>
<th>Disease</th>
<th>Entry</th>
<th>Geographic Region</th>
<th>Purpose</th>
<th>Associated Publications</th>
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<td>HIV Testing among MSM in Yantai</td>
<td>2016</td>
<td>HIV</td>
<td>Short messages</td>
<td>China</td>
<td>Increase HIV testing in a Chinese city through collaboration between the local CDC, CBO, university and MSM populations.</td>
<td>Trials: <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5625620/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5625620/</a></td>
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<td>HIV Testing among MSM in Qingdao</td>
<td>2017</td>
<td>HIV</td>
<td>China</td>
<td>Improve HIV testing services in local CBOs, as well as better the training of youth volunteers and VCT.</td>
<td>Trials: <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5625620/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5625620/</a></td>
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<tr>
<td>HIV Testing among MSM in Shenzhen</td>
<td>2017</td>
<td>HIV</td>
<td>China</td>
<td>Increase HIV testing through widespread dissemination of entries through social media and in-person events.</td>
<td>Trials: <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5625620/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5625620/</a></td>
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<td>Guangzhou HIV Testing Contest</td>
<td>2016</td>
<td>HIV</td>
<td>China</td>
<td>Encourage sharing of HIV testing stories among MSM in the local community, as well as encourage other MSM peers to test.</td>
<td>Trials: <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5625620/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5625620/</a></td>
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<td>A Day with HIV</td>
<td>2010-Present</td>
<td>HIV</td>
<td>United States</td>
<td>Collect photos about HIV on the autumnal equinox for an anti-stigma campaign about HIV.</td>
<td>Website: <a href="http://www.adaywithiv.com">www.adaywithiv.com</a></td>
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<td>HIV Cure Crowdsourcing Contest in China</td>
<td>2016-2017</td>
<td>HIV</td>
<td>China</td>
<td>Collect and share stories or pictures from key populations (MSM, PLHIV, PWID) and local residents on what an HIV cure would mean in their lives.</td>
<td>AIDS Res Hum Retroviruses: <a href="https://www.ncbi.nlm.nih.gov/m/pubmed/28891318/">https://www.ncbi.nlm.nih.gov/m/pubmed/28891318/</a></td>
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<td>IAS Logo Contest for conference in Melbourne, Australia</td>
<td>2014</td>
<td>HIV</td>
<td>Logos</td>
<td>Global</td>
<td>Solicit logo designs, allowing people most affected by HIV to play a prominent role in designing a logo for the largest HIV conference in the world.</td>
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<td>Videos to promote HIV testing in China</td>
<td>2013</td>
<td>HIV</td>
<td>1-minute videos</td>
<td>China</td>
<td>Promote HIV testing in China through 1-minute video submissions by CBOs in China. Crowdsourced videos were cost-effective compared to a health marketing video developed by the Guangzhou CDC.</td>
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<td>SIHI – Makerere University Health Solutions Contest</td>
<td>2017</td>
<td>Maternal and child health</td>
<td>Solutions: descriptions of programs</td>
<td>Uganda</td>
<td>Solicit five solutions in Uganda to improve maternal and child health.</td>
<td><a href="https://socialinnovationinhealth.org/partners/makerere-university/">Website: https://socialinnovationinhealth.org/partners/makerere-university/</a></td>
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<td>CAMTech</td>
<td>2017</td>
<td>All</td>
<td>Device, Pitch</td>
<td>Massachusetts General Hospital, India, Uganda</td>
<td>Identify clinical challenges through summits, source promising innovations through hackathons, and develop technologies through its accelerator.</td>
<td>PNAS: <a href="www.pnas.org/content/108/47/18949.abstract">www.pnas.org/content/108/47/18949.abstract</a> Bioinformatics: <a href="https://academic.oup.com/bioinformatics/article/33/17/2765/3803439">https://academic.oup.com/bioinformatics/article/33/17/2765/3803439</a></td>
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<td>Data analysis, prediction, manuscript editing</td>
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<td>Evaluate model predictions and pathway inference algorithms in systems biology and medicine.</td>
<td>Global Health Informatics: Principles of EHealth and MHealth to Improve Quality of Care: <a href="https://mitpress.mit.edu/books/global-health-informatics">https://mitpress.mit.edu/books/global-health-informatics</a> Publications in Nat Methods, JAMA Oncology, and Science in 2017; For a full list: <a href="Dreamchallenges.org/publications/">Dreamchallenges.org/publications/</a></td>
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*Inclusion in this table required an average judge score of 7 or higher (out of a maximum of 10)*
Figure 1. Advantages of Challenge Contests to Improve Health
Figure 2. Stages of a challenge contest.

