

A framework for assessing the impact of health research from a broad population perspective

Alessandra Buja ⁽¹⁾, Chiara Bertoncetto ⁽¹⁾, Mirko Claus ⁽¹⁾, Kreald Demiraj ⁽²⁾, Massimo Castoro ^(2,3), Tatjana Baldovin ⁽¹⁾, Vincenzo Baldo ⁽¹⁾, Gianfranco Damiani ^(4,5), Silvia Cocchio ⁽¹⁾

(1) Hygiene and Public Health Unit DSCTVPH University of Padua, Via Loredan 18, Padova, Italy

(2) Evaluation and Technology Assessment Unit, University Hospital of Padua, Via Giustiniani 1, Padova, Italy

(3) CReHTA, Coordinamento Regionale HTA, Regione del Veneto, Italy

(4) Unità Operativa Complessa Igiene Ospedaliera, Fondazione Policlinico Universitario A. Gemelli IRCCS, Roma, Italia

(5) Istituto di Sanità Pubblica, Università Cattolica del Sacro Cuore, Roma, Italia

CORRESPONDING AUTHOR: Alessandra Buja, Hygiene and Public Health Unit DSCTVPH University of Padua, Via Loredan 18, Padova, Italy; Email: alessandra.buja@unipd.it; phone: +39 49 8275406; fax: +39 49 8275392

DOI: 10.2427/13094

Accepted on July 09, 2019

ABSTRACT

Background: research in the health sector is an activity associated with an uncertain return on investment. This study aims to outline a multidimensional framework for assessing the impact of research funded by public (or mixed public and private) sponsors.

Methods: a focus group representing different stakeholders was created to develop a sense of purpose that would be shared by the intended beneficiaries of the research assessment process, and others with a direct or indirect interest in a program's implementation.

Results: a framework was designed that takes a holistic approach to the impact of research in which not only technical, but also economic, social and political dimensions are interrelated with the results achieved for the population and health services.

Conclusions: the framework reflected the views of different stakeholders, favoring the development of the positive, proactive relationships essential to orienting the process of transforming the evidence emerging from research into action for health.

Key words: research impact, public health investments, research accountability

INTRODUCTION

Public health resources are invested to: promote and improve the health of the general population; improve the

value and quality of healthcare; reduce health inequalities and improve equity [1]. Public-financed research is one of the activities that enables these goals to be achieved. Research and innovation are essential to the development

and continuous improvement of good-quality healthcare and health service management [2]. They also play a key part in the knowledge economy of a country by contributing to its international competitiveness and economic growth. Research in the health sector is an activity associated with a particularly uncertain return on investment, however. Hence the scientific community's increasing interest in assessing its impact, which has resulted in the production of novel theoretical models and multidimensional methodological approaches [3-5]. In parallel with the growing attention of the scientific world, there has been an increasing demand for social accountability and strategic planning, making it essential to establish meaningful criteria for the action of policymakers and stakeholders. Such criteria should be designed to track research programs and focus on measuring their valuable outputs and outcomes on the grounds of the values held by those commissioning the research. According to a recent proposal from Palumbo [6], the assessment should focus on accountability and learning. In the first case, the objective is to establish responsibility for the results achieved and for the use of public resources. In the second, the aim of the assessment is not only to see whether goals have been reached and health needs have been met, but also and importantly to identify any shortcomings in order to improve future programs [6]. In fact, if the customer is a national or regional public healthcare service, then the assessment of a research program becomes a way to demonstrate accountability for the use of public resources to an array of stakeholders, such as funding providers, policymakers, the State, local agencies implementing the program, and community leaders. Depending on the needs of stakeholders, the findings of such assessments can show whether the program contributes to improving the health of the target population, or reducing major risk factors for said population, and whether research impacts might lead to even better healthcare services. By holding research programs accountable in these terms, their assessment helps to ensure that the most effective lines of research are maintained, and that limited resources are spent efficiently.

Several conceptual frameworks proposed in the literature have been designed in an effort to facilitate assessments on the impact of research. Numerous reviews have considered the various conceptual and methodological approaches to examining biomedical and health research programs. [Ref] Different approaches to assessing the impact of research make different assumptions about the nature of research knowledge, the purpose of research, the definition of research quality, the role of values in research and its implementation, the mechanisms by which impact is achieved, and the implications for how impact is measured [5].

