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Perspective

Expert Views on Their Role as Policy Advisor: Pilot Study for the Cases of Electromagnetic Fields, Particulate Matter, and Antimicrobial Resistance

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This perspective presents empirical data to demonstrate the existence of different expert views on scientific policy advice on complex environmental health issues. These views are partly research-field specific. According to scientific literature, experts differ in the way they provide policy advice on complex issues such as electromagnetic fields (EMF), particulate matter (PM), and antimicrobial resistance (AMR). Where some experts feel their primary task is to carry out fundamental research, others actively engage in the policy dialogue. Although the literature provides ideas about expert roles, there exists little empirical underpinning. Our aim is to gather empirical evidence about expert roles. The results of an international study indicated that experts on EMF, PM, and AMR differ in the way they view their role in the policy dialogue. For example, experts differed in their views on the need for precaution and their motivation to initiate stakeholder cooperation. Besides, most experts thought that their views on the risks of EMF/PM/AMR did not differ from those of colleagues. Great dissensus was found in views on the best ways of managing risks and uncertainties. In conclusion, the theoretical ideal–typical roles from the literature can be identified to a certain extent.

KEY WORDS: Antimicrobial resistance; electromagnetic fields; expert roles; particulate matter; policy advice; Q methodology; uncertainty

1. INTRODUCTION

Scientific knowledge, particularly the position of scientific experts, is publicly contested, especially when the topic under debate is surrounded by uncertainty (Lentsch & Weingart, 2011; Organisation for Economic Co-operation and Development 2015, 2015; The Netherlands Scientific Council for Government Policy [WRR], 2008). Topics exemplifying this uncertainty are electromagnetic fields (EMFs), antibiotic resistance, and particulate matter (PM). Sometimes, debates are covered heavily by the media, as seen in the cases of IPCC Climategate and the L'Aquila earthquake, potentially leading to public distrust of science. When this occurs, expert advice may lose its legitimacy (Martini & Boumans, 2014). Several scholars have discussed the various potential roles of experts in the interplay between science and policy. Wildavsky's (1979) famous phrase, "speaking truth to power," suggests a clear division of labor between science and politics. According to Wildavsky, scientific experts should communicate objective and true knowledge to politicians.

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Jasanoff (1990), however, states that "the notion that scientific advisers can or do limit themselves to addressing purely scientific issues seems fundamentally misconceived" because the idea of the completely impartial, value-free scientist is outdated and the relationship between science and policy is intricate. These competing positions point to the dilemmas that scientists often face in their interactions with policymakers, as well as to the tension between science and policy making in general (McNie, 2007).

Discussions about the position of scientific experts in the policy process are especially likely to occur when knowledge is incomplete, the research subject is characterized by uncertainty, and values are ambiguous. These properties characterize many modern environmental health risks that are complex problems embedded in wider environmental, social, economic, and political systems (Beck, 1992; Briggs, 2008; Klinke & Renn, 2006; Renn & Graham, 2005; Sarewitz, 2004; Van Asselt, 2010; Van Asselt & Renn, 2011). The World Health Organization (WHO) defines environmental health risks as "all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviors. It encompasses the assessment and control of those environmental factors that can potentially affect health" (WHO, 2012).

In many cases, the effects of environmental health hazards may be determined to be irreversible before conclusive scientific evidence becomes available. This requires policymakers to make decisions even when the available data are scarce, uncertain, and contradictory (Van der Sluijs, 2010; Wardekker, Van der Sluijs, Janssen, Kloprogge, & Petersen, 2008). Hence, there may be pressure on scientific experts to give policy advice even under conditions of substantial scientific uncertainty and ambiguity of values. Our interest lies in the roles of scientific experts and the tension that results from the combination of uncertain knowledge with society's demand for clear policy advice. In this article, we present an approach to examine the ways in which scientific experts cope with this tension, with an empirical focus on the topics of EMFs, PM, and antimicrobial resistance (AMR). These cases were chosen because they are all complex environmental health issues surrounded by scientific uncertainty, but they differ in the level/type of uncertainty that affects them, the societal unrest they cause, and the current policy processes addressing them. These three topics entail disparate risks. The list of complex issues that we could have studied is longer and subject to change. Other issues worthy of study are, for example, nanotechnology, endocrine disrupters, and climate change.

