

# Assessing and Communicating the Value of Biomedical Research: Results From a Pilot Study

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## Abstract

### Purpose

Assessing the impact of research requires an approach that is sensitive both to the context of the research and the perspective of the stakeholders trying to understand its benefits. Here, the authors report on a pilot that applied such an approach to research conducted at the Collaborative Center for Health Equity (CCHE) of the University of Wisconsin School of Medicine and Public Health.

### Method

The pilot assessed the academic impact of CCHE's work; the networks between CCHE and community partners; and the

reach of CCHE's programs, including an attempt to estimate return on investment (ROI). Data included bibliometrics, findings from a stakeholder survey and in-depth interviews, and financial figures.

### Results

The pilot illustrated how CCHE programs increase the capacity of community partners to advocate for their communities and engage with researchers to ensure that research benefits the community. The results illustrate the reach of CCHE's programs into the community. The authors produced an estimate of the ROI for one CCHE program targeting childhood

obesity, and values ranged from negative to positive.

### Conclusions

The authors experienced challenges using novel assessment techniques at a small scale including the lack of comparator groups and the scarcity of cost data for estimating ROI. This pilot demonstrated the value of research from a variety of perspectives—from academic to community. It illustrates how metrics beyond grant income and publications can capture the outputs of an academic health center in a way that may better align with the aims of the center and stakeholders.

**M**edical research has traditionally been evaluated through short-term metrics, but justified on long-term bases (e.g., health and economic benefits). Short-term metrics include the numbers of articles published, students trained, and funding dollars granted. These metrics remain markers of academic quality but do not measure the benefits of medical research reaped by society, which include better health and improved well-being. Additional indicators are necessary to capture and communicate these benefits.<sup>1</sup>

In 2011 the Association of American Medical Colleges (AAMC), in partnership with RAND Europe, started an initiative to promote a more holistic tool set for

cataloging the value of research. We developed the tool set to help academic health centers (AHCs), scholars, funders, and the public better understand and support research.

The AAMC initiative proceeded in phases that have been described elsewhere.<sup>1</sup> First RAND Europe reviewed research evaluation frameworks used throughout the world, along with the specific tools and methods these frameworks entail.<sup>2</sup> Second, the AAMC and RAND Europe held workshops during which medical college faculty and research leaders not only determined which approaches for evaluating research would be appropriate for medical colleges but also identified key stakeholders who might benefit from a pilot to test the approaches. A third phase of the work validated the stakeholders' interests.<sup>1</sup> A separate publication has detailed the long list of metrics and the groups of metrics identified as relevant to U.S. medical colleges and their stakeholders.<sup>3</sup> Finally, the AAMC and RAND Europe worked with the University of Wisconsin School of Medicine and Public Health (UWSMPH) in Madison, Wisconsin, to pilot some of the approaches developed.

Together, we selected a set of approaches and metrics particularly relevant to UWSMPH and its stakeholders. Here, we have summarized the pilot study and its results.

### Method

We have conducted this pilot study in collaboration with the Collaborative Center for Health Equity (CCHE), which is a National Institute on Minority Health and Health Disparities P-60 Center of Excellence housed within the UWSMPH's Institute for Clinical and Translational Research. We identified CCHE through its previous engagement with the RAND Europe/AAMC initiative. CCHE represented an ideal entity to study for the pilot because it provided a diverse but compact portfolio of projects all focused on training health equity researchers and conducting translational research with communities.

UWSMPH stakeholders reviewed a long list of possible metrics.<sup>2</sup> Next, on the basis of their interests and data availability, they selected six metrics to study; these covered a diversity of research impacts, from knowledge to improved health, and

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a range of feasibilities, from routine to ambitious.<sup>3</sup>

We have organized the six metrics identified by CCHE into three groups:

1. **Internal:** These assessed academic impact. We used training data to reflect CCHE's role in capacity building, and we used emerging bibliometric data to show the topics and reach of published works.
2. **Networks and relationships:** These assessed the impact of research on CCHE's community partners. These metrics included interview and survey data, which we used to explore the application of the Steps Model (explained below) to understand relationship building.
3. **External:** These assessed the wider health and social impact of CCHE's work. We selected these metrics because of their novelty and because we could use them to test the feasibility of quantifying both the breadth and the depth of an entity's research impact.