Among various attempts to assess research, some investigators have focused on different aspects of its impact assessment. For example, some methods are more academically-oriented, like the Research Impact

Framework originally developed by and for academics who were interested in measuring the impact of their own research [5]. Other frameworks are more focused on assessing the impact of research on society, taking constructivist approaches developed in the social sciences and emphasizing impacts beyond health (e.g. SIAMPI, Sci-Quest). Certain models also try to monetize both health and non-health returns from research, expressing them in various ways, such as cost savings, QALY, internal rates of return (return on investment as an annual percentage yield).

The most widespread impact frameworks are based on a logical and multidimensional model, taking a number of impact categories (i.e. epidemiological, economic, and social) into account and applying advanced analytical approaches [3]. To give a first example of such a multidimensional approach, Buxton and Hanney developed their "Payback Framework" in the early 1990s to examine the 'impact' or 'payback' of health service research [7]. It consists of a logical model representing the complete research process, and a set of categories used to classify individual paybacks from a given research program. Its multidimensional classification of the benefits starts with the more traditional academic fallout in terms of knowledge production and research capacity-building, then extends to broader benefits to society [8]. These categories move "downstream" from research through translation to society, and can capture outputs of interest to different audiences. Other approaches inspired by the Payback Framework include the CAHS Framework. Constructed by a panel of international experts, this framework takes into account the various non-linear influences at work in contemporary health research systems. For each impact assessment category, it offers a menu of metrics and measures, favoring flexibility and adaptation to circumstances.

The UK also adopts a logical model for assessing the quality of research conducted at higher education institutions. The "Research Excellence Framework" provides for a very detailed and extensive assessment of the performance of university research. It defines impact as "a recorded or otherwise auditable occasion of influence from academic research on another actor or organization" [9]. From a population health perspective, there has to be evidence of the transferability of research, which depends on the research activity itself, the context, and the interactions between a given activity and its context [10].

The NIEHS logical model, the medical research logic model, the NIOSH logic model, and the Wellcome Trust's assessment framework are also examples of frameworks based on multidimensional logical models.

Multidimensional conceptual frameworks appear to be appropriate because they carefully identify the links between inputs, processes, outputs and outcomes. Although logical models are only an approximation of reality, they cover a range of impacts considered important to stakeholders, and provide a framework for consistently organizing data collection, analysis and data

presentation, allowing for the inevitable variations between projects or programs.

The purpose of impact assessments is to measure all valuable outputs and outcomes consistently with the goals of public health authorities, which is to maximize the value of research investments to the general population they serve. This objective is reached if the research impact assessment is done not only considering patients involved in the research, but also long-term measures of the effects, both positive and negative, at population level. Hence our study, which describes a multidimensional framework for assessing the impact of translational and clinical research funded by public (or mixed public and private) sponsors from the perspective of the public health authorities.

MATERIALS AND METHODS

Context

In Italy, there are regional authorities that have public health departments for planning and organizing healthcare facilities and activities, and they also finance health-related research. Since 2008, the Veneto Regional Authority (which serves a population of 4.9 mln) has adopted an original financial model for public health research in partnership with private stakeholders (PRIHTA). One of the main aims of the projects that it has financed is to pursue the development and improvement of the Regional Health System's quality, efficacy, and effectiveness.

Key steps in developing a framework for assessing a research program

The first step involved defining which dimensions could be assessed at the various stages of a research program. It proved useful to adopt the same dimensions as in the widely-used classical Logical Model for Program Planning and Evaluation [11], adapting them to the assessment of research programs, such as: resources, process, outputs, and short-, intermediate-, and long-term outcomes. Briefly, the assessment concerned:

- Inputs: the resources used to implement a program. Reviewing the resources needed for a program can tell us a good deal about the amount and intensity of its assets. It can also pinpoint situations where there is a mismatch between the results obtained and the resources needed to achieve them. It is essential to ascertain how a program was funded in order to judge its cost-benefit ratio as part of the assessment;
- Process: the actions taken by the program to achieve its research outcomes, be they tasks, operations or work processes undertaken within an organization, or programs that use inputs to

produce outputs. In assessing processes, it is important not only to examine how the actions were taken, and whether they were taken on schedule, but also to identify obstructing and facilitating factors, and errors occurring during the activities, for learning purposes;

