Approaching Impact Meaningfully in Medical Education Research

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Abstract

Medical education research faces increasing pressure to demonstrate impact and utility. These pressures arise amidst a climate of accountability and within a culture of outcome measurement. Conventional metrics for assessing research impact such as citation analysis have been adopted in medical education, despite researchers’ assertion that these quantitative measures insufficiently reflect the value of their work. Every knowledge community has its own definitions of what counts as knowledge, how that knowledge should be produced, and how the quality of that knowledge production should be evaluated. Definitions of impact and knowledge shape and constrain researchers’ foci and endeavors. Therefore, metrics that meaningfully evaluate the knowledge outputs of researchers need to be defined within each field. It is time for medical education research, as a field, to examine how to measure research impact and carefully consider the broader implications these measures may have. The authors discuss developments in research metrics more broadly, then critically examine impact metrics currently used in the medical education field and propose alternatives to more meaningfully track and represent impact in medical education research. Grey metrics and narrative impact stories to more fully capture the richness and nuanced nature of impact in medical education research are introduced. The authors advocate for a continual examination of how impact is defined, eschewing unquestioned use of conventional metrics. A new conversation is needed, as well as a research agenda to help medical education conceptualize and study metrics more appropriate for the field.

Medical education researchers, like other academics, face increasing pressure to demonstrate, or “prove,” the impact of their work.1-4 This pressure may represent accountability, but it also results from a need to prove the relative value of one’s work in a competitive, constrained funding environment in academic health sciences.5,7-9 Historically, conventional metrics for assessing research impact have prioritized counts of grants, publications, and citations. Together, these conventional measures of research productivity are considered evidence of the significance of a researcher’s work and thus drive promotions and affect future funding successes. Increasingly, however, researchers from diverse fields question the ability of these conventional metrics to adequately represent the impact of their work.10-12

The full influence and effects of research, including societal impact and research quality, are difficult to capture using only conventional, quantitative metrics.

Metrics establish incentives that influence behavior and can change the academic system.13 What counts as impact represents what is valued and rewarded in any given context, with implications for the types of questions researchers choose to pursue. Every knowledge community has its own definitions of what counts as knowledge, how that knowledge should be produced, and how the quality of that knowledge production should be evaluated.14 Definitions of impact and knowledge shape and constrain researchers’ foci and endeavors. Therefore, metrics that meaningfully evaluate the knowledge outputs of researchers need to be defined within each field.

It is time for medical education research, as a field, to examine how it measures research impact and consider the broader implications these measures may have. In this article, we will discuss developments in research metrics more broadly, critically examine impact metrics currently used in our field, and propose an alternative to more meaningfully track and represent impact in medical education research. The term “impact” is used to discuss the effect or influence of research, within and beyond academia. Metrics, measures, and indicators are the data collated to provide evidence of research impact.

Developments in Research Metrics

Commonly, researchers are evaluated by their number of peer-reviewed publications, which may include considerations of authorship position and journal impact factor (JIF).15,16 Another conventional metric is grant capture, encompassing number of grants, dollar amount of grants, and type of grant (e.g., local, national, international, foundation based). Often, researchers with more publications are more competitive for grant funding. Citations are a conventional metric to assess research impact, the rationale being that if a paper is cited, then dissemination of knowledge is occurring, and therefore the research is having an impact on policy or future research. The most common metric is citation counts, though some researchers may take the time to delve into who is citing their work or where their work is being cited. While conventional metrics are commonly used to evaluate researchers, the pressure to publish can lead to questionable authorship practices.17 Moreover, a journal’s JIF is derived from citations for all articles in that journal and does not indicate the quality of a specific journal article18; citations are slow

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to accrue and can often misrepresent an article's content.18

