Evaluating health research impact: Development and implementation of the Alberta Innovates – Health Solutions impact framework

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Alberta Innovates – Health Solutions (AIHS) is a Canadian-based, publicly funded, not-for-profit, provincial health research and innovation organization mandated to improve health, the health system, and socioeconomic well-being of Albertans through health research and innovation. Investments in health research are substantial and funders face increasing pressure to measure the impact of their investments and demonstrate ‘value for money’. However, measuring impact in this context is a challenge given the lack of agreement on a common approach or gold standard, diverse stakeholder interests, attribution issues, and time lags between investments and the realization of long-term impact. To address these issues and ideally optimize impact, AIHS developed and implemented an impact framework based on a model published by the Canadian Academy of Health Sciences (CAHS). The purpose of this article is to: (1) describe the evolution of the framework’s development and implementation; (2) summarize the results of tests undertaken to verify the suitability, feasibility, and applicability of the CAHS model to the AIHS context; and (3) present the AIHS framework, with discussion focused on the challenges of development and implementation, lessons learned and future plans for its ongoing development and implementation.

Keywords: payback; CAHS; implementation; framework; impact; indicators.

1. Introduction

This article describes the development of a framework for measuring, assessing, and ideally optimizing the impact from Alberta Innovates – Health Solutions (AIHS) health research and innovation investments. Specifically it: (1) describes the evolution of the framework’s development; (2) summarizes the results of tests undertaken to verify the suitability, feasibility, and applicability of the CAHS model (2009) to the AIHS context, showcasing two applications for illustrative purposes; and (3) presents the AIHS framework, with discussion focused on the challenges of development and implementation, lessons learned and future plans for its ongoing development and implementation.

AIHS is a Canadian-based, publicly funded, not-for-profit, provincial health research, and innovation funding organization mandated to improve the health, health system, and socioeconomic well-being of Albertans through the support of health research and innovation. AIHS is one of four Alberta Innovates organizations newly established to catalyze research and innovation within the province. Investments in health research and innovation are substantial and funders face increasing...
pressure to demonstrate the impact of their investments. Building upon the work of others (Buxton and Hanney 1996; CAHS 2009), AIHS developed an impact framework to demonstrate impact and illustrate the pathways between research investment and impact: a framework intended to support organizational decision making to optimize research impact and provide the most societal benefit from research investments.

Health research funding agencies are increasingly interested in providing valid and reliable measures of the outcomes of their investments. Measuring outcomes in a research and innovation context is particularly challenging. For example, competing interests among affected stakeholders can result in a lack of consensus on what constitutes value and what should be measured in order to demonstrate impact. Other challenges include problems of attribution (i.e. determining how an organization has contributed to impacts arising from its investments), understanding how best to translate knowledge for effective uptake, and accounting for the time lags between investments and the realization of long-term (e.g. socioeconomic) impacts. Finally, the absence of common methods or a gold standard to inform evaluations of health research investments has resulted in evaluations that lack concurrent validity and comparability due to the non-standard use of methodologies, data collection techniques, and measures. Such inconsistencies make it difficult for funding organizations to compare or benchmark their performance against others. As Jordan (2011) argues, to build an evidence base and theory for something as complex as the research and innovation system, multiple studies, and synthesis across those studies will be required. AIHS anticipates such efforts would be greatly facilitated by the wide-scale adoption of common theory, methods, and tools by the research and innovation funding community and its stakeholders.

To this end, AIHS set out to develop a standardized impact framework, using the guiding principles of integrating evidence-based practice and practice-based evidence. Until recently, the evidence-based practice approach was difficult to incorporate given the lack of consensus on agreed upon methods for assessing health research. However in 2009, the CAHS released a report outlining a preferred framework to assess health research impact in Canada. AIHS decided to adopt this generalized impact model that had a strong theoretical basis, thus potential to establish construct validity. This article describes the phased evolution of the AIHS impact framework. The focus of this article is not intended to present a comprehensive overview of evaluation frameworks and approaches to health research impact assessment; these are available elsewhere (e.g. CAHS 2009; Yazdizadeh, Majdzadeh and Salmassian 2010; Banzi et al. 2011). Rather the intent of this article is to illustrate how modifications to a generalized systems-level model can meet specific organizational requirements. The implementation of sound theoretical models and tools contributes to the emerging ‘science of science policy’ knowledge base, which provides evidence to inform policy and decision makers in assessing the impact of investments in science (Husbands Fealing et al. 2011).

