INTRODUCTION
For nearly a decade, the prevailing conversation in continuing medical education (CME) has been around reforming the system and establishing new metrics by which to judge the effectiveness of CME. As long as there has been the concept of CME, there have been shifts in the important metric by which CME is valued. Initially, the distinction of quality CME was based on the type of organization administering the education, with medical schools and the American Academy of General Practice being regarded as the top providers and all others as secondary players. When the American Medical Association (AMA) established its own system of CME credit, all types of organizations could apply for and gain accreditation by proving compliance with a set of requirements [1]. Accredited providers were all regarded as the experts in CME and were able to offer the same type of credit regardless of the type of organization. The primary measure of credit at the time was the number of hours spent engaged in CME.

As the CME landscape developed, so too did the call for revisions to the existing credit system, and in 2003 the AMA responded by removing the word “hours” from its credit statement. They recognized that with the variety of emerging CME delivery formats, time was no longer the proper way to measure CME credit. The CME enterprise seems to be moving toward the value of the CME activity as the basis for a new system of credit. Outcomes have been the focus of this discussion, with more credence being lent to activities that influence a change in physician behavior leading to improved practice and patient outcomes [1]. However, the effect an activity has on
physician behavior is unique to that activity, and a standard system of measure that fits all CME activities does not currently exist. Providers have routinely struggled with the challenge of keeping up with the amorphous entity that is CME outcomes.

In 2005, Spivey suggested that “a revised and reformed CME system would allow simplified and identical reporting of CME experience and credits for the individual physician and a simplified and more rational system of credit” [2 (p. 136)]. The statement was highlighted by a review of the recommendations and next steps identified by the Conjoint Committee on Continuing Medical Education that did little to identify a simplified credit system. The value of Spivey’s review was the recognition that CME stakeholders need a way to identify the value of CME. Understanding that physicians have diverse learning preferences and that no generally accepted outcomes system exists that fits across that diversity of learning opportunities, the simplest way to identify the value of CME is once again based on the value of the organization offering the education. Much like a journal impact factor suggests the value of the journal and the reliability of the science within its pages, the proposed CME impact factor will demonstrate the value of the individual CME provider based on its classification as a particular provider type and the activities it develops and offers to the medical community. The hope remains that more data will ultimately be made available to the public so that the value of a CME provider can include its ability to reach greater levels of outcomes or produce activities with greater effect size, but under the current proposed calculation of the CME impact factor, the value of a CME provider type is equal to its comparative reach.

**MATERIALS AND METHODS**

**The Journal Impact Factor**

Developed by Thomson (now Thomson Reuters) in the 1960s, the journal impact factor uses the frequency of citations to a given journal to develop an impact score for that journal. It is a simple calculation of the number of times a journal is cited over the previous 2 years divided by the number of articles, reviews, proceedings, or notes published during the same time period. The factor rests on the idea that those journals more highly cited routinely publish more valuable articles and therefore should garner greater respect from the community.

The journal impact factor is not without its flaws. First, Garfield cautions against using the factor as the only means for evaluation of the value of an individual article, stating that “although journal assessments are important, evaluation of faculty is a much more important exercise” [3 (p. 413)]. He implies that an article written by a respected author and published in a lesser journal may have more value than one from a lesser author in a more respected journal. The journal impact factor should simply be one tool in an entire toolbox with which to value the effect of a single article, author, or journal itself.

The editors of *PLoS Medicine* also raise questions about the validity of the journal impact factor by suggesting that there are ways for editors to purposely improve their impact factor simply by publishing more review articles (which tend to garner more citations) or by publishing only a few highly cited research papers [4]. The editors claim that the primary flaw in the journal impact factor is that the selection of articles deemed to be “citable” is both unscientific and arbitrary, yet the journal impact factor remains an important and valued measure of a journal’s, an author’s, and an article’s impact on the scientific community.

With flaws accounted for, the journal impact factor has stood the test of time, remaining largely unchanged and widely accepted as a valued tool for evaluation purposes. In fact, Saha et al found that general opinion of the quality of a journal within the scientific community strongly correlates with the journal’s impact factor [5]. The CME impact factor should be viewed in the same light. The following pages will outline the calculation of the CME impact factor, its potential uses, its inherent flaws, and potential opportunities for improvements.

**CME Impact Factor**

The CME impact factor is designed not to value the effectiveness of each individual CME activity, but to value the accredited provider type as a single resource. During the early stages of developing the CME impact factor, the types of data to include and the level of detail by which to calculate the impact factor were weighed and considered. Ultimately, the decision was made to develop a CME impact factor equation that supports the most detailed application presently possible but still allows for expansion should more data become available. The CME impact factor described here is based on total numbers of all types of CME activities provided by a particular organization type. Therefore, the impact factor represents the organization’s ability to present CME activities of any kind based on its classification as a particular provider type. The equation could just as easily be applied to determine the organization’s ability to develop and present activities of a particular learning format, such as Internet enduring materials or performance improvement CME.

