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EDUCATION FORUM

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Strength in numbers: Crowdsourcing the most relevant literature in pediatric cardiology

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Abstract

Objective: The growing body of medical literature in pediatric cardiology has made it increasingly difficult for individual providers to stay abreast of the most current, meaningful articles to help guide practice. Crowdsourcing represents a collaborative process of obtaining information from a large group of individuals, typically from an online or web-based community, and could serve a potential mechanism to pool individual efforts to combat this issue. This study aimed to utilize crowdsourcing as a novel way to generate a list of the most relevant, current publications in congenital heart disease, utilizing input from an international group of professionals in the field of pediatric cardiology.

Design and Setting: All members of the PediHeartNet Google group, an international email distribution list of medical professionals with an interest in pediatric cardiology, were queried in 2017 to submit literature that they considered to be most relevant to their current practice. A Google Form submission platform was used. The articles were evaluated by a multi-institutional panel of four experts in pediatric cardiology using the Delphi method via an electronic evaluation form until a consensus was reached regarding whether the article merited inclusion in the final list.

Results: In total, 260 articles were submitted by members of the PediHeartNet Google group. Expert review using the Delphi method resulted in a list of 108 articles. The final collection of articles was published on a publicly available educational website.

Conclusions: Crowdsourcing represents a novel approach for generating a high-yield, comprehensive, yet practical list of the most relevant recent publications in pediatric cardiology. The same techniques could be easily applied to any medical subspecialty. By enlisting the input of frontline providers, the value and relevance of such a list will be significant. A web-based platform for publication of the list allows for real-time updates to ensure continued relevance.

KEYWORDS
crowdsourcing, medical education, pediatric cardiology

1 | INTRODUCTION

Crowdsourcing describes a collaborative process of obtaining information, data, or ideas from a large group of individuals, typically from an online or web-based community. Crowdsourcing in its current form was first described in 2006.[1] It has most typically been used in business and technology to outsource work previously performed by a small number of individuals to a larger community in order to generate more diverse, efficient, or timely solutions to often complex or labor-intensive tasks. Recognizing the potential of this strategy in advancing educational collaborations, individuals have also utilized crowdsourcing in education to collect data, design curricula, create educational tools, and generate feedback. Within the medical field, crowdsourcing has been utilized in health care and biomedicine to assist in assessment of public health information, to further the diagnosis and management of patients, to generate study materials and educational tools and to design continuing medical education.[2–13]

Collaboration within the practice of medicine, and more specifically, medical education, is becoming increasingly common, and an essential part of medical training. A wide variety of free, easy-to-use, web-based tools such as Google Forms, make the collection of data from an international sample of interested individuals accessible to nearly all medical professionals. Crowdsourcing requires the use of an open call format, that is, a public solicitation to participate, and access to a large group of potential contributors. A robust number of possible contributors, most of whom have a vested interest in their respective medical fields, currently exists through professional medical societies, as well as less formal Internet-based medical communities.

With the growing body of medical literature in pediatric cardiology, it is increasingly difficult for any one individual to stay abreast of the most current, meaningful articles to help guide practice. Individual academic institutions have generated internal lists of important articles for review and distribution among their trainees and frontline providers, but these are not typically shared with members of the larger academic community. Additionally, these lists are often not comprehensive, nor up to date with the latest literature in the field. Communities of professionals within the field of pediatric cardiology provide an opportunity for collaboration in generating potential management strategies for complex cases, but also for the sharing of educational materials and relevant primary literature. Crowdsourcing represents a novel way to generate a comprehensive list of the most relevant, current publications in pediatric cardiology. This list can then be curated by respected experts using a formal review process. We aimed to use a crowdsourcing model and expert revisions to generate a comprehensive, yet practical list of the most relevant and recent publications that guide current practice in congenital heart disease from an international group of professionals in the field of pediatric cardiology.