In an attempt to address critiques of conventional metrics,15,18–20 Priem (an information science PhD student) and colleagues21 developed altmetrics as a way of expanding definitions of research impact measurement beyond the narrow focus on peer review, JIF, and citation count. Unfortunately, altmetrics still suffer many of the same pitfalls as conventional metrics.22 They focus on counting citations, albeit from different, nonacademic sources (e.g., blogs, social media, news reports), and are measures of attention to, rather than quality of, research output.23–26 For example, Wakefield and colleagues’ (1998) now-infamous article about the measles, mumps, and rubella vaccine and predisposition to pervasive developmental disorder in children is in the top 5% of all research outputs ever tracked via Altmetric, with 1,533 tweets, 168 news reports, and 106 blog mentions as of late 2018.27 This is because Wakefield’s publication was retracted, igniting a scandal that caused the paper to be highly shared. Such an instance exemplifies how altmetrics cannot answer the criticism that conventional metrics face—that is, they are measures of attention, not quality—and that quantitative measures cannot adequately represent societal impact resulting from research.18,20,29

In an attempt to address these remaining issues, scholars in other fields (e.g., health services and policy,30,31 biomedical sciences,30,31 management,19 research evaluation,32 arts-based health research11) have built upon conventional metrics and altmetrics approaches in a number of unique ways (see Table 1 for a summary of trends in the development of research impact from different fields). Although these frameworks offer promising ways forward, we cannot simply adopt them in medical education. Every field has unique forms of impact that are not necessarily captured by the tracking strategies used by other fields. The frameworks can, however, serve as a starting point for a customized way of representing impact for the field. This Perspective proposes a reconceptualization of both what is captured and how to communicate research impact.

**Introducing Grey Metrics**

Education is a complex social process, and medical education research contributes ideas and orientations that influence perspectives, practices, and policy33 that are not fully captured by conventional metrics and altmetrics. Thus, we propose a novel indicator of research impact called “grey metrics,” which can contribute to identifying meaningful research impact not currently captured. Grey metrics may include but are not limited to nonconventional citations, informal sharing of research findings, informal and formal consults, and communications indicating appreciation or applications related to one’s research. Grey literature is unindexed and/or unpublished materials, often difficult to find since it exists outside of academic databases. Yet, grey literature is a key source of knowledge (hence its inclusion in systematic and scoping reviews).34 Similarly, grey metrics are so named because they may be difficult to track due to being informal and unindexed, and yet contribute crucial insights to how one’s research is making an impact. The lack of a searchable database for grey metrics should not be confused with lower importance. Aligning research metrics with the purposes of the field is a more rigorous way of demonstrating impact than relying on existing metrics developed for other fields with different purposes. Grey metrics comprise many different indicators that capture the kinds of impacts researchers wish to see in education but that are insufficiently represented by conventional metrics or altmetrics. When collected, grey metrics demonstrate the influence and effects of one’s research.

By nonconventional citations (beyond the websites or podcasts suggested by altmetrics), we are referring to sources such as peer-reviewed conference posters, presentations, and keynote addresses (e.g., mentioned in the slides); listserv mentions; inclusion in curricula or to inform innovative teaching tools; or citation on websites as seminal papers (e.g., inclusion of publication in Key Journal Articles in MedEdWorld [https://www.mededworld.org/Resources/Publications/Articles.aspx]). These instances represent well-aligned markers of impact because they illustrate how an education researcher’s work is influencing actual education practices and thinking.

Another indicator of research uptake is informal requests to share research findings. Slide sharing requests represent how one’s research is addressing knowledge gaps, as one’s research findings are used to inform perspective, practice, or organizational changes. Although one’s research may have influenced practice or policy decisions, if the use is not published (e.g., to design a curriculum or inform an innovative teaching tool), there is no formal recognition. Tracking informal research sharing produces data documenting an otherwise-undiscoverable impact of research. Capturing informal sharing may be facilitated by sites such as ResearchGate (https://www.researchgate.net), which makes it easy to contact researchers and encourages users to provide comments about why they used a research output or how they adapted it.