Notably, the metrics selected to study the research impacts of CCHE are illustrative; they do not represent a universal model to be applied elsewhere. The selection and combination of metrics will be unique for each institution based on its focus, stakeholders, and assessment needs. Likewise, the metrics selected cannot provide a complete evaluation of all the activities of the CCHE. Instead, they are intended to illustrate how different types of metrics and approaches can be used to provide evidence of the benefits resulting from an AHC's research that emanates to the wider community.

The RAND Europe team comprised six researchers—one an econometrician—all experienced in evaluation and impact assessment (the team included authors S.G., J.K., B.G., G.C., and S.W.). Together they spent around 75 business days (or about 600 hours) working on the pilot. Collectively, CCHE staff (including authors A.A., S.E., and C.S.) spent a total of around 40 working days (or about 320 hours) on the pilot. In addition, the team commissioned bibliometric data for several metrics (i.e., citation or impact and coauthorship information) from the Observatoire des Sciences et des Technologies (OST). We used previously

collected survey data from graduates of two leadership training programs (both described below): the Health Equity Leadership Institute (HELI) and Advancing Health Equity and Diversity (AHEAD). Additionally, we (specifically, members of the RAND Europe team) conducted the interviews with and surveys of community partners. The AAMC reviewed the research protocol and deemed it exempt.

#### **Internal metrics: Academic impact**

As mentioned, the first two metrics focused on the academic impact of CCHE.

**Training and mentoring of future research leaders.** CCHE runs two main programs—HELI and AHEAD—to train future research leaders. Participants receive access to experienced researchers who provide informal advice and mentoring.

HELI is a weeklong “research boot camp” focused on increasing the number of investigators, particularly minority investigators, engaged in health disparities research. HELI targets junior faculty to increase the likelihood of their promotion and tenure at health research institutions.

The AHEAD initiative, a collaborative of five UWSMPH programs, focuses on postdoctoral or junior faculty scholars. AHEAD participants learn to use translational research approaches for investigating topics in health disparities and health equity.<sup>4</sup> Like HELI participants, many AHEAD scholars are from underrepresented minority groups.

To gather the data on HELI and AHEAD scholars, we collated and deidentified responses from annual questionnaires, compiled bibliometric data on graduates' publications, and extracted funding information on graduates from the National Institutes of Health reporter.

**Academic performance.** To gather information on the academic performance of faculty at the CCHE, RAND staff (G.C., S.W., and S.G.), in collaboration with OST, conducted bibliometric analyses of publications authored or coauthored by CCHE faculty between 2010 and 2014. To calculate normalized metrics of performance,

such as those we have used here, required access to a comprehensive bibliometric database (either Scopus or Web of Science) which, in turn, required collaboration with a specialist bibliometric provider. Interpreting the data also required bibliometric expertise.

In addition to examining the bibliometric data, we also examined the networks among CCHE-affiliated authors and their coauthors. For the pilot we made use of a bibliometric database built by the OST, which was based on the Thomson Reuters Web of Science.

#### **Networks and relationships: Impact on community partners**

The next two metrics provided information about the relationships between CCHE and its community partners. The first was a survey of a range of partners, and the second was the exploration of one relationship in depth through interviews. We chose the particular community partner for the in-depth review on the bases of its long-standing relationship with CCHE and its capacity to engage with the research. The survey and interview protocol were structured around the Steps Model developed by CCHE to investigate research–community partnerships.<sup>5</sup> This model provides an overview of the steps involved in developing a research partnership and highlights challenges, keys to success, and activities at each step. RAND Europe developed the survey and interview protocols, which the research partners (AAMC, UWSMPH) reviewed and approved. Hour-long interviews were conducted by telephone (J.K.), recorded with consent of the interviewee, and analyzed (J.K. and S.G.) using NVivo software (Victoria, Australia) to identify common themes.