2 | METHODS

All members of the PediHeartNet Google group, an international collective of medical professionals with an interest in pediatric cardiology, made up of greater than 1600 members in over 60 countries, were queried by email to submit primary literature that they considered to be the most relevant to their current practice. We allowed a one-month submission period to collect suggested articles. Articles were submitted using Google Form (https://www.google.com/forms/about/). Individuals were requested to provide as much information as possible, including article title, author, year of publication, and journal of publication. If this information could only be partially provided, a PubMed search was completed using all available information to identify the correct publication. Respondents could volunteer their level of training, name, affiliated institution, and contact information. Respondents were also asked whether they would be interested in helping curate the list of submitted articles, and whether they were interested in receiving a final copy of the curated list of submissions.

All submitted articles were reviewed and complete bibliographic information was obtained. The submission list was then screened for *current* publications, which was defined as those with a publication date between January 2007 and December 2017. The remaining list of articles was compiled and sent to a multi-institutional panel of four experts in pediatric cardiology for evaluation using the Delphi method, a widely used and accepted structured method for group communication using serial rounds of expert review.[14] The complete bibliographic citation and abstract for each article were provided, as well as a hyperlink to the full article on PubMed. Serial questionnaires were sent using a Google Form submission platform to solicit comments from each expert regarding whether an article merited inclusion in the final curated list. The panel was allowed two weeks to complete each round of review. In the initial round of review, the experts were provided with four options for each article: (1) the article should be included, (2) the article should not be included, (3) the article possibly could be included, and (4) there is not enough information to evaluate this article. Reviewers also had the option to provide written commentary. All articles with 100% of responses recommending inclusion or greater than or equal to 50% of responses recommending inclusion without any responses recommending exclusion were accepted to the list. All articles with 100% negative response, or greater than or equal to 50% of responses recommending exclusion without any responses recommending inclusion were excluded from the list. All articles not meeting consensus for inclusion or exclusion based on these criteria were sent out to the expert panel for an additional round of review.

Comments and results for each remaining unclassified article (neither included nor excluded after the first round of review) were compiled and sent out to the panel for a second round of review. The expert panel was provided with an anonymized graphical depiction of the group responses from the first round as well as an anonymized list of all submitted commentary for each article. In this second round of review, the experts were provided with three options for each article: (1) the article should be included, (2) the article should not be included, or (3) the article possibly could be included. In the second round, the same criteria were utilized to determine inclusion in the final list.

The remaining unclassified articles were again compiled and provided to the expert panel with an anonymized summary for review. A third round of review was completed, with only two options now provided for each article: (1) the article should be included or (2) the article should not be included. After this round, an article was classified for inclusion if greater than or equal to 75% of the experts recommended inclusion. If the article did not meet this threshold, it was excluded.

The final list of classified articles was then published on a publically accessible educational website (Figure 1, https://media.bcm.edu/documents/2018/cb/final-crowdsourced-list-of-most-significant-articles-in-pediatric-cardiology.pdf).

3 | RESULTS

Two hundred sixty articles were submitted by members of the PediHeartNet Google group after a single email request. Respondents represented all levels of medical training from resident to attending physician, as well as nursing staff (Figure 2). One hundred percent of respondents to the submission request expressed interest in receiving a final list of curated articles. Fifty percent of respondents answered that they would be interested in assisting in curating the collection of articles.

One hundred forty-four of the submitted articles had publication dates within the specified time period defined as 2007-2017. The initial round of Delphi expert review was able to classify 60 articles (42%), with 51 meeting inclusion criteria, and 9 being excluded. The second round of Delphi expert review was able to classify an additional 43 articles (30%), with 34 being included and 9 excluded. The third round of Delphi expert review classified the remaining 41 articles (28%) with 23 meeting inclusion criteria and 18 meeting exclusion criteria. The final number of included articles was 108 (42%) and excluded articles was 152 (58%) (Figure 3).

The final curated list of articles was assembled and published on a publically available educational website. The PediHeartNet Google group was notified by email that the project had been completed so that the entire community was able to access the final crowdsourced collection.

