TITLE

Challenges in assessing the characteristics of influential public health research.

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ABSTRACT

The development of frameworks to effectively measure both the scientific and social impact of research is a topic of international interest. This paper examines how Australian public health researchers in six fields (alcohol, drugs, injury, obesity, skin cancer and tobacco) classified the scientific and social impact of what they judged to be their five most influential papers. We compared the classifications of researchers who were rated as most influential by their peers with those not as highly ranked. There was strong consensus on who were the most influential researchers in five of the six research fields examined. Traditional measures of scientific impact (publication in high impact journals and high citations) were nominated by all researchers regardless of their peer-nominated research influence status. Highly ranked researchers identified social impact characteristics of their research (X^2 = 8.13; P = 0.004) more often than their less influential colleagues. The lack of other differences between the ratings of more and less influential researchers probably reflects the limitations of the approach used when asking researchers to assess their own level of social impact. As a consequence, caution is advised when asking researchers to describe the value of their own social impact for research evaluation.

KEYWORDS

Research Excellence Framework

Public Health

Research Impact

Social Impact

Scientific Impact

Influential Researchers

1. INTRODUCTION

In recent decades emphasis has increased on 'research-informed' or 'evidence-based' health policy and practice (Nutley et al., 2007). Research funders have increasingly considered not just the contribution of research to new knowledge but also its value to society through new products, processes, and improvements in clinical practice and the stimulation of policy reform. In the United Kingdom, for example, the Cooksey review of health and medical research funding noted that 'The UK is at risk of failing to reap the full economic, health and social benefits that the UK's public investment in health research should generate' (Cooksey, 2006). Correspondingly, the role of health research has moved from generating new knowledge of uncertain utility to creating more socially applicable knowledge and ensuring that researchers are actively engaged with, and accountable to, society (Gibbons, 1999; Nowotny et al., 2001).

It is less clear how we measure the value of research (Grant et al., 2009; Macilwain, 2009; Smith, 2001). How much weight should be given to the research metrics (publication output, journal ranking and citations) that today inform peer evaluation, academic promotion and institutional rankings? Conversely, how much weight should be given to evidence of social impact and how can this evidence be measured? Critics argue that quantitative measures of scientific impact are poorly related to applied utility and socioeconomic outcomes but the veracity of proposed alternatives are also strongly questioned (Macilwain, 2009) . For example, the proposed UK Research Excellence Framework (REF) attempts to combine measures of scientific impact with a more socially-oriented evaluation of contributions to policy development, advocacy and knowledge dissemination and application (Grant et al., 2009). Within this model 25% of a university's performance would be assessed by panels of stakeholders (business, government, other researchers) 'reviewing thousand-word "case studies" of how work done up to 15 years ago has benefitted the economy and society' (Macilwain, 2009). This proposal has stimulated heated debate among researchers (Nolan et al., 2008). Critics doubt that it is possible to develop a standardised framework that sensitively, objectively and accurately assesses the scientific and social impact of research in socially applied

fields such as public health as well as in scientific fields such as theoretical physics. As a consequence, the research policy community is struggling with how to recognise and reward research that has both scientific and social impact (Cooksey, 2006; Smith, 2001).

Public health is an especially pertinent field in which to consider how scientific and social impact measures of research relate. It has empirical roots, but also has a strong social and political orientation (Rychetnik et al., 2004). It is, by definition, concerned not only with the pursuit of knowledge but also with the application of this knowledge to improve population health (Beaglehole et al., 2004). It is therefore reasonable to assess researchers within public health by their success in achieving both scientific and social impacts.

Previous studies on the social application of research have concentrated on establishing methods to quantify social impact by producing lists of activities with which researchers can engage to maximise the social impact of their work (RNAAS, 2002). Few studies have examined researchers' views on the characteristics of their own research which have had scientific and/or social impact. How researchers assess their own research may have implications for the measurement of 'social impact' in proposed evaluation frameworks such as the REF.

In this paper we examine the views of Australian public health researchers in six fields on the characteristics of their five most influential research publications. We conceptualised 'influence' broadly to encompass the diverse ways in which research findings, dissemination and application may affect not only the research knowledge base, but practice, policy, legislation, public debate and societal views. Following Weinberg's classic internal/external criteria for assessing the value of research (Weinberg, 1963), we sub-divided influence into scientific and social impact. Scientific impact was defined in traditional terms e.g. peer-reviewed publications in high impact journals or publications generating high numbers of citations. Social impacts were developed from societal engagement and applications identified in the literature where research: informs policy and practice development (Kuruvilla et al., 2006; RNAAS, 2002), contributes to public debate (Davies et al.,

2005), attracts media coverage (Benelli, 2003; Cook et al., 1983), improves understanding of health risks or determinants (Armstrong et al., 2009), changes ways of thinking about health problems and/or solutions (Weiss, 1986), or is used as evidence in legal proceedings (Cwik & North, 2001).