#### **External metrics: Wider health and social impact**

The final two metrics attempted to quantify the impact of CCHE research on society through estimating how many people had been “touched” by the research program and the economic return on investment (ROI) of one intervention. We defined “touched” as participating in, or being influenced by, a CCHE program or intervention. We based the numbers reported here on the CCHE's and community partners' administrative data.

To test whether we could estimate an economic ROI for a previously implemented community intervention, we selected the project most likely to be analytically tractable: Healthy Children, Strong Families (HCSF). The HCSF study, which aimed to reduce levels of obesity through a family-based intervention working with American Indian (i.e., Native American) children ages 2 to 5 and their primary caregivers, had produced quantifiable improvements in health between 2012 (when HCSF began) and 2014 (the most recent year for which data were available when we began our analyses). Notably, we did not select the project judged to have had the largest benefit; rather, we felt HCSF would be the project most amenable to an ROI analysis because of the following qualities:

- The project had a delineated community,
- The project was intended to modulate a significant risk factor,
- The project's duration was sufficient to yield actionable data,
- Data were available for analysis, and
- Data allowing us to estimate the change *absent* (or without) the project were also available.

We assessed the economic ROI by comparing childhood obesity at baseline and year 2 of the study. We estimated the costs of obesity by summing additional health care costs (from existing literature; see below) and monetizing the reduction in life expectancy.

## Results

### Internal: Academic impact

**Training and mentoring of future research leaders.** Of 79 HELI scholars whose responses to annual surveys we had, 49 (62%) felt the program had been “greatly influential” on their career development, and 28 (35%) had been promoted since participating in HELI (notably, interpretation of these data would benefit from a comparator group). HELI scholars have built networks with their classmates and instructors: 49 (62%) reported remaining in touch with other HELI participants; 23 (29%) reported collaborations with HELI colleagues; and 24 (30%) reported maintaining links with HELI presenters, faculty, and CCHE staff.

### CCHE academic performance.

Bibliometric analysis showed that the 109 HELI scholars published 545 articles, with, collectively, 1,529 coauthors. We found little coauthorship among HELI scholars, suggesting that the mentioned collaborations had yet to produce papers. Only 1% of the coauthors were community partners, and a random sample of 50 papers identified only seven acknowledgments of community partners.

A standard bibliometric indicator—the average relative citation rate (ARC)—is available for scholars who want to measure the impact of their published articles. ARC measures the number of citations received, *normalized to account for publication year and scientific field*.<sup>6</sup> This normalizing corrects for differences in citation practices among disciplines and over time and allows for the comparison of scholarship across research fields. We used fields defined according to the National Science Foundation journal classification system. The ARC for HELI scholars is close to the world average, with small fluctuations from year to year (Figure 1). The ARC for all AHEAD scholar publications (2010–2014) is slightly above the world average for their field, although data were unavailable for their years of participation in the program and hence not shown.

We collected and similarly analyzed the articles authored by CCHE-affiliated researchers. Figure 1 shows the ARC by year of publication relative to the world average (1.0). The relatively small number of publications by CCHE-affiliated researchers means that significant stochastic variation occurs between years.

The coauthorship network of CCHE scholars (Figure 2)—part of the bibliometric analysis—shows the diversity of author affiliations within different clusters of publications from CCHE. CCHE-affiliated researchers have produced articles with colleagues from the University of Wisconsin, community partners, and scholars from other universities and nonacademic institutions on a range of different research topics including (among others) health equity, telemedicine, tobacco use/smoking cessation, obesity/healthy living, and mental health.

The networks show that both the degree of including community partners

and the extent of U.S.–international collaborations vary. By comparing networks for 2010–2012 and 2013–2015 publications, we see increased output and greater cross-linking as CCHE developed.

