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Health impact assessment – A survey on quantifying tools

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A B S T R A C T

Integrating human health into prospective impact assessments is known to be challenging. This is true for both approaches: dedicated health impact assessments (HIA) as well as inclusion of health into more general impact assessments. Acknowledging the full range of participatory, qualitative, and quantitative approaches, this study focuses on the latter, especially on computational tools for quantitative health modelling. We conducted a survey among tool developers concerning the status quo of development and availability of such tools; experiences made with model usage in real-life situations; and priorities for further development. Responding toolmaker groups described 17 such tools, most of them being maintained and reported as ready for use and covering a wide range of topics, including risk & protective factors, exposures, policies, and health outcomes. In recent years, existing models have been improved and were applied in new ways, and completely new models emerged. There was high agreement among respondents on the need to further develop methods for assessment of inequalities and uncertainty. The contribution of quantitative modeling to health foresight would benefit from building joint strategies of further tool development, improving the visibility of quantitative tools and methods, and engaging continuously with actual and potential users.

1. Introduction

Integrating human health into prospective impact assessments is widely seen as necessary but challenging; this is true for both approaches: inclusion of health into more general impact assessments as well as dedicated health impact assessments (HIA) [Birley, 2011; British Medical Association, 1998; Diwan et al., 2000; Kemm et al., 2004, Kemm, 2013; O'Mullane, 2013; US National Research Council, 2011]. Acknowledging the full range of participatory, qualitative, and quantitative approaches, this study focuses on the latter, especially on computational tools for quantitative health modeling.

In previous publications [Fehr and Mekel, 2010; Fehr et al., 2012], we studied the role of quantification within HIA. In a survey conducted in 2011, we identified 14 tools for quantitative health impact assessment and concluded that while further tool development is no longer a priority, targeted improvements, comparative evaluation of different tools, and maintenance and continued availability are issues to address in further work [Fehr et al., 2012].

Adding on to this, we note that already the Gothenburg HIA workshop in 1999 identified "a false dichotomy between qualitative and quantitative methods," stating that "both can generate meaningful evidence" for HIA [Douglas, 2000]. A "Quantifiable HIA discussion group," initiated at the third United Kingdom conference on HIA in 2000, concluded: "Only if quantitative estimates of one or more impacts will help inform decision making and robust estimates can be calculated should we generate these estimates" [Mindell et al., 2001]. In an early synoptic view, four quantitative approaches were compared [McCarthy and Utley, 2004]. Soon after, an editorial observed: "Mathematical modelling is ... seldom applied to non-communicable diseases..., despite its great potential" [Mindell and Joffe, 2005].

An early analysis of methods for quantification identified availability of valid data and of methods as two major difficulties, and concluded, "quantification in HIA is useful but not often achieved" [Veerman et al., 2005]. The same authors proposed that three types of validity are relevant for HIA: plausibility, formal validity, and predictive validity [Veerman et al., 2007]. A Swedish-origin guide to quantification in HIA is largely based on methods from Health Technology Assessment and from economic evaluation [Brodin and Hodge, 2008]. In a British guide [Glover and Henderson, 2010[1]], the focus is also on valuing health effects, especially on Quality Adjusted Life Years.

A review of the strengths and weaknesses of quantitative methods in HIA concluded that "the production of a single estimate, or range of

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[1] includes references until 1995

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estimates, for the likely health impacts ... can obscure the complexities and uncertainties that underlie these figures" [O'Connell and Hurley, 2009]. Synthesizing the experience from 15 quantitative estimations in HIA practice in the USA, the authors identified four critical issues: causation, external validity, heterogeneous effects, and secular trends [Bhatia and Seto, 2011]. Applying a broad view on risk assessment, quantification in HIA is seen as a form of "top-down policy risk assessment" [Ádám et al., 2014a]; a combined tool includes textual guidance and a checklist [Ádám et al., 2014b].

In summary, we see a strong growth of computational tools for health impact quantification, particularly in Europe, but also several areas of underdevelopment such as lack of insight into the relative usefulness of various tools, lack of experience in applying them in a real-life context, limitations in whether and how they estimate impacts on health inequalities and deal with uncertainty, and problems of maintenance. We therefore decided to conduct a survey among tool developers to answer the following questions:

- What is the status quo of development and availability of tools for quantitative health impact assessment?
- Which experiences are being made with model usage, especially in real-life situations?
- What priorities are seen by tool developers/suppliers for further development?