In addition, informal and formal consults (telephone, in-person, electronically via email, or on platforms such as ResearchGate) can also indicate impact. Consults may range from providing insights on a grant citing one’s work to consulting on evidence-informed curriculum change using one’s findings. One might receive email requests for more information or guidance. These communiques improve understanding of one’s work and might lead to further recognition and are examples of how research affects future research questions and practice changes, as one informs work at other departments or institutions. Invitations to consult indicate that one is considered to have expertise and is serving as a collaborator and capacity builder. This is influential work, but often done invisibly and, if tracked, could serve as an indicator of significant impact. These important exchanges may be sacrificed if they don’t “count.”

A separate but related and important grey metric is the communication of appreciation or applications regarding one’s research (e.g., email, direct messages on ResearchGate, in-person conversation at conferences). An assessment of the United Kingdom Research Excellence Framework (UK REF) identified that evidence of realized outcomes for specific stakeholders “is particularly powerful when … backed by data or testimony from research users.”35 Such unsolicited stakeholder feedback may provide a chance to understand how one’s findings are being used, can lead to consultations or collaborations, and should be tracked as evidence of research impact.

With unconventional or grey metrics in mind, one begins to notice new types of indicators and different connections that demonstrate the influence of one’s
Table 1  
Trends in Development of Research Impact

<table>
<thead>
<tr>
<th>Research metric</th>
<th>Research field</th>
<th>Developments proposed</th>
<th>Benefits of the metrics</th>
<th>Limitations for academia/HPE</th>
</tr>
</thead>
</table>
| Conventional metrics | Common across academia | - Grants (number and dollar amount received, institution that grants it)  
- Publications (number, JIF)  
- Citations (number, H-index) | - Easily collected and collated  
- Recognized, widely used | - Focus on quantity, not quality  
- Indicate academic attention only  
- Citation counts slow to accrue  
- JIF calculation opaque, can be misrepresentative  
- H-index misleading if comparing researchers at different career stages and does not indicate level of contribution |
| Altmetrics | Information science | - Additional research products (e.g., code, datasets, Twitter, blog posts) | - Tries to address quality oversight of conventional metrics by focusing on “article-level” metrics (a.k.a. altmetrics), as opposed to journal-level metrics (e.g., JIF)  
- Attempts to broaden what “counts” as research product (i.e., dissemination via nontraditional/nonacademic outlets) with live, immediate feedback (e.g., number of views or downloads) | - Remain unable to answer the criticism that conventional metrics also face; are often measures of attention, not quality  
- Tries to capture attention beyond academia (through nonacademic outlets, e.g., news)  
- But most widely used altmetrics (e.g., Twitter) often still indicate attention within academia, between academics (albeit on different platforms, more instantaneous) |
| Research impact framework | Health services | Indicators across four broad areas of impact:  
- Research-related impact (e.g., publications, patents, research methods, awards, communication)  
- Policy impact (e.g., level of policymaking, type of policy, political capital)  
- Service impact (e.g., evidence-based practice, quality of care, cost-effectiveness)  
- Societal impact (e.g., knowledge, attitudes, and behaviors; health literacy; equity and human rights) | - Provides indicators for different types of research impact within academia (research-related impact) and beyond academia (policy impact, service impact, societal impact)  
- Indicators include conventional metrics and altmetrics | - Many of the new suggested indicators by RIF and Becker are specific to their field and not usually applicable to HPE (e.g., patents, clinical practice guidelines)  
- If these new indicators become the norm, HPE researchers still risk appearing “less productive” than health services or biomedical researchers |
| Becker Medical Library Model for Assessment of Research | Biomedicine | Indicators and evidence of impact across four stages of research:  
- Research output (e.g., biological materials, databases and algorithms, measurement instruments, media releases)  
- Knowledge transfer (e.g., cited references, consensus development conferences, license agreements, curricular guidelines, medical devices)  
- Clinical implementation (e.g., quality measure guidelines, clinical or practice guidelines, medical devices)  
- Community benefit (e.g., quality of life, economic outcomes) | - Provides indicators for different types of research impact within academia (research output) and beyond academia (knowledge transfer, clinical implementation, community benefit)  
- Indicators include conventional metrics and altmetrics | - (Table continues) |
Pluralistic Management
Multistakeholder way of conceptualizing and measuring scholarly impact, with indicators inside and outside the academy, across four types of impact:
- Inside the academy (e.g., citations, H-index)
- Outside the academy (e.g., invitations to practitioner events, media coverage, requests for time from industry, popular press business books, expert witness in high-profile court cases, partnerships with outside stakeholders such as policymakers)
- Inside and outside the academy (e.g., followers on social media, number of textbooks published, citations in textbooks, volume of book sales)
- Altmetrics (e.g., social bookmarking on Mendeley, Reddit; number of clicks, comments, shares, tweets on social media such as Facebook, Twitter, ResearchGate, mentions in blogs, Wikipedia, news)