### Networks and relationships: Impact on community partners

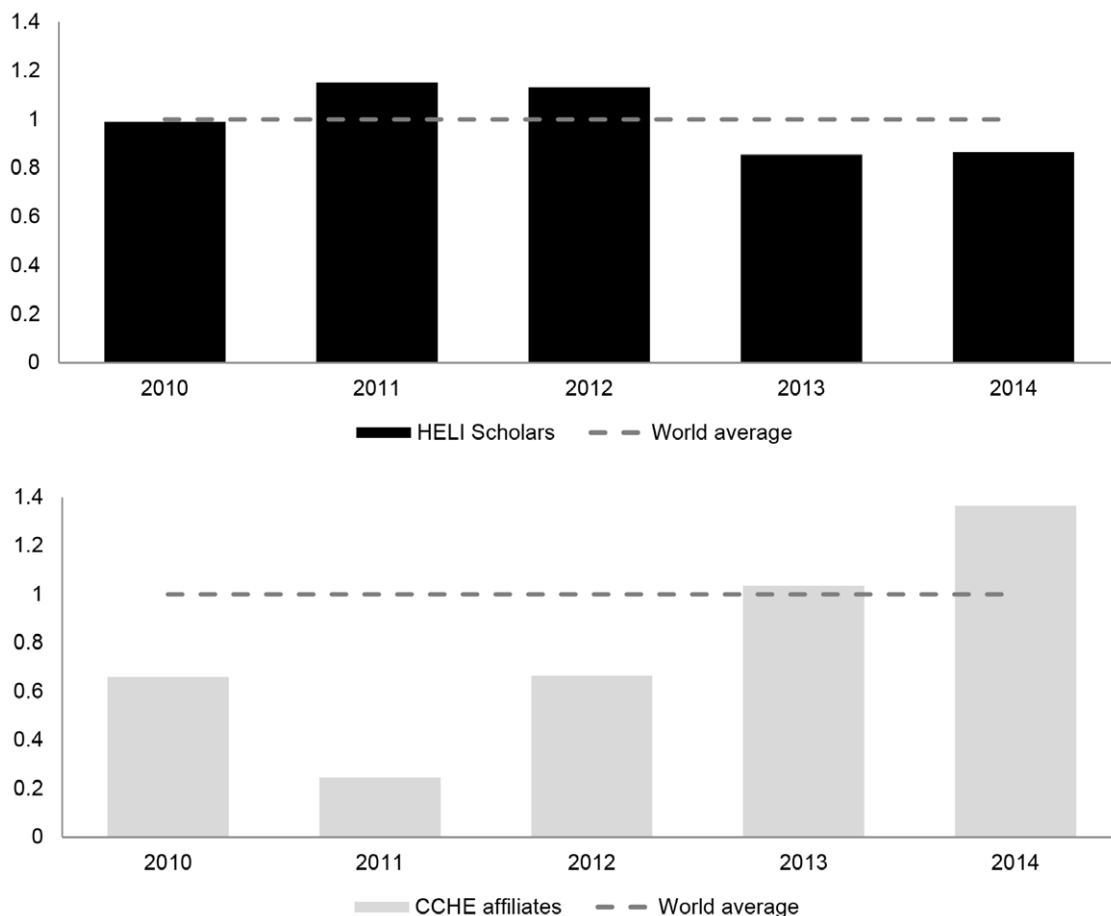
As mentioned, we conducted a survey and interviews to measure CCHE's impact on its community partners. Eight respondents representing six community partner organizations (two organizations had two respondents) completed the online survey, and we conducted six interviews (five with current staff members and one with a former staff member of the United Community Center [UCC; described below]).

**Impact across all partners.** The survey results revealed that community partners felt the partnership had both strengthened their advocacy on behalf of their communities (a theme identified in the Steps Model<sup>5</sup>) and increased the interest of the community in their work. Four community partners thought the partnership had improved the health of the community. Table 1 summarizes key impacts, as perceived by community partners.

**In-depth analysis of the impact on one key partner.** The UCC is a social service agency serving primarily people of Hispanic origin who live in and near the south side of Milwaukee, Wisconsin. UCC serves residents of all ages in the areas of education, cultural arts, recreation, community development, and health and human services. One UCC interviewee noted the strengthened advocacy that has resulted from its partnership with CCHE:

It [the partnership] is making us be more selective and wiser in the kind of partnerships we get into ... the community looks to us to vet these things and helping them to understand what these researchers are wanting or needing ... vice versa it helps if researchers have been referred by [academic partner] and are open to hearing from the community on how best to approach the community, on how to best get the information. And sometimes we send them back, to rewrite, rethink ... we have to see what is the long-term value not just for the researcher, but what is the long-term value for the community.