- Outputs: the products obtained with program's activities;
- Outcomes in the short-intermediate term: changes, results in terms of the numbers of patients enrolled in a study, or in a network of teams participating in the research;
- Outcomes in the long term: from the perspectives of the population (health outcomes) and the health services (efficiency, accessibility outcomes etc...)
- Adverse outcomes in the short-intermediate and long term: unwanted outcomes both in the setting of the study (patients and team of researchers), and at population level (the general population or the population in need of health care services).

In a second step, we focused on the level of cooperation achievable in defining the variables to assess as part of the above-mentioned dimensions. A focus group was created, representing different stakeholders chosen from among those involved in research assessment or funding at regional level. The aim was to develop a sense of purpose that would be shared by the intended beneficiaries of the research assessment process, as well as by others with a direct or indirect interest in a program's implementation. The stakeholders included: industries co-funding the research; the Veneto Regional policymakers, legitimate representatives of the interests of patients and citizens; and hospital managers as recipients of the impact of the research on the healthcare services they manage. These stakeholders interacted with a working group comprising university researchers on public health and research methodology, and a researcher with expertise gained from running previous research programs. The resulting focus group gave us the opportunity to construct a framework that would accurately reflect the views of stakeholders and policymakers as a whole, as well as providing fresh input for discussing the model for assessing the impact of health-related research from a broad population perspective.

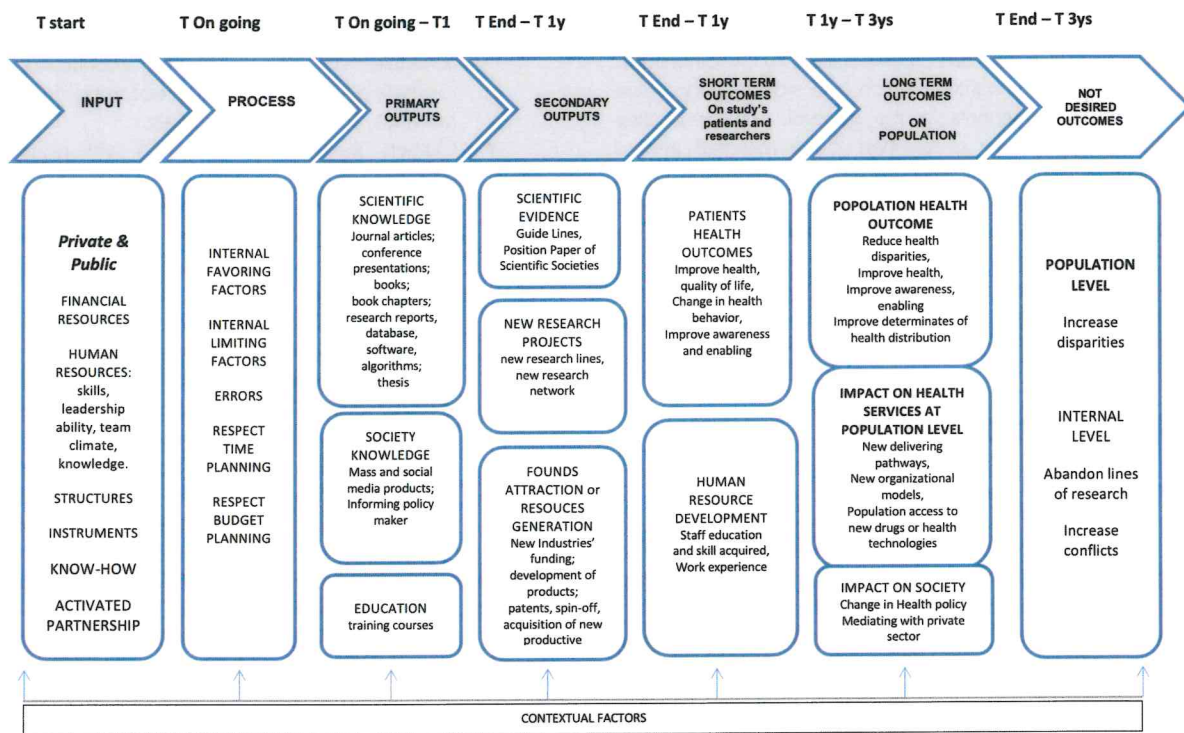
RESULTS

Figure 1 shows the framework developed for assessing the impact of public-funded research.