FIGURE 1 QR Code to access the final crowdsourced list of the most relevant current articles in pediatric cardiology

4 | DISCUSSION

To our knowledge, this project is the first reported attempt to use crowdsourcing and the Delphi method to enlist the input of an international collective of frontline care providers in pediatric cardiology to create a more relevant and valuable collection of primary literature. With an ever-increasing body of primary medical literature, the ability to efficiently sort through the spectrum of publications has become a difficult task for any single individual to complete. Crowdsourcing represents a powerful approach for generating a high-quality and comprehensive, yet practical list of the most relevant and recent publications in pediatric cardiology that guide clinical practice. Using expert input along with freely available Internet-based tools, we were able to generate an approachable list of primary literature for use as a resource by all individuals within the field of pediatric cardiology. As many individual practitioners are already searching the literature to help guide management decisions for their patients, this tool now provides a starting point for many of the most common questions that face frontline providers today.

Previous attempts at generating consensus lists of relevant primary literature have often relied only upon the input of content experts, or have only been produced at a single institutional level. In fact, we were contacted by several individuals from other institutions who had been involved in the generation of lists of their own, thus duplicating work around the globe. These individuals expressed a strong interest in contributing to and benefiting from our crowdsourced project. As evidenced by the response of the community, there is substantial interest among the international community in the creation and management of such a list, and this encourages active collaboration between a very large number of individuals and institutions. Multiple providers, including those who did not submit articles, requested access to our final product. Furthermore, an individual creating an educational website for pediatric cardiology has already reached out to request collaboration. In this way, we learned that a project such as this generates much public interest and begets

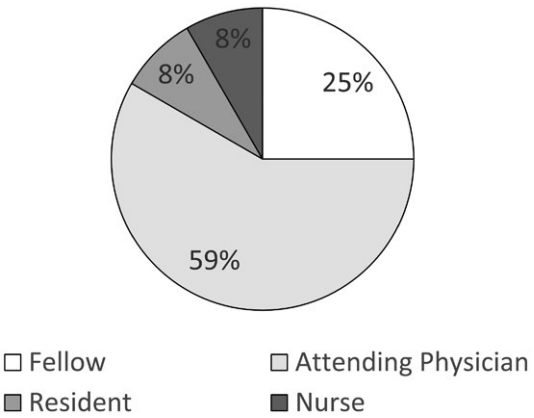

FIGURE 2 Breakdown of respondents by level of training. Twelve total respondents provided their level of training with their submission. Attending physicians represented the largest number of responses