In addition to asking about community benefits, we inquired—of survey participants and UCC interviewees



**Figure 1** Average relative citation rate (ARC) of Health Equity Leadership Institute (HELI) publications (top) and Collaborative Center for Health Equity (CCHE) publications (bottom) from 2010 to 2014. The ARC measures the number of citations received normalized to account for the year of publication and the scientific field. The figure for HELI scholar publications (n = 545) shows the average relative citation for each training cohort, by year of participation, and how they compare to the world average (1.0). Publications are included for the year of participation and years after. Citations appear to be relatively consistent throughout, with citations around the world average. The figure for CCHE publications shows the differences year-on-year (by year of publication) in average relative citations, and how CCHE’s ARC compares to the world average (1.0). Although there appears to be an upward trend from 2011, the small sample of papers (n = 30) means that drawing conclusions on this indicator is difficult.

alike—how CCHE benefited from the partnership. Survey participants noted that the partnership improved CCHE’s access to research participants and the quality of its research. An interviewee from UCC noted:

What I experienced firsthand was that the research is better.... When it is done well, the results, and by the results I do not mean satisfying the hypothesis, but what I mean is getting accurate data that represents the true state of the community. That’s the best benefit for research.

**External: Wider health and social impact**

**Lives touched.** We mapped engagement with programs to four levels (Table 2).

*The first level.* The first level consists of those directly involved in delivering

CCHE programs (e.g., CCHE research ambassadors, researchers leading training and research programs, and volunteers engaged in running activities). The stakeholder groups for this first level are academics, community members, and health care practitioners.

*The second level.* The second level consists of those directly benefiting from CCHE programs. Level 2 beneficiaries include, for example, students and scholars enrolled in training programs (including HELI and AHEAD scholars) or engaged in projects (e.g., the HCSF intervention). Other Level 2 beneficiaries include, like in Level 1, community members, such as those who enrolled in a randomized controlled trial. In sum, the stakeholder groups for this level are academics (primarily students) and community members.

*The third level.* The third level consists of members of the wider community affected by CCHE initiatives. Community members who remain engaged with CCHE, even after a program they participated in has ended, represent one example. Other Level 3 beneficiaries include those who participate in follow-up, replication, or tangential projects led by others outside CCHE and/or those who engage in the CCHE’s social media venues (e.g., Twitter and Facebook). The stakeholder groups for this third level are community members. Notably, we split social media participants into a separate group because of the different nature of engagement in those venues.

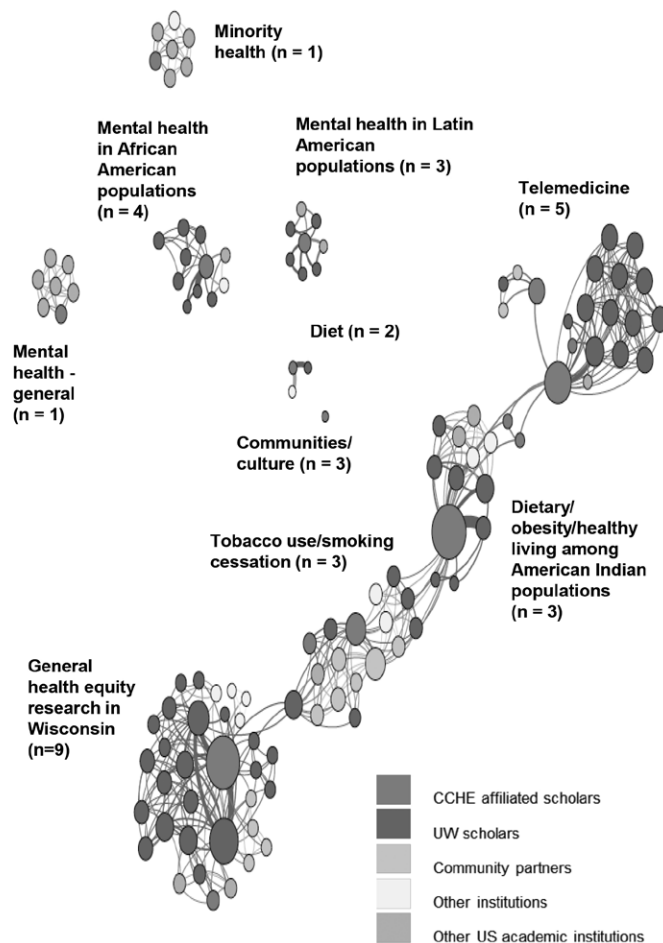
*The fourth level.* Finally, the fourth level consists of those in the wider community whose lives have potentially been