2. History and background

Given its organizational mandate to contribute to the health and socioeconomic well-being of Albertans, AIHS aims to realize impacts from its health research investments that are multi-dimensional and far reaching in nature. In 2007, decision makers at AIHS wanted to develop an evaluation framework that could be systematically applied to assess organizational and program-level impacts. In addition to assessing research impacts, AIHS decision makers were also interested in tracking progress towards strategic goals and objectives. This required a framework that included concepts pertaining to organizational system dynamics, as well as social (e.g. well-being) and economic value, in addition to measures of traditional scientific impact. The following section describes how the AIHS impact framework developed and evolved to meet these organizational requirements. First, a brief overview of the models from which the AIHS framework evolved is provided.

2.1 The Payback model

AIHS (formerly the Alberta Heritage Foundation for Medical Research [AHFMR]) has had a long history of experience with the Payback model. The model was applied to the organization’s funding programs by Martin Buxton in 1999 using a case study methodology. Results from the case studies suggested that the model could be used to assess the returns of clinical and biomedical research investments within the Alberta context (Buxton and Schneider 1999). Since then, the organization has used the model’s concepts to inform its evaluation activities.

The Payback model (Buxton and Hanney 1996) provides a comprehensive overview of the returns that could be gained from investments in research. The model defines impact (i.e. payback) across five categories: knowledge production; benefits to future research and research use; political and administrative benefits; health sector benefits; and broader economic benefits. Secondly, it uses an input–output logic model to depict the research activity life-cycle and the types of impact, or payback, possible from each. The Buxton–Hanney Payback model hypothesizes that returns on investment are realized when research results are translated downstream into policy and health improvements, and later into societal and economic benefits.

AIHS wanted to adopt an existing model of health research impact that was not only comprehensive but also used the best available evidence to support its implementation. In 2010, AIHS conducted a review of the
Payback literature. From an initial search, the titles and abstracts of 933 articles were reviewed against inclusion (e.g. application of the Payback model to health research) and exclusion criteria (e.g. studies relying on interviews or anecdotal evidence were excluded). Twelve documents (peer-review articles and gray literature) were included in the analysis. The results illustrated the Payback model’s application in a variety of countries including the UK (Ferguson et al. 2000; Wooding et al. 2005; Soper and Hanney 2007; Raftery et al. 2009; Wooding et al. 2009), Australia (Kalucy et al. 2007; Kingwell et al. 2006), Canada (Buxton and Schneider 1999; Magnan et al. 2003), Ireland (Nason et al. 2008), the Netherlands (Oortwijn et al. 2008), and Hong Kong (Kwan et al. 2007). One study of particular relevance was Wooding et al.’s work (2009) where the impacts of funded arthritis research were evaluated: the authors developed an end of research survey which provided impact ‘profiles’ for a variety of programs, thus permitting comparisons of program performance across the funding portfolio. Overall, the Payback model had been applied in a variety of contexts including health systems, health technology assessments, basic science, and clinical research projects.

The studies included in the review were primarily retrospective case studies. Despite the common method, there was considerable variation in how the study methodology was applied and in the data sources used. Nevertheless, limitations of the model were identified and suggestions for improvement were offered by the study authors; the following were particularly relevant to the development of the AIHS impact framework:

- Progress Monitoring Limitations: Most of the research done on the Payback model did not address the design of systematic, routine methods for evaluating research activities on an ongoing basis (Buxton and Schneider 1999). To address this issue, several authors suggested using electronic data collection methods to facilitate more frequent collection and limit respondent burden (Kalucy et al. 2007; Nason et al. 2008; Wooding et al. 2009).
- Aggregation and Pooling of Results: It was recommended that evaluators assess and monitor payback of related projects and pool the results as a potentially more effective way to influence decision makers (Oortwijn et al. 2008).
- Additional Impact Categories: Kalucy et al. (2007) suggested the addition of a research transfer payback category may be necessary based on their research that found a key pathway to impact was through the interpersonal networks of researchers.

Twenty years into development, application of the Payback model is still an emerging area of research and practice. The CAHS model, which built upon the Payback model, provided AIHS with an updated version of the return of research investment theory applicable to the Canadian context as well as a toolbox to operationalize the AIHS impact framework.