Figure 3. Phases of the judging process.
Figure 4. Examples of prizes for entries

1: Failure to organize steering committee
Durex Condom Contest – In a Facebook campaign, the city of Batman in Turkey won rush delivery for emergency contraception over cities like Singapore and Paris.

2: Failure to engage community
German contest – The government sought public input on banning circumcision.

3: Poor judging
Boaty McBoatface – The public voted to rename a $300M British research ship an absurd name.

4: Poor implementation
Google Flu Trends – Algorithm did not perform well and was not transparent.

Figure 5. Risks associated with challenge contests.
Supplementary Data 1. Checklist of challenges for health.

The following elements are not meant to be exhaustive, but should be considered when organizing crowdsourcing contests for health.

1. **Assessing appropriateness of challenge contests**
   - Organizers have identified a rationale for using a crowdsourcing challenge, either because of problems that have social/behavioral origins or a need for strong community engagement.
   - Organizers have identified a problem that can draw on crowd wisdom: the idea can solicit a diversity of responses (each participant bases his or her opinion on private information); independence of ideas (opinions are formed separately from others); decentralization of information (specialists are from a variety of fields); a mechanism exists for aggregating private judgments into a collective decision.

2. **Organizing a community steering committee**
   - Organizers form a community steering committee composed of local community members, health professionals, community-based organization (CBO) leaders, or private sector leaders.
   - The steering committee has a clear challenge purpose and well-defined criteria for evaluating entries, both of which are articulated in the call for entries.
   - The steering committee creates a prize structure to recognize exceptional entries.
   - Organizers avoid providing examples as much as possible to spur creativity.

3. **Engaging the community to contribute**
   - The steering committee organize appropriate in-person activities to promote and clarify the challenge contest (e.g., classroom didactics at schools, feedback sessions in public spaces, or community-driven activities decided by community leaders).
   - The steering committee organize appropriate online activities to promote and clarify the challenge contest (e.g., short videos, live discussions, and banner advertisements).

4. **Receiving and evaluating entries**
   - Identify sufficient judges to evaluate entries for eligibility (phase 1) and content (phase 2), allowing each entry to be evaluated by three independent individuals.
   - A set of judges (potentially some steering committee members) evaluate the eligibility of all entries based on entry requirements (e.g., focused on the topic, appropriate format, etc.).
   - Either the crowd (when larger numbers of entries) or a panel of judges (when fewer entries) evaluate eligible entries on the pre—specified criteria.

5. **Recognizing finalists**
   - Judges provide feedback and the steering committee provide commendations to a subset of individuals who submitted exceptional entries (often those scoring 7/10 or better on a scale from 1-10).
• Encourage online and in-person recognition of finalists at professional conferences, awareness days (e.g., World AIDS Day), and special events

6. Sharing solutions and implementing ideas
   • The steering committee disseminate the ideas and/or evaluate the ideas
   • The public, including and beyond those who participated in the contest, receive some benefit
CONTESTS FOR HEALTH

This article provides two case examples in using crowdsourcing contests for health and then implementation advice.

This systematic review examines innovation design contests to improve public health.

Crowdsourcing innovation: Changing the world one idea at a time. Rob Wilmot. TEDxKrakow. 6 August, 2015.
This 10-minute TED talk discusses crowdsourcing generally and in a medicine context.

GENERAL CONTESTS

This overview provides a range of practical advice on how to structure challenge contest prizes, incentivize participation, and achieve social impact.

This helpful review examines challenge contests to achieve social goals, including but not limited to health.

This US government website provides tips for organizing public sector prizes, hackathons, crowdsourcing activities, and related events.

This primer examines the wisdom of crowds in a wide variety of contexts. A classic introduction to the general field, with a business focus.
Supplemental Data 3. Frequently asked questions about challenge contests.

1. Why use challenge contests for health?
   By drawing on the wisdom of community input, challenge contests promote the development of creative and innovative solutions to improve public health. These simple, inclusive contests are effective in leveraging networks, sharing data, and engaging communities in order to solicit community feedback on health.