The discussion of what data to include and what not to include was limited by what data were available. The primary source of data quickly became the Accreditation Council on Continuing Medical Education (ACCME) 2011 and 2010 Annual Reports (the most recent reports available at the time of development) [6]. The task then quickly focused on determining which types of data to include. With hours engaged in CME seemingly no longer relevant, the elimination of hours of instruction was an easy decision. The number of nonphysician participants was not included in the calculation because nonphysicians are not the target of ACCME-accredited
providers. However, there is certainly the potential for inclusion as the multidisciplinary approach to medicine increasingly becomes the focus of CME. Income and expense were strongly considered for inclusion, but the authors have some concerns as to the reliability of reporting in this area. Most notably, income in the ACCME’s Program and Activity Reporting System (PARS) is calculated as a roll-up from each activity, and overhead funding may not be properly accounted. Also, if in a large institution, such as a medical school or health care system, resources and staff are shared across departments, including CME, the expense for those resources may not be represented in the PARS reporting. The number of activities by organization type was valued for input because it may represent the efficiency with which the organization can develop and execute educational activities. The number of physician participants was included because it represents the reach of the educational organization and may be an indicator of its ability to produce interesting and desirable educational activities of value to the physician community.

Similar to the journal impact factor the previous 2 years were included in the calculation of the CME impact factor (Figure). In order to calculate the factor for a particular organization, we first calculated the average number of activities conducted by that organization’s type in 2011. For example, 132 publishing/education companies produced 19,417 CME activities in 2011 for an average of 147 activities per organization. We then calculated the weighted average of all activities from all provider types for 2011. The weighted average is the sum of the products of the average number of activities for each provider type and the number of providers in that type all divided by the total number of providers. In this example, the weighted average for activities by provider type in 2011 is 64 activities. Then, in order to compare each provider type we calculated the ratio of the average number of activities for that provider type to the weighted average of all providers. In this example, the ratio of average activities conducted by publishing/education companies to the weighted average is 2.3. The same ratio was calculated for the total number of physician participants by organization type (4.76). The product of the two ratios determines

## CME Impact Factors by Provider Type

<table>
<thead>
<tr>
<th>Organization Type</th>
<th>Count</th>
<th>2010</th>
<th>2011</th>
<th>Accreditation with Commendation</th>
<th>Accreditation</th>
<th>Provisional Accreditation</th>
<th>Accreditation with Progress Report</th>
<th>Probation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government or military</td>
<td>41</td>
<td>0.53</td>
<td>0.54</td>
<td>0.52</td>
<td>0.28</td>
<td>—</td>
<td>0.05</td>
<td>0.00</td>
</tr>
<tr>
<td>Hospital/healthcare delivery system</td>
<td>1210</td>
<td>0.26</td>
<td>0.61</td>
<td>0.25</td>
<td>0.16</td>
<td>0.07</td>
<td>0.02</td>
<td>0.00</td>
</tr>
<tr>
<td>Insurance company/managed-care company</td>
<td>28</td>
<td>1.03</td>
<td>0.40</td>
<td>0.62</td>
<td>0.41</td>
<td>0.15</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Nonprofit (other)</td>
<td>106</td>
<td>0.29</td>
<td>0.15</td>
<td>0.08</td>
<td>0.04</td>
<td>0.03</td>
<td>0.00</td>
<td>—</td>
</tr>
<tr>
<td>Not classified</td>
<td>76</td>
<td>0.34</td>
<td>0.23</td>
<td>0.15</td>
<td>0.08</td>
<td>0.04</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Publishing/education company</td>
<td>132</td>
<td>10.96</td>
<td>2.46</td>
<td>50.95</td>
<td>26.96</td>
<td>13.21</td>
<td>4.31</td>
<td>2.43</td>
</tr>
<tr>
<td>School of medicine</td>
<td>124</td>
<td>14.73</td>
<td>3.05</td>
<td>73.67</td>
<td>44.92</td>
<td>15.27</td>
<td>2.25</td>
<td>0.00</td>
</tr>
</tbody>
</table>
the impact factor of publishing/education companies for 2011 (10.96). The same calculations were done using the data from the ACCME 2010 Annual Report so that the 2010 impact factor for publishing/education companies is 2.46. The product of the two annual impact factors determines the current impact factor for all publishing/education companies that have been awarded accreditation status (26.96).