The debate over EMF focuses on whether a causal relationship exists between exposure and adverse health effects at the exposure levels experienced by the general population. Reviews of the association between EMF exposure and health effects in the general population either show no association or report insufficient and contradictory evidence. Although long-term health effects remain uncertain, concerns in the general population about such effects persist. The policy process currently addressing EMF relies on regulatory science and is directed at monitoring, compliance, and debating ways to cope with the general public's worries about possible health effects. The notion of regulatory science can be generally described as the sciences targeted at addressing the challenges of regulatory and policy processes (Jasanoff, 1990; Weinberg, 1972).

The debate regarding PM mainly concerns the health impacts of different particle types, the underlying causal mechanisms of these health impacts, and the nature of the exposure–response relationship for various health endpoints. The quality of outdoor air has improved in recent decades in much of the Western world. Concurrently, the evidence of health effects resulting from long-term chronic exposure to air pollution at levels currently experienced by the general population has grown more compelling. Research efforts on PM can be described as regulatory science: the focus is on identification of the most toxic constituents, monitoring, compliance, and approaches to cost-effective emission reductions from various sources to reduce exposure and the health effects associated with exposure.

The debate over AMR focuses primarily on the question of how to cope with the global threat of emerging antibiotic resistance. What are the transmission routes and potential impacts of resistant bacteria on human health? Given such uncertainty, which policy measures can be taken and what is the proportionality of the possible measures? Current measures aiming to counter AMR follow the paradigm of human medicine: that is, infection prevention, screening, treatment, and isolation of infected hospital patients. Future measures may be stricter, which would raise ethical questions: for example, can we isolate individual patients for months using the argument that such a strategy would benefit public health? The policy process currently addressing AMR is different from the EMF and PM processes. There is no regulatory science because medical doctors (i.e., experts) are also making professional policies. In many cases, these policies are made on the national level, and adjusted and implemented at the institutional level, that is, in hospitals and other health-care facilities.

The debates involved in all three issues raise the question of how experts address requests to provide policy advice under conditions of scientific uncertainty. Linked to all these debates is the question of whether (precautionary) measures should be taken and, if so, what these measures should consist of. Theoretical approaches to these questions exist, but empirical foundations are limited (Spruijt et al., 2014). Among others, Pielke (2007) and Weiss (2003) published typologies that address four and five roles, respectively, that experts can assume when providing policy advice. Central to their descriptions is the notion that scientists assume different expert roles in different situations. Our claim is that more data and insight need to be added to the small existing empirical knowledge base, and we demonstrate in a pilot study a method to do this for three cases. Based on existing theories one would expect there to be four or five expert roles. The method that we use to explore expert roles in empirical data leaves open how many roles will be found. Note that the ideal–typical roles described in the literature show different perspectives on expert roles but also some overlap (Spruijt et al., 2014).

This study aims to answer the following research questions: How do experts view their roles when providing policy advice on EMF/PM/AMR? and What are the main similarities and differences between experts' views of their roles in the fields of EMF, PM, and AMR?

2. METHODS

To explore expert views on their roles as policy advisors, we selected and approached internationally renowned experts and performed a Q-method survey. The Q survey first involved the formulation of statements (Q sample) on various aspects of potential expert roles. Experts were then asked to score and rank these statements. Finally, a Q-factor analysis was performed on the experts' scores to identify similar response patterns among experts. Clusters of similar patterns were then interpreted by the authors. We also performed a qualitative analysis to address two open-ended research questions. A full description of the methods and pilot study results can be found in the Supporting Information.

3. MAIN FINDINGS

In total, 92 experts participated in the consultation: EMF (32), PM (31), and AMR (29). One of our main results was that expert roles (i.e., factors) were dominated by specific fields: AMR, EMF, and PM, respectively (see Supporting Information for background information). The principal component analysis (PCA) resulted in six factors, which we interpreted as representing the following six roles: (1) engaged scientist, (2) pro-science expert, (3) regulatory advocate, (4) humble scientist, (5) transparent expert, and (6) issue advocate. Engaged scientists highly valued scientific knowledge and stressed the importance of a continuous dialogue between scientists and policymakers. Pro-science experts strongly agreed that new policies should be based on scientific knowledge, that knowledge possessed by the general public is less valuable, and that monitoring is the most suitable way to address the risks and uncertainties of EMF/PM. Regulatory advocates strongly agreed that possible health problems are best managed through legislation and regulation, that scientists should publish in peer-reviewed journals as their primary responsibility, and that they are not responsible for maintaining a continuous dialogue with policymakers. Humble scientists strongly agreed that scientists should be humble about the role of science in solving societal problems and had modest judgments regarding most other statements. Transparent experts emphasized the importance of transparency regarding research methods and assumptions, explicating differences of opinion among experts, and informing policymakers about the science underlying policy advice. Finally, issue advocates focused on actively interacting with policymakers and politics; they were fairly neutral in regard to the policy measures that should be taken.