- Clearly details how to think beyond single-stakeholder metrics (e.g., citations that are a measure of academic concern only)
- Multistakeholder considerations of impact are vital if researchers want to affect not only students and colleagues but also practitioners and society at large
- Many of the indicators are not novel (e.g., altmetrics), and the new indicators are very specific to management

Research contribution framework Evaluation
Differentiation between research uptake, use, and impact to set out a process-oriented definition of research utilization, with typical indicators, evaluation criteria, and possible sources from the three overlapping processes:
- Research uptake (e.g., project reports, peer/funders review, web-use tracking, seminar/conference evaluations)
- Research use (e.g., tracking participants over different time frames for levels of understanding of key concepts, evaluation of user engagement activities, analysis of context for research use at practice and policy levels)
- Research impact (e.g., levels of research cited in policy/practice documents, changes in areas of policy or practice)

- Clearly details how to think about research impact indicators using a process-oriented framework to capture how (what processes) research has contributed to outcomes using context-specific indicators
- This contribution analysis approach is fulsome
- But HPE researchers need to use the guiding questions from the research contribution framework to ensure indicators of research uptake, use, and impact that are appropriate for the HPE context

Arts based Arts-based health
More nuanced understandings of impact are needed, beyond more conventional notions focused on outcomes and ease of measurement. While participants in the study found it hard to tease out the processes and products of ABHR, they did highlight that the process of engaging with ABHR is as important as any products of ABHR. Impact is expanded to encompass social scientific and artistic considerations aligned with ABHR.

- Clearly highlights how current assessment methods and language from the biomedical model of evaluation is insufficient for exploring the impact of ABHR
- Identifies specific issues around knowledge generation/dissemination that are interlinked in ABHR
- This article is an example of the need to grapple with what impact means in one's own field, with considerations of the “intentionality” of a project to ensure alignment between original purpose and how impact is conceptualized
- HPE researchers should be encouraged to engage with these questions and determine metrics appropriately aligned with the goals and values of education research

Abbreviations: JIF indicates journal impact factor; RIF, research impact framework; HPE, health professions education; ABHR, arts-based health research.

Indicators that are evidence of one type of impact (e.g., knowledge transfer) can also be indicators of another type of impact (e.g., clinical implementation).
research. As knowledge is created, shared, and applied to practice in nonlinear ways, grey metrics are key in expanding thinking about “what counts” as research impact. Just as grey literature makes important contributions to a systematic review, grey metrics are seemingly small pieces of evidence but, when collected and combined, more fully capture the processes of medical education research and its effects, charting research’s ability to influence perspectives, practice, and policy.

**Piecing It All Together: Impact Stories**

To capture the knowledge outputs and impact of researchers meaningfully, we need to not only reconceptualize what we think of and capture as impact (e.g., expanding our definition to grey metrics), but we also need to rethink how we present impact. A cohesive picture of research impact is missing in quantitative measures. Rather than tracking impact as a collection of piecemeal data sources, we suggest a move toward more cohesive representations of research impact.