Distinction should be made for those individual organizations that have earned accreditation with commendation, the ACCME’s highest level of accreditation. In 2011, the ACCME published The ACCME at Work “to provide an in-depth, easily understandable explanation of the ACCME accreditation system and services” [7]. The report details the number of providers by type that have earned accreditation with commendation, accreditation, provisional accreditation, accreditation with progress report, probation, and non-accreditation. In an effort to recognize the value of the organizations that have earned accreditation with commendation, we calculated the percentile rank of organizations earning commendation within their provider type. In our example, a publishing/education company that has earned accreditation with commendation is in the 89th percentile of all publishing/education companies. We then multiplied the factor by 1.89 to calculate the impact factor for those publishing/education companies that have earned accreditation commendation, yielding an impact factor of 50.95. Similarly, a publishing/education company that has earned provisional accreditation would be in the 49th percentile of all publishing/education companies. Since provisional accreditation is a lesser status than accreditation, we removed the whole number 1 from the calculation so that the impact factor was simply multiplied by 0.49, yielding an impact factor of 13.21. The table provides the 2012 CME Impact Factors for all provider types based on accreditation status.

Potential Application

As stated, there are limited data available for inclusion in the calculation of the CME impact factor. Therefore, the CME impact factor may have some inherent flaws until more data on CME providers become available. Since the published data on which the CME Impact Factor is based is limited to “provider type” (ie, publishing/education company, non-profit, etc.), as opposed to individual provider statistics, some providers may benefit from being in a particularly strong category, ie, medical schools that are accredited with commendation. Though the temptation may exist to regard all medical schools that are accredited with commendation as valued providers of quality CME, it would be naïve to make that assumption. Certainly, there must be some outliers nearing the end of their accreditation term that have not conducted quality CME for some time. It is also irresponsible to believe that a valued CME provider with a high impact score is an expert in all therapeutic areas across all activity types. The more rational belief would be that a particular CME provider is most effective at planning and designing particular activity types in a set of therapeutic areas.

In order to realize the potential of the CME impact factor, more data need to be made available. If the PARS data were available by provider, then potentially, the CME Impact Factor could be calculated in its current format for each individual provider. Stakeholders would be able to determine the potential value of one provider’s educational activities against that of another’s. With increasing demand on participants’ time and commercial supporters’ dollars, this information would be useful in making decisions around which activities to support and to attend. If therapeutic area were included in the annual reporting, then decisions could be made about a particular provider’s ability to conduct valuable educational activities in a particular therapeutic area. Potentially, impact factors could be calculated at the individual provider level based on the accreditation status, type of activity, and therapeutic area.

With Moore’s CME Framework [8] providing the basis by which each individual activity is evaluated, the publication of data regarding a provider’s ability to design programs that attain the higher levels of the framework would also improve the calculation of the CME impact factor. As these data are already being reported to the ACCME through PARS, their publication and inclusion in the calculation of the CME impact factor would easily be realized. More value could be placed on those organizations that regularly design activities impacting physician performance and patient health. Perhaps some weighting could be assigned within the calculation to improve the impact factor of those providers that achieve the higher-level outcomes they set out to measure. This would also create incentive for providers to design more impactful educational activities, thus improving their CME impact factor rating.

The calculation of effect size (ie, Cohen’s d) is another idea that has been proposed as a measure of effectiveness of CME activities, and its inclusion in the calculation of the CME impact factor is certainly within the realm of possibility. Olivieri et al suggest that the calculation of effect size can be a useful tool for CME stakeholders to compare the effectiveness of multiple CME activities and perhaps lead to a determination of which educational strategies are most effective for a specific audience or in a specific therapeutic area [9]. Similar to the inclusion of weighting for the outcomes level realized in an activity, a weighting system could be applied to the calculation of the CME impact factor based on the effect size of that activity. This would be a more ambitious venture because the ACCME would first need to mandate the calculation and reporting of effect size then make public the data received. However, the value that the calculation of effect size would add to the CME impact factor might be worthy of such ambition.
CONCLUSION

The CME enterprise has been an evolving entity since its inception, but the need for a system by which providers and the value of their education can be evaluated has remained consistent. As the call for transparency increases for the CME enterprise, so too does the need for an accepted standard by which CME providers may be fairly evaluated by stakeholders. The CME impact factor offers a tool for CME stakeholders to determine a provider’s ability to design and conduct valuable activities. The simplicity of its calculation and its adaptability to additional data as they become available grants valuable potential to the CME impact factor. If adopted, the impact factor would not only measure providers against each other, but also provide a measured, systematic approach to evaluating those providers and motivating them and the CME enterprise in general to provide better, more impactful educational activities. Competition for the physician audience and commercial support remains stout for many providers, and improving one’s impact factor from year to year may draw in more of each. All CME stakeholders have a shared need for evaluating providers, and the CME impact factor provides one potential solution.

REFERENCES