Q methodology asks participants to rank order statements in a forced distribution, which results in an overview of existing subjective view patterns in a group of people. The six observed roles show the dominant patterns of viewpoints that exist in the expert group we studied. The six roles demonstrate different views regarding both experts' willingness to act on uncertain risks and experts' roles in interacting with policymakers. The views in the observed factors range from "no need for additional measures or research" to "investment in additional regulation, legislation, and research." This supports the theory of Weiss (2003). The observed roles also show support for Pielke's theory (Pielke, 2007) that experts hold different views of their roles when interacting with policymakers in highly uncertain and politicized contexts. Views of the interaction between scientists and policymakers range from strict separation to continuous dialogue.

4. DISCUSSION

4.1. Sensitivity Analysis

Two different methods have been described and advocated for the analysis of Q-method data: the first is PCA in combination with a varimax rotation, and the second is centroid analysis in combination with a manual rotation. Both strategies include arbitrary selection criteria, such as the minimum number of respondents loading significantly on a factor and the threshold that determines whether a sort (i.e., an individual view) loads significantly on a factor. We tested both strategies on our data in a sensitivity analysis. We found a large overlap between the two approaches. More information about the sensitivity analysis can be found in the Supporting Information.

4.2. Selection of Experts

We used a structured expert selection procedure, based on nominations from the top 50 published experts in their fields. The nomination process resulted in two groups: singly and multiply nominated experts. This raises the question whether all experts should be treated equally or whether the judgments of some should be rated more highly than others (differential weighting) (cf. Bolger & Rowe, 2015). Because we cannot assess the extent to which the consulted experts are engaged or influential in the policy arena, we decided to give all experts equal weight.

We observed differences in the nominees among the different fields. For AMR, the number of nominated experts was highest (132), while the number of multiply nominated experts was lowest. For PM, the number of nominated experts was 98 and the number of multiply nominated experts was highest (up to 12 nominations per expert), which indicates that the consensus among nominators regarding the top international experts in a particular field is diverse. Out of the multiply nominated PM experts, 58% participated; from the multiply nominated EMF experts, 41% participated. For AMR, this rate was 28%. In conclusion, compared to the other two fields, the sample of PM experts is more broadly supported by the selection of the top 50 published authors. We speculate that this is partly a consequence of the current stages of development of the fields, ranging from a well-established field with longer traditions (PM) to newer developing fields like EMF and AMR. This may also explain why AMR experts nominated more key scientific issues in the open questions than did the experts from the other two fields.

4.3. Comparison of Theory and Empirical Data

The factors with the largest number of significant loadings and highest explained variances in the case-specific analyses are also found in the overall PCA. More specifically, factor 2 (pro-science expert) and factor 3 (regulatory advocate), as described in this article, show strong similarities with, respectively, factor 2 in the EMF analysis (cf. Spruijt, Knol, Petersen, & Lebret, 2015) and factor 1 in the PM analysis (cf. Spruijt, Knol, Petersen, & Lebret, 2016). Factors 1, 4, 5, and 6 in this pilot study show combinations of factors from the previous case-specific analyses.

In our earlier literature review, we identified a number of notions and ideal–typical classifications of expert roles, particularly those of Wildavsky (1979), Pielke (2007), and Weiss (2003) (Spruijt et al., 2014). This review also identified a number of suggestions from different schools of thought for improving the ways in which experts (should) advise on complex issues. These suggestions include the following: (1) transparency in methods and assumptions; (2) professional attitude of humility; (3) explicating different points of view within the expert community; (4) democratizing science (i.e., stakeholder dialogues); (5) public participation; and (6) precautionary principle. We developed our Q-method statements based on these notions and classifications. Among the participating experts, broad consensus was observed on the necessity of being transparent about methods and assumptions. We also found support for the view (represented in the literature) that there is no strict separation between science and policymakers, but rather that the two are interlinked (not in the sense of "speaking truth to power" but rather engagement in continuous dialogue).