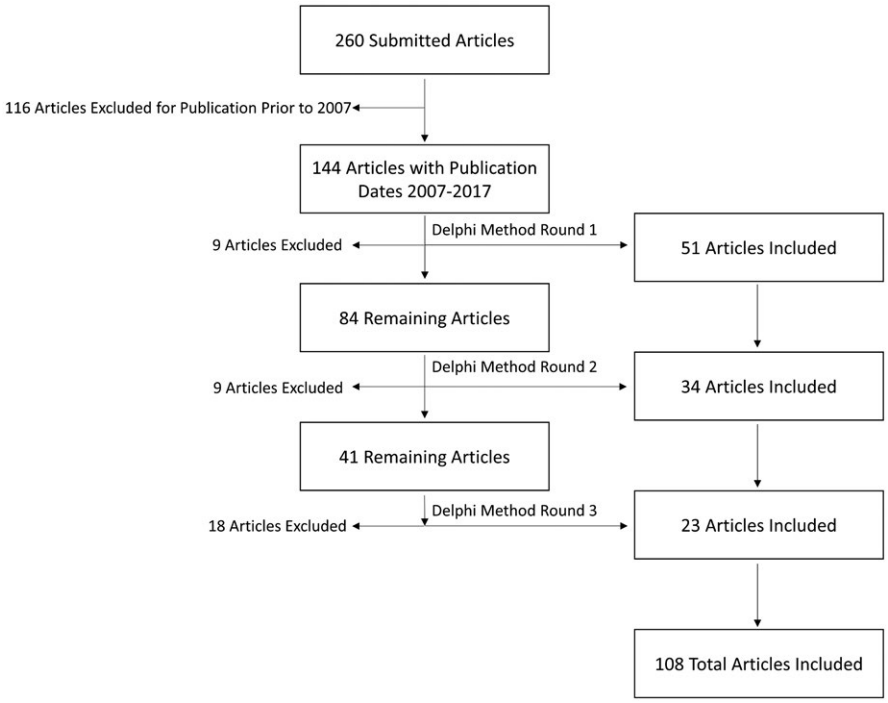

FIGURE 3 Results of crowdsourcing process by stage of evaluation. Articles were initially excluded based on date of publication prior to 2007. Serial evaluation with Delphi method expert panel review resulted in a final list of 108 included articles in our crowdsourced list of the most relevant current articles in pediatric cardiology

further opportunities for education, collaboration, and distribution, thereby improving knowledge for all in less time.

Utilizing a web-based platform for publication of this curated list of publications provides several significant benefits. Using a publically available educational website, we hope to allow access to the widest possible audience of frontline providers and members of the medical community. In order to maximize exposure to the final product among practitioners of pediatric cardiology, we publicized the list at a recent national conference on congenital heart disease and have distributed the list to the PediHeartNet Google group. Further considerations include posting of the list to a major educational website for pediatric cardiology (currently under development) and distribution to pediatric cardiology training programs on a national and international level.

An editable website would allow for continued updates of the list, as well as provide an easy platform for the submission of new suggested articles for consideration. Ultimately, the goal would be to create a crowdsourced, crowd-managed, "living document," with continuous real-time updates by the audience of frontline providers. Such an approach would overcome the largest challenge facing any list of significant literature: maintaining relevance in a field where new techniques and evidence are generated on a continuously evolving basis. Until the time that such a living document can be created, our current submission platform remains open and allows for the PediHeartNet community, as well as any other consumers of the list, to submit suggested articles for consideration on a running basis. We plan to revisit the list on at least an annual basis to ensure continued relevance.

Limitations of the crowdsourcing approach exist, and in this initial process, we have attempted to overcome the majority of these with the additional step of expert review using the Delphi method. Limitations include the possibility of biased submissions by respondents hoping to promote their own research or publications, which we encountered in a very small number of cases. Additionally, our initial list of articles contains only submissions by individuals motivated to take the time to respond to an email request. While we attempted to make the submission process as simple as possible, it is possible that this subsample of providers is not representative of the overall group of professionals in the field of congenital heart disease and thus the generated list may not reflect the needs of the larger community. Additionally, our expert review phase, while using an established Delphi methodology, may detract from the goal of generating a list of literature truly relevant to the community of frontline providers, as these experts may carry their own inherent biases in the selection process. We have attempted to overcome this by involving experts from multiple institutions at different levels of experience to allow for diverse opinions and practices.

While this project focused specifically on the field of pediatric cardiology, the same techniques could be easily applied to any medical subspecialty. Most individual practitioners are already investing time in searching the medical literature to help guide management decisions for their patients. Utilizing this existing pool of prospective contributors and their already ongoing labor to generate a product that is freely accessible, relevant, and readily modifiable helps promote more effective, evidence-based care among the larger medical community.

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CONFLICT OF INTEREST

Authors report no conflicts of interest.

AUTHOR CONTRIBUTIONS

Joseph J. Knadler contributed to the concept/design, data collection, data analysis/interpretation, statistics, drafting of article, critical revision of article, and approval of article.

Daniel J. Penny contributed to the concept/design, data collection, data analysis/interpretation, critical revision of article, and approval of article.

Tyler H. Harris contributed to the data collection, data analysis/interpretation, critical revision of article, and approval of article.

Gary D. Webb contributed to the data collection, data analysis/interpretation, critical revision of article, and approval of article.

Antonio G. Cabrera contributed to the data collection, data analysis/interpretation, drafting of article, critical revision of article, and approval of article.

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