Drawing on the power of narrative, we suggest telling “impact stories,” which can provide a memorable way to depict the effects of medical education research. Impact stories link different metrics to a broader educational goal by expressing how one’s work aligns with medical education’s purposes and values. Impact stories are useful in elucidating why a chosen metric is meaningful and how one’s work has been influential, offering a cohesive and compelling narrative structure rather than strings of sentences listing conventional metrics, altmetrics, or grey metrics. Examples of practical contexts where impact stories could be used include “Most Significant Contributions” sections on Canadian Institute of Health Research applications, when asked for case studies as evidence for research impact assessment (e.g., UK REF), research statements in curricula vitae, documents for promotions and tenure committees, and annual reports.

An impact story could encompass diverse metrics, tracked and combined into a narrative that shows why one’s research is valuable. Part of crafting an impact story is identifying and developing indicators that make sense for one’s particular context and research question. It is useful for medical education researchers to understand potential types of impact and stay attuned to the developments of new metrics, but one should not incorporate a metric simply because it is a new measure. The indicators of impact must be relevant to one’s story. Impact stories in medical education are effective when they elucidate how the research is helping achieve or transform educational goals. Lingard’s “The Writer’s Craft” series of papers in *Perspectives on Medical Education* offers many useful writing guidelines specifically tailored to medical education research; they may also be useful in writing impact stories.

An impact story should align with the educational goals of one’s department and institution, but what is emphasized will depend on the audience. Determining a static representation of value is difficult (perhaps impossible). Instead, foregrounding and backgrounding indicators that resonate with the audience can help the audience understand and remember the significance of one’s research. For example, when presenting to a hospital board, one could highlight how one’s research aligns with institutional missions and vision, or consider how medical education research might save or contribute money to the institution.

The guiding questions for crafting impact stories are many and may include the following: What are the purposes and values of education? As elucidated in Baker and colleagues’ article about aligning and applying the paradigms of education, the answer to this question likely guides one’s work as a researcher, in the types of questions asked and pursued. Is the purpose of education to allow learners to gain knowledge and become competent? Is it to inspire lifelong learning? Is it to encourage learners to think critically? What goals does one want to accomplish with one’s research? What indicators more fully demonstrate whether one’s research has achieved those goals? Does one’s research address the moral work of education? If one’s work contributes to developing health professionals with a commitment to caring, or an awareness of social justice, include descriptions of the types of societal and educational benefits afforded by implementation of one’s research findings. What is the most meaningful story to help others understand the value of one’s research? Is the impact story told in a way that is authentic, transparent, and trustworthy (based on data, not embellishment)?

To better represent the suggestions above, we provide an impact story example using conventional and grey metrics (see Box 1).

**Considerations**

There are practical concerns regarding grey metrics and impact stories, including time and resources for tracking, asystematic collection, and subjective interpretation of their significance. A limitation of grey metrics is the focus on measures within academia, with the caveat that medical education research applied to curriculum and instructional design holds the promise of effecting changes beyond academia (e.g., critical pedagogy to help learners recognize social structures and relations, challenge dominant beliefs, and become agents of change). All metrics are susceptible to being gamed, which can include inflation or misrepresentation, or inspire questionable practices earlier in the research process to better meet a metric (e.g., unethical authorship practices or salami slicing to increase publication counts). In the case of grey metrics, individuals are given freedom to provide their own rationale for why a measure is meaningful and indicative of impact (e.g., acting as consultant on curriculum development). This is a highly subjective activity; a grey metric could be interpreted in myriad ways and is susceptible to manipulation. Yet the act of having to interpret an indicator, to always question why an indicator is important and how it is meaningful, is an important activity researchers should engage in to ensure that metrics are not collected and used without thinking—this applies to conventional metrics, altmetrics, and grey metrics. Reconceptualizing the types of metrics that may be appropriate for medical education research is not to pit quantitative (conventional and altmetrics) against qualitative (grey metrics). Numbers can be made meaningful through sound analysis and application; the same is true of qualitative measures. “One size is unlikely to fit all,” but carefully selected quantitative and qualitative indicators can complement one another. As per the impact story example (Box 1), combining quantitative and qualitative metrics constructs a more holistic, meaningful representation of why and how medical education research affects academic and societal perspectives, practices, and policy. One of the main challenges facing new metrics and ways of communicating impact is that adoption is predicated on leaders, departments, and institutions recognizing the need for and
“Relationships of Power” Article Grows “Louder Than Words”: An Example of an Impact Story