As resources, we considered private and public funding, as well as the talent, equipment, and other assets made available for use in the research program activities.

As process, we examined the action taken and the issue of its timing, as well as seeking to identify any factors that interfered with or expedited the program, and any

FIGURE 1. Framework to evaluate the impact of health research in a wide population perspective



mistakes made in implementing the activities from which a lesson could be learned.

As primary outputs we considered all incremental knowledge. The magnitude of the influence of the results of any research in the health sector depends partly on how well the information can be circulated, not only within the scientific community, but also to policymakers and society at large. The output in terms of developing human resources could be in the form of training courses or other significant products that improve the research team's knowledge and skills.

As secondary outputs we identified other sources of scientific evidence such as guidelines, the setup of new research projects, the power to attract more funding, new partnerships with industry, patents, and spin-offs.

Outcomes were divided between those achieved in the short term (the effects on the health of patients involved in a clinical trial, benefits to the researchers' knowhow) and in the long term (health benefits for the general population, as measurable from epidemiological data in terms of the distributions of determinants of health, medical conditions, and healthcare disparities). Changes in the organization and delivery of health services to improve their accessibility, quality and efficiency could also be listed among the long-term outcomes. Even effects on society, as a result of changes in health policy and interactions with industry and the private sector, are

important outcomes because they can drive change in a population's state of health.

The framework considers negative outcomes too, in terms of any unwanted or side effects that may come to light as a consequence of the research program, such as other lines of research that have been neglected, new disparities, or new conflicts of interest.

The setting in which a research program is conducted is influenced by a variety of external factors that can affect the program's success. These external factors include the local cultural milieu and economic conditions, demographic patterns, and the political environment. Such factors can have a strong influence on the achievement of outputs and outcomes, and should be analyzed in the assessment framework.

DISCUSSION

This paper outlines a framework that takes an approach to assessing the impact of research not only at patient level (for those enrolled in a study), but also at population level. Another novel aspect concerns the process assessment, seeking any factors that interfered with or expedited the program, which could be useful for interpreting the ultimate impact of the research. The nature of public-funded clinical or translational research initiatives

engenders relationships between enablers (e.g. resources, process, contextual factors), and output dimensions. When assessing research programs, the effort should focus on analyzing their impact, and this entails something more than testing isolated associations between certain criteria, disregarding how all the various dimensions of a program are interrelated [12]. The crucial importance of the environment (internal and external contextual factors) as an interface between researchers and policymakers clearly emerged in the present study as a factor to consider in assessing a research program. We chose a model that would also describe context variables capable of explaining how the process did or did not achieve the predicted outputs and outcomes. In fact, public health and healthcare are complex phenomena, and fundamentally context-dependent systems. Programs that work well in some settings fail dismally when transplanted in others with different fiscal, socioeconomic, demographic, interpersonal, and inter-organizational characteristics [13]. This makes it necessary to pay careful attention to the context when designing, conducting, and reporting research relating to health and healthcare, given its great potential for advancing our knowledge and explaining seemingly inconsistent results. What works in one context often does not work elsewhere, prompting potentially conflicting conclusions, or masking effects [when outcomes are obscured by heterogeneous results] [14].

The present conceptualization of a research program assessment model has evident parallels with the EFQM Excellence Model (2003) [14], which is a framework developed to define the main quality management dimensions, measured at staff, customer, society, and key performance levels. In our framework, these factors can be translated into the impact on the development of human resources, on the health outcomes of patients and populations, on society at large, and on health services.