## 2010 - 2012



## 2013 - 2014



**Figure 2** Maps showing the networks of CCHE-affiliated authors and their coauthors (2010–2012 and 2013–2015). This figure presents the external collaboration network of CCHE publications (n = 47) for the period 2010–2015. Nodes represent authors (shaded by affiliation), linked by lines representing coauthorship on articles with CCHE scholars and other collaborating authors. The lines between nodes represent coauthorship on a particular article. Clusters of nodes are labeled with their research area. CCHE staff identified these research areas based on the articles and authors included within each cluster. Node size relates to the “degree of centrality” of each author, defined as the number of immediate contacts (or in this case, the number of coacknowledgments) an author has in a network. Finally, the thickness of the lines connecting the respective nodes represented the strength of that collaboration (i.e., the number of copublished articles).

affected by any CCHE initiative. We base this number on the estimated size of demographic groups targeted by CCHE. Where possible we tried to define a target population for each program separately. The stakeholder groups for this level include community members.

**Impact on community health.** The HCSF study, which we selected for our ROI analysis, showed improvements in child and adult fruit and vegetable consumption, decreased TV time, and reduced body mass index (BMI).<sup>7–9</sup> Our analysis attempted to monetize the health benefits identified in the trial.

We analyzed the number of children who were initially obese (who became nonobese) and the number who were initially not obese (who became obese). To enable the use of data from cost and mortality studies, we dichotomized children broadly as either obese or not obese.

Of the 98 children successfully followed in the two-year study, 67 were initially nonobese, of whom 9 became obese (BMI > 95th percentile for age and sex).<sup>10</sup> The remaining 31 were initially obese, 10 of whom became nonobese. This represents a net reduction in 1 case of obesity; however, if the general trend is

an increase in obesity, the intervention may be preventing additional cases of obesity. If we were to include 2 prevented cases, we could double-calculate effectiveness; however, we did not have a matched sample to determine “normal” progression of childhood obesity in American Indian children. We used BMI as a proxy for obesity-related morbidity even though other factors, including percentage of body fat or fruit and vegetable consumption, may be better proxies. We used several different estimates to monetize greater life expectancy resulting from the decreased mortality associated with decreased obesity, by using estimates of the value

**Table 1**  
**Results From Survey of Six Community Organizations That Partner With the CCHE<sup>a</sup>**

Question stem	Question	Organization 1	Organization 2	Organization 3	Organization 4	Organization 5	Organization 6
<b>Our partnership with CCHE has resulted in</b>	More community interest in our organization's work	Strongly agree	Strongly agree	Strongly agree	Agree	Strongly agree	Agree
	Our organization being better able to advocate on behalf of the community	Agree	Strongly agree	Strongly agree	Agree	Strongly agree	Agree
	Improved community health	Agree	Strongly agree	Strongly agree	Don't know	Strongly agree	Don't know
<b>Through the partnership we have</b>	Secured funding independently to support our organization's activities	Yes	Yes	Yes	No	Yes	Yes
	Increased community members' research skills	Yes	Yes	Yes	No	Yes	Yes
	Increased community members' understanding of data	Yes	Yes	Yes	Yes	Yes	Yes

Abbreviation: CCHE indicates Collaborative Center for Health Equity.