Researchers completed an online survey in which they categorised up to five of their most influential research publications against nine indicators of scientific and social impact (see table 2 below). They also nominated peers whom they considered to be most influential. We determined whether the nominations of research impact characteristics differed between those who were ranked by their peers as 'highly influential' public health researchers and those who were not.

2. METHODS

2.1. Participants

During May 2009, we entered selected search strings into Thomson Reuters' Web of Knowledge (WoK) database to obtain a list of authors in Australian institutions who had published a minimum of 10 papers in the past 10 years (1999-2008) in any of six fields of public health-related research (tobacco, alcohol, drugs, injury, skin cancer, and obesity). All these authors' papers from this period were downloaded to a database and assessed for public health-relevance. A public health-relevant paper was defined as one that contained information of possible interest to those active in public health policy development, intervention, surveillance, program evaluation or publicity generation. This information might relate to health or illness in populations, insights into the causes and consequences of population health or illness, or implications for policy and practice.

Many of the papers initially identified by author and key-word searches were not judged as relevant to public health. For example, the "injury" search included surgical papers and the tobacco search several agricultural science papers. Three authors (AH, GD, HS) separately reviewed each researcher's 1999-2008 papers and placed the researcher in one category - *Yes, No or Maybe*. Researchers classified as *'Yes'* had ten or more relevant public health-relevant publications, while those with *'No'* did not. *'Maybe'* was used when the reviewer was uncertain if a researcher had ten or more papers which were public health-relevant. Each list was independently reviewed by two of the authors. All researchers' outputs that were classified by either reviewer as *'Maybe'*, or who had received different categorisations, were reviewed by a highly published researcher in that field for a determination on the public health relevance of their publications. The ultimate test of public health relevance was that all reviewers were required to judge whether a hypothetical grant application in the area of the paper would have been allocated to the Public Health Grant Review Panel of Australia's National Health and Medical Research Council.

Table 1 shows the number of research active authors who were initially identified, those invited to participate in each of the six focal areas, and the number who completed our survey. There was little overlap of researchers in the six fields of interest. However, researchers who appeared in more than one field were asked to complete a separate survey in all fields where they qualified.

Table 1 here

The researchers who were judged as having published ten or more relevant papers (n=211) were invited to complete an online survey in which they were asked to: (1) nominate up to five of their most influential papers in the study period (1999-2008), ; (2) indicate *'In what ways have your nominated publications been influential?'* in relation to the criteria in Table 2 (any or all of these nine options could be used to describe each nominated paper); and (3) nominate up to five Australia-based researchers in their fields whom they considered to be most 'influential in shaping any aspect of policy, programs, legislation, clinical practice or public understanding'. Self-nominations were permitted.

2.2. Scientific and Social Impact Criteria

Ratings against the nine criteria of research influence are shown in Table 2 classified as either scientific (A and B) or social impact (C to I).

Two calculations assessed relationships between scientific and social measures of influence. First, for each influence criterion, we calculated an average score out of a possible maximum 5. A score of 5 would have been obtained if every researcher in each respective health area marked that criterion for each of their five nominated papers.

Second, since researchers were allowed to choose more than one category for each nominated paper, the proportion of responses for the social and scientific impact was calculated using the following

formula; $(N_R/N_C*176)*100$, where N_R is the number of responses for the survey category and N_C is the number of categories (2 for Scientific and 7 for Social Impact). This calculation was then multiplied by the total number of participants completing the questionnaire (n=176). The percentage shown in line 1 of Table 3 represents the number of times the average participant selected that criteria.

Table 2 here

2.3. Nomination of Influential Researchers

The six most nominated individuals in each of the six fields of interest (n=36) were identified as the leading 'influential' researchers (INFL) in each field. Any researcher who participated in the survey who was not so ranked was classified as a not-influential researcher (NOT-INFL) for the purposes of our analysis. All but two of the 36 most nominated influential researchers completed the survey.

A Kruskal-Wallis test (ANOVA alternative) was used to assess whether there were any statistically significant differences in the criteria nominated by INFL and NOT-INFL researchers.

3. RESULTS

More than two thirds (69.9%) of the 176 Australian public health researchers who completed the survey worked in universities and 23.8% worked in independent research organisations or non-government organisations. 126 (71.6%) of the university researchers had achieved the rank of professor or associate professor. 69 (39%) were women.

3.1. Influential Researchers

Figure 1 shows the distribution of rankings made by researchers in each of the six fields for the six most influential researchers in their fields. In all six fields, the total votes received by the six most influential researchers exceeded 50% of all votes cast.

Figure 1 here

3.2. Scientific and Social Impact Nominations

Just under half of the respondents (46.2%) chose at least one scientific impact criteria to characterise their research influence and 36.7% chose at least one social impact criteria. The most popular scientific impact option was A *'Published in a prestigious journal'* (52%) with the other option; *'Received many citations' receiving 40% of the votes'*. The most popular of the social impact options was *'Improved the understanding of health risks and their determinants'* (55.9%). The remaining social impact criteria were more or less equally selected with the exception of H *'Used in Litigation'* which was chosen by very few participants.