As amply discussed in a recent paper, the first step to finding ways to reduce waste and increase value in biomedical research is to produce consistent and valid primary or secondary scientific outputs (as defined in our framework); in fact, the paper makes the point that there is a general failure to publish relevant research promptly, if at all. Studies with disappointing results are less likely to be published promptly, more likely to be published in the harder-to-access grey literature, and less likely to proceed from abstracts to full reports. Research reports also remain much less useful than they should be due to biased reporting or inadequate information on the interventions involved [15].

Other authors have broadly divided the outcomes and impact of research into "research value" (defined as knowledge generation) and "research utility" (defined as change in practice), with many links between the two categories [16]. Horizon 2020, the current European research and innovation program, defined science as an undertaking to be practiced "with" society and "for" society. If using research refers to "making decisions concerning

policy, advocacy and resource allocation, planning and management, and program systems development and strengthening, using information generated from research" [16], then the existence of relevant research is a necessary, but not sufficient condition for this to happen. Although the role of research utilization in policymaking is seen as a key element, and more attention is being paid to research utilization and its assessment, evidence-based policy is difficult to achieve, and it is widely felt that health policies do not reflect research evidence as much as they could in theory. The policymaking process is known to be extremely complex, with many genuine obstacles to evidence-based policymaking, as well as factors that might facilitate research utilization [17]. It is clear, however, that long-term outcomes, and health outcomes at population level will be greater, the more widely effective technologies, developed during research activities, are communicated and shared at professional level [20].

We also chose to consider the impact of a research program in reducing health disparities, improving health awareness, and enabling a better distribution of health determinants. Community-based participatory research is predicated on a critical philosophy that emphasizes social justice and the value of knowledge in liberating the disadvantaged from oppression [21]. Some of these outcomes can be achieved, for example, by means of strategies to communicate research findings to a wider public, as this can have an impact on individuals' behavior and response to public health messages. Efforts to improve the general population's health literacy by means of scientific-evidence-based education sessions using mass media or conferences can also have a range of benefits [22]. Some studies have clearly demonstrated that health equity can improve as a result of policy changes: "research has also played an important role in the expansion of health care services to poor pregnant women, young children, the elderly, and disabled" [17].

Outcomes of research may be foreseen or unexpected, however, and they may be intentional or unintended. Assessing research only in terms of its intended positive outcomes may overlook its other positive or negative consequences, such as producing health disparities or creating unsustainably costly technologies, which undermine the application of research findings or create economic disequilibrium [23].

CONCLUSIONS

Consistently with the goal of public health authorities, which is to maximize the value achievable by allocating the resources they control to best effect among patient and population groups in the population they serve, the assessment framework described here takes into account several aspects of research programs, including the interrelationships between different dimensions

(epidemiological, economic, social) and different stakeholders (researchers, patient groups, the general population, health authorities, policymakers, sponsors). Devising metrics for assessing the return on investment in research is important to funding organizations (be they public or private), researchers, and the population at large. The method used to develop our framework accurately reflects the views of such different stakeholders, favoring the development of the positive, proactive relationships essential to orienting the process of transforming the evidence emerging from research into action for health.

Authors' contributions

AB made substantial contributions to the conception and design of the framework; CB, TB, SC reviewed the literature and drafted the manuscript; MaC, MiC, DK were involved in constructing the framework; CV checked the paper for ethical issues; VB, GG were involved in critically revising the manuscript for important intellectual content. All authors read and approved the final manuscript.

References

1. Brambleby P, Jackson A, Miur Gray JA. Programme-Based Decision-Making for Better Value Healthcare: Second Annual Population Value Review. NHS, National Knowledge Service, Department of Health. 2008.
2. Graham KER, Chorzempa HL, Valentine PA, Magnan J. Evaluating health research impact: development and implementation of the Alberta innovates – health solutions impact framework. *Res Eval.* 2012;21:354–367.
3. Banzi R, Moja L, Pistotti V, Facchini A, Liberati A. Conceptual frameworks and empirical approaches used to assess the impact of health research: an overview of reviews. *Health Res Policy Syst.* 2011;9:26.
4. Gillian Cohen, Jacqueline Schroeder, Robyn Newson, Lesley King, Lucie Rychetnik, Andrew J Milat, Adrian E Bauman, Sally Redman, and Simon Chapman. Does health intervention research have real world policy and practice impacts: testing a new impact assessment tool. *Health Res Policy and Syst.* 2015; 13: 3.
5. Greenhalg T, Raftery J, Hanney S, Glover M. Research impact: a narrative review. *BMC Medicine* 2016; 14: 78.
6. Palumbo M. Il processo di valutazione. *Decidere, programmare, valutare.* FrancoAngeli; 2002.
7. Buxton M, Hanney S. How can payback from health services research be assessed? *J Health Serv Res.* 1996; 1: 35–43.
8. Donovan C, Hanney S. The 'Payback Framework' explained. *Research Evaluation.* 2011; 20(3): 181-183.
9. Higher Education Funding Council for England . *Decisions on Assessing Research Impact.* London: Research Excellence Framework; 2011.