In this study, we did not intend a fully in-depth review of all individual tools. Rather, we set out to overview a field of activity which we consider to be important, both scientifically and for public health policy, but where overview has been lacking. We expect the results of this survey to be relevant for both tool developers (who tend to be unaware of each others' work, because there is a lack of established scientific networks in this area) and tool users (who are likely to be unaware of the status quo of tool development, which hinders decision making on which tool to use for answering a specific policy question).

2. Data and methods

For this survey, the units of interest are (quantitative) health modeling tools. There is no maintained database of such tools and so the core group for inclusion in this survey were the 14 modeling tools covered in our earlier analysis [Fehr et al., 2012]. We added three tools which we discovered later and which have also been used for health impact assessment.

For each of the 17 tools, we identified a key toolmaker group, consisting of between one and three persons, 26 toolmakers altogether. The distribution by country was as follows: Netherlands 9, United Kingdom 7, Australia 4, USA 2, and one each in Canada, Germany, Finland, and Greece. In 2013, each of the 26 toolmakers received information explaining our intention, and – via email – a questionnaire which covered (i) current status of tool development since 2011: tool features incl. methods for handling health inequalities and for dealing with uncertainty; financial support for tool development; tool maintenance and availability incl. user support; tool use incl. for what purposes and by whom; and tool evaluation; and (ii) perspectives for further tool development: priorities incl. development of methods for handling health inequalities and for dealing with uncertainty; tool maintenance and continued availability; tool use; and tool evaluation as a priority.

The addressees were informed that we expected to receive one completed questionnaire per tool. To those who did not respond by the deadline, a reminder message was sent via email; in some instances, we also made contact by telephone. Results from completed questionnaires were transferred into a master spreadsheet. From this, a series of specific spreadsheets was generated, involving manual coding and spreadsheet-based counting of answers where appropriate. The coding and counting were cross-checked within the group of authors.

3. Results

3.1. Response rates

We received no response from three groups; another group responded in free-style only. The other 13 groups responded by questionnaire:

- 10 groups sent back one questionnaire each, concerning their respective tool.
- Two other groups returned one questionnaire concerning their original tool plus one questionnaire concerning an additional tool.
- One other group did not send back a questionnaire on the original tool but three questionnaires on additional tools.

Thus we received completed questionnaires for 12 "original" and five additional tools – see Fig. 1.

3.2. Current status of development and use

Fourteen tools were described as "Ready for use," one as "Under construction," and two "Awaiting maintenance." For 11 tools, maintenance had been carried out or new elements or options have been added, since 2011; in two more cases, new tools had been developed. Thus, most of the 17 tools were being maintained and reported as ready for use.

Toolmakers described a wide range of topics covered, including risk and protective factors, exposures, policies, health outcomes. Analysts, consultants, academic researchers, decision makers "in all jurisdictions across the country," national cancer league, and non-governmental organizations (NGOs) were mentioned as users. Countries of tool usage included Canada, Denmark, Finland, Germany, The Netherlands, New Zealand, South Africa, and the USA; also "53 member states of the European region of the World Health Organization" and "European Union member states." For full results on tool use, see Web Appendix Box 1.

The main results concerning the status quo of tool development are summarized in Fig. 2. When asked if their tool can handle health inequalities, in seven cases, the answer was "yes" and in six cases "to a limited extent," often via separate specific analyses; data availability was identified as a likely problem. When asked whether tools included methods for dealing with uncertainty, 13 answered "yes," three reported "to a limited extent": handling uncertainty apparently is a standard feature but the degrees of sophistication is likely to vary.

For 10 tools, there was financial support for development, maintenance, use, or evaluation since 2011. The source of funding was, non-exclusively, given as national (8 cases), European Union (3 cases), or others (3 cases).

The possibility of usage of a tool by others than its developers was confirmed for nine tools; another four specified "not easily." Eight of the tools were reported to have been used by external users. Thirteen tools indicated support for users via detailed written guidance, helpdesk, or training. Nine of the tools can be accessed via a website, six other tools via contact or collaboration with developers. Eight toolmakers reported they were satisfied with the use of their tool since 2011, another six reported limited satisfaction.

Formal evaluation of the tool was confirmed in four cases, with widely varying methods and approaches (e.g., via comparison with measurements from continuous measurement stations, application of the tool in practice, internal audit, and publications with peer review or assessment of a PhD thesis). In four additional cases, respondents mentioned informal (implicit) evaluation, by being included in a database, presentations of results, or internal evaluation within the team of developers. The evaluations identified areas for improvement in software, in modeling, and in uncertainty assessment.

Selected properties of the tools are summarized in Table 1.