<sup>a</sup>The CCHE is based at the University of Wisconsin School of Medicine and Public Health in Madison, Wisconsin. The table covers only 6 of the 33 questions asked in the survey.

of a quality-adjusted life year (QALY). The lowest estimate of a QALY, \$31,000, comes from the National Institute of Health and Care Excellence in the United Kingdom.<sup>11</sup> The middle estimate comes from a *Time* magazine article suggesting that the standard for the U.S. health insurance industry is \$50,000 per QALY.<sup>12</sup> The highest estimate—from estimates of the costs to Medicare of funding kidney dialysis and of the corresponding quality-of-life benefits—suggests a QALY value of \$129,000.<sup>13</sup>

Notably, our estimate for additional lifetime medical costs of childhood obesity (from Finkelstein et al<sup>14</sup>) takes into account nonobese children who become obese later in life. If HCSF reduces this subsequent risk of obesity, we are *underestimating* HCSF's benefits. The central figure (\$12,000; see Table 3) is the estimate of lifetime medical costs of obesity preferred by Finkelstein and colleagues, which we have further discounted in the present

value calculation to adjust for the younger age of HCSF participants (as compared with the age assumed by Finkelstein and colleagues) and then adjusted to 2015 U.S. dollars. The higher and lower estimates (respectively, \$7,180 and \$40,870) are the extremes from the articles that Finkelstein and colleagues included in their review.<sup>14</sup> Finally, we monetized only the additional years of life gained from avoiding obesity using the QALY estimates, not the improved quality of life, increased productivity, or decreased health risks. Jia and Lubetkin<sup>15</sup> and Finkelstein and colleagues<sup>16</sup> attempted this type of analysis but did not report figures suitable for our analyses.

Given the high degree of uncertainty, our estimated ROI is best expressed as a range, as in Table 3, which illustrates the effects of varying key assumptions. Our most conservative estimates, for both one and two cases of obesity prevented, result in a negative ROI. Increasing the value of

lifetime medical costs of obesity and/or the value of a QALY (i.e., raising the value of a QALY from \$31,000 to \$129,000) results in a positive ROI.

**Discussion and Conclusions**

The pilot demonstrated not only the usefulness of examining the impact of research from the perspectives of a range of stakeholders but also, notably, the extent and variety of the benefits that accrue from research (as perceived by the stakeholders). Different metrics show, for example, capacity building through training, as well as improved child health through an obesity prevention program. The pilot itself provided another avenue for CCHE to engage its community partners, and it highlighted anew the benefits the community sees in academic partnerships.

The interaction of research and society, and the benefits from research accrued by academia and communities, are complex

**Table 2**  
**Number of Lives “Touched” by CCHE-Based Research, 2009–2014<sup>a</sup>**

Level	Description of stakeholders at level indicated	Academics	Community members	Health care practitioners	Social media
1	Directly involved with CCHE in delivering research programs	174	148	20	—
2	Participants in CCHE research programs	279	4,051	—	—
3	Wider community impacted by CCHE research	—	9,552	—	2,366
4	Potential reach of CCHE research	—	278,278	—	—

Abbreviation: CCHE indicates Colloaborative Center for Health Equity.  
<sup>a</sup>The CCHE is based at the University of Wisconsin School of Medicine and Public Health in Madison, Wisconsin. The authors define “touched” as participating in, or being influenced by, a CCHE program or intervention.

and multifaceted. Understanding and assessing those benefits requires a multimethod approach, a range of metrics, and triangulation of findings to provide a fuller picture of the impact of research. This pilot illustrates the feasibility of using metrics beyond traditional measures to capture the outputs of an AHC, and it shows that these outputs may better align with the interests, aims, and priorities of the AHC and other stakeholders. We suggest that our approach—selecting just a small set of metrics—is valuable and generalizable. It is a manageable compromise between a comprehensive evaluation of all effects/ outputs and a narrow assessment of just

traditional metrics. Examining a small set of metrics can provide a tailored assessment framework to address the specific needs of a particular institution.

We also note that we encountered challenges in our efforts to examine a complex research and translation system. For example, the publication outputs of a small research center or institute such as the CCHE may be fewer than for a large center, and small sample sizes will generally produce large stochastic variations in citation levels.