Lindsay Baker, Eileen Egan-Lee, Tina Martimianakis, and Scott Reeves published an article in 2011 titled “Relationships of Power: Implications for Interprofessional Education.” This article, cited 91 times in Web of Science, highlights the important but underexplored factor of power relations in interprofessional education (IPE). In 2015, Elise Paradis and Cynthia Whitehead published a review of power and conflict in IPE literature titled “Louder Than Words: Power and Conflict in Interprofessional Education Articles, 1954–2013.” Out of 2,191 publications only 6 actually focused on power and conflict in IPE. They featured Baker and colleagues’ article as the 1 work out of the 6 that is “an exemplar for future power-related research in IPE.”

Even more excitingly, medical educators at the University of Toronto have added the article to a model undergraduate medical education curriculum on power and collaboration. This model curriculum included Baker and colleagues’ research as a means to expose students to crucial ideas and questions around sociological power and its effects on IPE. By engaging with this research, medical students are exposed to new ways of viewing and examining the world, and critically engaging with questions around power relations, which are arguably necessary to genuinely achieve interprofessional collaboration. Baker and colleagues’ research is making a scholarly contribution by drawing attention to an otherwise underaddressed, but critical, issue in IPE. In addition, it is proposed as part of a model curriculum that would make a practical contribution by affecting what and how students learn.

Valuing measures beyond conventional metrics. We hope this article contributes to leaders’ considerations of how “inappropriate indicators create perverse incentives.” Individuals need organizations to create and support change if new cultural values are to be created and promoted.

Conventional and altmetrics should not be used uncritically, and neither should grey metrics and impact stories. As with all metrics, there are challenges to collecting grey metrics and ensuring their responsible use. Grey metrics and impact stories are not meant to supplant existing metrics but, instead, are meant to offer a starting point for medical education researchers to further investigate possible ways of understanding and communicating research impact.

Concluding Observations

It behooves those in the field of medical education to critically examine current research metrics and engage in creating and supporting indicators of research impact that align with educational philosophy, values, and goals. If one conducts medical education research to transform how curriculum, teaching, and learning occur in the field, then conventional metrics may fall short in demonstrating this type of impact. With conventional metrics and altmetrics, medical education researchers risk capturing too few, or inappropriate, forms of impact. Grey metrics advance a way to track other types of impact—not only numbers but also collaborations and processes indicative of research impact (e.g., formal and informal consults).

Numbers alone do not express the human impact of education work, but impact stories can begin to convey the richness and nuance of medical education research impact. Existing research metrics too often focus on measuring, without attending to meaning. As it has been observed, “We need to ensure that we are indeed measuring what we value,” not just measuring what we can easily count, and then end up valuing what we can count. Medical education researchers need to value and develop the use of stories to build credible and interesting narratives about the impact of their work. Doing so successfully can increase interest and investments in education. We hope that this article will begin a conversation and set out a research agenda to help medical education conceptualize and study metrics more appropriate for the field. This suggestion is timely and aligned with work around expanding definitions of scholarly activity in medical education.

Yet we end with a note of caution: As the medical education research community works toward a broader definition of impact, researchers must be mindful about the urge to further quantify their achievements and be wary of the “impact agenda.” The purpose of reconceptualizing impact is not to continually invent new metrics. Our observations are not meant to be prescriptive, nor to create increasingly burdensome ways for researchers to “prove their worth.” The hope is to inspire alternative, innovative ways of seeing, thinking about, and representing medical education research impact more appropriately aligned with medical education researchers’ contexts, values, and drive for quality. Demonstrating meaningful impact matters because it has implications for individual careers and institutional reputations, but we must try to resist a full embrace of the impact agenda. We must always be mindful that the time we spend measuring, without attending to meaning, could often be better spent doing work that has impact.

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