10. Rychetnik L, Frommer M, Hawe P, Shiell A. Criteria for evaluating evidence on public health interventions. *J Epidemiol Community Health.* 2002;56(2): 119-27.
11. McCawley. *The Logic Model for Program Planning and Evaluation.* University of Idaho. 2001. <https://www.d.umn.edu/~kgilbert/educ5165-731/Readings/The%20Logic%20Model.pdf>. Accessed 28 Oct 2016.
12. Shirshamsi A, Ashoub M. Rearranging criteria of the EFQM Excellence Model: An empirical assessment in the Iranian Rubber industries. *Aust. J. Basic & Appl. Sci.* 2012;6(5):120-124.
13. U.S. Department of Health and Human Center of Disease Control and Prevention (CDC). *Introduction to Program Evaluation for Public Health Programs: A Self Study Guide.* Atlanta: CDC; 2011. <https://www.cdc.gov/eval/guide/cdcevalmanual.pdf> . Accessed 28 Oct 2016.
14. Stange KC, Glasgow RE. Contextual Factors: The Importance of Considering and Reporting on Context in Research on the Patient-Centered Medical Home. *AHRQ.* 2003: 13-0045-EF. <https://pcmh.ahrq.gov/sites/default/files/attachments/ContextualFactors.pdf> . Accessed 28 Oct 2016
15. Calvo-Mora A, Leal A, Roldán JL. Relationships between the EFQM Model Criteria: a study in Spanish Universities. *Total Quality Management.* 2005;16(6):741–770.
16. Moher D, Glasziou P, Chalmers I, Nasser M, Bossuyt PMM, Korevaar DA, Graham ID, Ravaut P, Boutron I. Increasing value and reducing waste in biomedical research: who's listening?. *Lancet.* 2016;387:1573.
17. Aditya A, Black D, Graham ID, Ward JE. Research engagement and outcomes in public health and health services research in Australia. *Aust N Z Public Health.* 2009;33:258-61 .
18. Population Council. *Maximizing utilization of research.* FRONTIERS Legacy Series. 2008 <http://www.popcouncil.org/uploads/pdfs/frontiers/legacy/08ResearchUtilization.pdf>. Last accessed June 2013
19. Hanney SR, Gonzalez-Block MA, Buxton M J, Kogan M. The utilisation of health research in policy-making: concepts, examples and methods of assessment. *Health Res Policy Syst.* 2003;1:2.
20. Fleuren M, Wiefferink K, Paulussen T. Determinants of innovation within health care organizations literature review and Delphi study. *Int J Qual Health Care.* 2004; 16(2):107–123.
21. Jagosh J, Macaulay AC, Pluye P, Salsberg J, Bush PL, Henderson J, et al. *Uncovering the Benefits of Participatory Research: Implications of a Realist Review for Health Research and Practice.* *Milbank Quarterly.* 2012;90(2):311–46.
22. Public Health England, UCL Institute of Health Equity. *Local action on health inequalities Improving health literacy to reduce health inequalities.* London: Public Health England; 2011. <http://www.kindengezin.be/img/inproving-health-literacy.pdf>. Accessed 28 Oct 2016.
23. Chang VW, Lauderdale DS. Fundamental Cause Theory, Technological Innovation, and Health Disparities: The Case of Cholesterol in the Era of Statins. *Journal of Health and Social Behavior.* 2009;50(3): 245-260.