2. What are the necessary elements needed to organize a challenge contest?
   Past challenge contests suggest the need for three main components for organizing a successful challenge contest: 1) A contest coordinator who can organize the logistical and administrative needs of the contest. Communications staff or an event organizer may also be useful. 2) Diverse networks are also necessary for organizing contests. Such networks aid in the creation of a strong steering committee, distributing the call for entries, and sharing solutions widely. 3) Individuals who are champions of the cause are also necessary, as they promote trust in the contest and can serve as key members of the steering committee.

3. What kinds of tasks have challenge contests been used for?
   Challenge contests have been used to solicit solutions for a variety of issues related to public health. Contests have been used to promote HIV testing among MSM in China, collect images for an anti-stigma campaign about HIV, identify descriptions of hepatitis approaches, solicit logo designs for a worldwide HIV conference, decipher the structure of an HIV retroviral protease, and recruit DNA samples for undiagnosed genetic conditions, among many others.

4. What groups are typically the target audience of a challenge contest?
   The target audience of a challenge contest is typically broad. For example, a contest to intended to solicit images promoting HIV testing among youth would engage youth, but would not be limited to youth.

5. For which diseases has a challenge contest approach been useful in soliciting solutions?
   Many past challenge contests focused on solutions relating to HIV or hepatitis B/C. However, contests have also been used for innovation in drug addiction, maternal and child health, and genetic diseases.
6. **What is the purpose of a steering committee in organizing a challenge contest?**

   A steering committee provides leadership and guidance for the challenge contest. This committee decides the purpose of the contest, outlines the rules and requirements for entries, develops a call for entries and selects a prize structure. In some cases, it might be useful to have a smaller group within the steering committee that is more focused on the organization and implementation of the project.

7. **Which group is most appropriate to organize a challenge contest?**

   Host organizations need to have diverse networks and some communications capacity. Previous health-focused challenge contests have been organized by universities, WHO or other UN agencies, and non-governmental organizations have all participated.

8. **What are some examples of in-person events used to promote challenge contests?**

   In-person events are more intensive sessions to promote engagement. These events are especially useful for incorporating preferences and ideas from those who will not participate online. In-person events can include community-based introductions to the contest, didactics at local universities, interactive feedback sessions, and community-driven events.

9. **How can social media be used to promote a challenge contest?**

   Social media can be used to distribute the call for entries through digital networks. This could include banner advertising on mobile apps, short text messages for registered users, announcements on social media applications (e.g., Facebook, Twitter), and forwards through listservs.

10. **How many submissions does a challenge contest need in order to be a “wise” crowd?**

    There is no simple threshold for predicting how many submissions are needed. It is important to consider both the quality and quantity of submissions when assessing the overall response. We typically evaluate both of these aspects one week prior to the contest deadline in order to consider extending the deadline.

11. **How can contest entries be evaluated?**

    Evaluating submitted entries is a key stage of a challenge contest. For a rigorous judging process, all entries should be initially evaluated by at least two independent judges for relevance and eligibility based on pre-specified criteria. In the second phase of judging, a diverse group of laypeople and experts can evaluate the entries.
12. **How can organizers of a challenge contest ensure a fair judging process?**

The steering committee needs to decide the judging criteria as part of the call for entries. Including multiple phases of judging can also be useful. Finally, having judges with a conflict of interest recuse themselves.

13. **During the judging process, can raw scores be used or should scores be adjusted to account for judging differences?**

Evaluation of the judging processes from past contests suggests that there is no need to adjust scores to account for differences in judging, and that using mean raw scores is sufficient.

14. **What are some examples of an appropriate prize structure for a challenge contest?**

In many cases, mentorship from experts and training opportunities are highly valued by participants, compared to monetary prizes. However, depending on the purpose of the challenge contest, other appropriate prizes can be determined.

15. **Are there risks associated with challenge contests?**

There are numerous reasons why a challenge contest might fail to reach its goals at any point throughout the process. By forming a steering committee, engaging with communities, developing an appropriate judging framework, and collaborating between institutions, contest organizers can avoid some of these risks. Notable cases which failed to follow one or more of these protocols can be seen in Figure 4.

16. **How have solutions and ideas from past challenge contests been shared widely and implemented by policymakers?**

Best practices, excellent entries, and key takeaways have been presented at academic conferences, forums, and other platforms. Other contests, like a hepatitis testing innovation contest, solicited descriptions of case studies that were included in the 2017 World Health Organization Hepatitis Testing Guidelines.

**References**

2. Ess Hv. Crowdsourcing: how to find a crowd. ARD/ZDF Academy; 2010; Germany; 2010.