Table 3 here

The 34 most influential researchers across the six fields (INFL) differed significantly from all others (NOT-INFL) only on two social impact criteria: *'Informed government decision making'* (P=0.001) and *'Changed ways of thinking'* (P=0.01) – see Table 3.

3.3. Differences between Fields

The only significant difference between the six fields (Table 4) was found for the options *'Improved health risks and determinants'* (P=0.01) and *'Informed government decision making'* (P=0.05).

Table 4 here

We used Kruskal Wallis tests to assess whether the fields and/or researchers differed in the weighting given to scientific or social impact of publications. The survey criteria were added to produce two scores, one for Scientific Impact (Sum of A and B), the other for Social Impact (Sum of C – I, minus H). As very few respondents marked criteria H it was omitted it from the Social Impact score. There was no difference for the scientific impact criteria (X^2=0.005; P = 0.94) between INFL and NOT-INFL researchers but there was a significant difference in the frequency of using the social impact criteria (X^2 = 8.13; P = 0.004). When the same analysis was conducted separately for each public health field, there were no significant differences for the frequency of marking of either the scientific (X^2=4.38; P=0.49) or for the social (X^2 = 0.99; P = 0.96) impact criteria.

4. DISCUSSION

The aim of this study was to examine; (1) whether there would be consensus among researchers within each of the six fields we examined about which researchers were most influential; (2) the patterns of attribution of scientific and social impact characteristics given by public health researchers to their peer-reviewed publications (3) whether these attributions differed between researchers nominated by their peers as the most influential and those who were not.

The highest ranked researchers in all but the injury field were clearly identified by the majority of their peers, suggesting that assessing influential researchers was unproblematic for most participants. However, more interestingly, there was an impressive concordance among active researchers in five of the six research fields about who were the most influential researchers in their own fields.

Researchers reflecting on their five most influential papers generally nominated a mix of both scientific and social impact characteristics. There was no differences in the frequency of nominating scientific impact criteria (X^2=0.005; P = 0.94) between INFL and NOT-INFL researchers. INFL researchers more often checked social impact criteria (X^2 = 8.13; P = 0.004) but these differences were not large.

The only significant difference between our six research fields in regard to nominations of social impact criteria occurred for Option C *'Understanding health risks and their determinants'* and Option G *'Informed government decision making'*. However, these small differences could be related to the nature of the research conducted within each field. For example, many skin cancer researchers are primarily concerned with identifying risk factors and promoting public awareness about avoiding sun exposure. Australian tobacco control researchers, by contrast, have a long history of conducting strategic research that aims to influence legislation and regulatory and fiscal policies (Chapman & Wakefield, 2001).

None of the 176 researchers surveyed criticised the seven social impact criteria we used but it may be that inviting them to only 'tick boxes' in regard to their five self-nominated most "influential" publications was insufficiently sensitive to discriminate between scientific and social impacts of research. Most public health researchers when asked to rate their most influential research will readily indicate that it contributed to 'Improving understanding of health risks or determinants', 'informing practice improvements' or 'changing ways of thinking'. However, such self-assessment may not always accord with peer judgements. Given that health is a common focus of news media reportage (Chapman et al., 2009), and many researchers have had some experience of their work being reported in the media it is surprising that 'attracted media coverage' was not among the most commonly nominated categories.

The seven characteristics of social influence we selected from the literature seem to be relevant to many public health researchers (Armstrong et al., 2009; Benelli, 2003; Cook et al., 1983; Cwik & North, 2001; Davies et al., 2005; Kuruvilla et al., 2006; Weiss, 1986). However, the relative importance of each characteristic probably requires more detailed investigation than a simple yes or no answer with multiple choices allowed. It may be that graded scales (eg: 'never ...always') or a ranking of the importance of each would better capture the influence of research.

There are limitations to our study. First, the statistical power for comparisons across fields was limited by the small samples of researchers in each field, reflecting the modest size of research fields in Australia with a population of around 22.2 million. Second, participants' selections of criteria may have been affected by social desirability. Researchers could use multiple responses rather than being forced to rank order or select the most important subset of the nine criteria. Their responses may have been influenced by the increased emphasis given in Australian research policy to the importance of broader social impacts. It is nonetheless of interest that more influential researchers gave a marginally higher weighting to social impact than did less influential ones. We are exploring these issues in greater depth in extended interviews with the influential researchers identified in this survey.

In conclusion, our findings show that it may be challenging to meaningfully differentiate influential from non-influential research. While peer-rated 'most influential' researchers did differ from their less nominated colleagues in the extent to which they marked two criteria of social influence, the differences were not great. The UK's proposed REF Impact Scoring System involves a self-completion questionnaire assessing over 150 potential research impacts (Grant et al., 2009), many of which required qualitative judgements. This approach would potentially be subject to the same concerns we have demonstrated. It remains to be seen whether different self-report instruments that ask for ranks or ratings might provide more useful data. A more positive finding was the impressive consensus among researchers on which of their colleagues were most 'influential'. This provides a sound sample of researchers with whom to conduct more qualitative interviews to better explore the complexities of research and researcher influence.

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