Views regarding the importance of a professional attitude of humility were diverse: engaged scientists see no need to be humble, whereas experts who loaded on the factor "humble scientist" obviously hold an opposite view. A diverse view was also found regarding the notion that different points of view within the expert community should be made explicit: transparent experts most strongly agree with this statement and issue advocates slightly disagree. Views on public participation and democratizing science were also diverse. In general, we observed no strong support among experts for initiating public participation. There was some support for assessments of scientific output by an extended peer community of all affected parties. Great diversity was found on the best ways of dealing with the risks and uncertainties of EMF/PM/AMR. Views ranged from supporting the need to monitor, to supporting additional regulatory measures, to supporting significant investment in precautionary measures. To illustrate the latter, pro-science experts and regulatory advocates hold completely opposing views on the statement that the risks and uncertainties of EMF/PM/AMR warrant significant investment in precautionary measures. The dissensus statements showed empirical evidence for Weiss's (2003) theoretical assumption that experts differ in their willingness to act and assessment of the necessity to act regarding uncertain risks.

Overall, we suggest that the existence of different expert roles can be proven by using the method that is used in this study. Empirical studies such as the present one may have implications for further research and possibly for the organization of expert advice. Further research should check our pilot study observations; at present, there is few other empirical data to go on. Alternative approaches to our Q-method approaches, for example, argumentation analysis, observation of roles, and actual behavior of experts in expert committees merit consideration.

The importance of context has been previously described in the literature (Spruijt et al., 2014). Indeed, the results of the present study of three cases provide preliminary evidence of the importance of context, as can be observed from the differences between the three cases. In this cross-sectional analysis of the responses we cannot assess to what degree the results are replicable.

We observed that experts themselves may be unaware of the normative aspects in their advice. Our empirical observations provide further substrate for a debate among professionals about conflicts of values and the different ways in which bureaucratic and academic organizations function (time horizons, communication styles, etc.) (Merton, 1945). We argue that normative aspects should be more explicitly addressed in the process of giving scientific policy advice; this is in line with the broad appeal for transparency, both in the literature and among our respondents. Also, in the composition of expert committees, not only the different disciplines need addressing, also the representation of different expert roles needs consideration.

Expert committees in which only one or two expert roles are represented may provide unbalanced and biased results with respect to available action perspectives for policymakers and stakeholders. The composition of scientific advisory committees is generally based on a set of criteria such as their individual knowledge base, their status as authorities within their field of study, and their willingness to put their knowledge at society's disposal in a disinterested way (Hendriks, Bal, et al. 2004). Expert roles could be added as selection criteria. A committee consisting of experts representing all dominant views and roles is more likely to present robust advice—advice that is broadly supported.

5. CONCLUSIONS

We have highlighted the importance of the empirical study of expert roles in a study for three different environmental health fields. We used a structured two-stage expert selection process. Our results support theoretical notions from the literature, but our empirical evidence shows an even richer variety than the classifications found in the literature. Experts generally agreed that they should be transparent about their research methods and assumptions made when giving policy advice. There are marked differences in views about whether and how experts should interact with policymakers, about whether to interact with stakeholders, and about the need for/usefulness of various action perspectives on uncertain health risk problems. Some of these views were more dominant in one research field than another. A particularly contested issue was the need for precautionary actions in response to uncertain health risks. We recommend that more empirical studies are done; these can use a similar method as the one we have demonstrated here.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Fig. 1. Example of score sheet used for the ranking of statements

Table I. Nomination of Participants in Numbers

Table II. Background Variables

Table III. Number of Experts and Explained Variance by Field
Table IV. Summary of Main Characteristics of the Six Expert Roles
Table V. Likert Scale Scores on Questions About Factors Possibly Associated with an Expert's Role
Table VI. Sensitivity Analysis of Centroid Analysis Versus Principal Component Analysis; Number of Experts Loaded on Factors and Explained Variance
Appendix: Factor Q-Sort Values for Each Statement