Interpreting results without comparator groups is also challenging. We

were unsure of what a network of coauthorships for a center “should” look like, or how many coauthored publications are ideal. This particular barrier will decrease if other scholars and stakeholders begin to examine other metrics and thereby provide comparative data. We hope that our pilot will inspire other investigators to undertake such studies, and that our findings will provide comparators for those who do. Further, we believe that where results are contrary to expectations, they can stimulate valuable discussion—even in the absence of comparators. For example, our examination of the number of community member coauthors and acknowledgments inspired a discussion on how to better include and recognize these community partners.

Monetizing the health benefits of research is especially challenging. For example, for the HCSF study, we did not have a comparator or matched group of children to determine typical rates of becoming obese (or becoming not obese) over time. BMI was an adequate, but not perfect, proxy for obesity-related morbidity. As mentioned, other metrics—more healthful eating, increased physical activity—might also be useful for measuring and monetizing health benefits. Additionally, no single source of QALY values, especially internationally, is available to match monetary cost with healthiness or illness.

Other metrics, such as the number of lives touched and the health and economic impact of the CCHE’s programs, should resonate with stakeholders in the university, in the state government, in funding agencies, and beyond. Our pilot illustrates the macro and micro challenges of estimating impact. Macro-level estimates require wide agreement on how to value improvements in health, and micro-level estimates require appropriate counterfactuals to provide like data for comparison.

Although challenging, illustrating the value of research is crucial in sustaining taxpayers’ support. Such analyses can also inform center development and policies. This pilot usefully increased awareness and appreciation of researcher networks, uncovered the need to consider how community partners are

**Table 3**  
**Total Benefit (and ROI) of HCSF Given Different Estimates of the Inputs to the ROI Calculation<sup>a</sup>**

Lifetime medical costs of obesity	No. of cases of obesity avoided	Value of a QALY <sup>b</sup>		
		\$31,000	\$50,000	\$129,000
\$7,180	1	\$18,000 (–73%)	\$25,000 (–63%)	\$53,000 (–22%)
	2	\$37,000 (–47%)	\$50,000 (–27%)	\$107,000 <b>(+55%)</b>
\$12,000	1	\$23,000 (–66%)	\$30,000 (–56%)	\$58,000 (–15%)
	2	\$46,000 (–33%)	\$60,000 (–13%)	\$116,000 <b>(+69%)</b>
\$40,870	1	\$52,000 (–24%)	\$58,000 (–14%)	\$87,000 <b>(+27%)</b>
	2	\$104,000 <b>(+52%)</b>	\$117,000 <b>(+71%)</b>	\$174,000 <b>(+154%)</b>

Abbreviation: ROI indicates return on investment; HCSF, Healthy Children, Strong Families; QALY, quality-adjusted life year.  
<sup>a</sup>The total benefit of HCSF is calculated by multiplying the net number of cases of obesity avoided and the benefit of avoiding one case of obesity. The benefit of avoiding one case of obesity is calculated by multiplying the number of years lost on average to obesity and the value of a QALY, and adding the avoided medical costs, with the value of the QALYs saved and medical costs avoided discounted to present values. Present values of future benefits are calculated by applying an annual discount to account for the interest-earning potential of money. ROI is calculated as (benefits – costs) / costs, expressed as a percentage. The assumptions the authors used across all cases are as follows: Life expectancy is 79 years; 3 years of life are lost to obesity per person; the discount rate in the present value calculation is 3%; the program cost is \$69,000. The values in bold italics represent a positive ROI.  
<sup>b</sup>The values \$31,000, \$50,000, and \$129,000 are from, respectively, estimates by Claxton and colleagues,<sup>11</sup> Kingsbury,<sup>12</sup> and Lee and colleagues.<sup>13</sup>

acknowledged, tested a wider range of metrics that will help CCHE-affiliated scholars assess and communicate their research processes and the value of their work, and highlighted the broader nonacademic benefits of research. To our knowledge, this is the first time an AHC has tried measuring its far-reaching impact using metrics defined by internal and external stakeholders. As such, this work represents an initial contribution to important ongoing national discussions on the best ways to measure the broader community impact of medical research.

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