### 2.2 The CAHS model

The CAHS model built upon the strengths of the Payback model while attempting to address some of its limitations (e.g. lack of ‘how to’ instructions to guide the model’s operationalization and implementation). The CAHS model utilizes a logic model approach that categorizes health research impacts into five domains: (1) Advancing Knowledge; (2) Building Capacity; (3) Informing Decision-Making; (4) Health; and (5) Broad Socio-Economic. The impact categories are divided into a number of subcategories with 66 indicators mapped to each category or subcategory. Figure 1 displays an image of the CAHS model which outlines the theoretical pathways from research investment to impacts. The model illustrates how research activity informs decision making, eventually resulting in changes that improve health, economic, and social prosperity. The framework also depicts how research impacts feedback upstream, potentially influencing the diffusion and impacts of other research and creating inputs for future activity.

The CAHS model’s modifications to the Payback model were applicable to AIHS. Consequently, most of the CAHS model was integrated into the AIHS impact framework for the following reasons:

- **Canadian health research context and use:** The CAHS model was designed to accommodate the health research landscape in Canada by proposing specific methodologies and indicators to evaluate different types of health research, as described by the Canadian Institute of Health Research’s (CIHR) research pillars (i.e. biomedical, clinical, health system and services, and social, cultural, environmental, and population health research). CIHR is the national agency responsible for funding health research and has adopted and modified the Payback model for its own use (2005).
- **Health categories clearly defined:** Another unique element of the CAHS model was the classification of health impacts that included health status and determinants of health considerations. In particular, including health determinants in the impact framework was a concept that had not been reflected previously.
- **Logic model and pathway to impact:** The CAHS model provided an updated logic model based on agreed upon theories and definitions of both the healthcare system and environmental factors that can influence health, products, services, and individual behaviors. It illustrates how translating research results moves ‘downstream’ and identifies impacts of interest to different target audiences. It also identifies the institutions and actors (i.e. the system stakeholders) who
are the primary conduits to the pathways through which advances in health research can lead to impact (Jordan 2011).

- Health research tool box: The CAHS model provided a tool box for evaluating health research including a comprehensive set of impact categories and definitions, and a library of indicators and metrics (including suggested methodology) at different levels of aggregation.

Overall, the CAHS model represented a significant advancement in health research impact assessment in Canada: it offered a systematic approach to evaluating health research with the intention of overcoming gaps and addressing inconsistencies in impact assessment practices.

3. Implementation of the CAHS model

Prior to adopting the CAHS model, AIHS verified whether it was applicable to the local context and feasible to implement. To determine its applicability, AIHS tested the model through a series of retrospective and prospective studies. Over the same period, the organization also implemented practice-based evidence approaches including the development of logic models and balanced scorecards (Kaplan and Norton 1996), cascaded across multiple levels of aggregation (organizational and program levels): these tools were used to map processes and outcomes across the pathway from inputs to impact comprehensively from multiple perspectives (e.g. financial, internal processes, stakeholder, etc.).

The retrospective studies were initiated to retrofit the CAHS model to existing program records and assess whether researcher and administrative information could be meaningfully classified and analyzed according to the model. Two different funding programs representing major AIHS’ investments (i.e. the AHFMR Independent Investigators [II] Program and the graduate/post-graduate Trainee Award Programs) were used in the retrospective studies. For the purpose of brevity, only findings from one study are reported here, although both studies provided evidence of the model’s applicability to AIHS programs.

3.1 Retrospective review: process and results

The objectives of the II program were to provide opportunities for researcher recruitment, to build health

![Figure 1. The CAHS impact model.](image-url)
research capacity in Alberta, and generate new knowledge from health research. The program’s target audience included highly qualified investigators at all career stages in all fields of health research.

In 2009, AIHS initiated a retrospective review of 215 II grantees whose award ended between 2004 and 2008. The data sources for the review included investigators’ applications, annual progress reports from each year of their award term, and financial data from administrative databases at AIHS. In total, 855 annual reports summarizing research activities and accomplishments were reviewed with two main results:

1. Preexisting information (quantitative and qualitative) was easily mapped to the CAHS impact categories and the results could be analyzed and presented using existing tools and resources. These results demonstrated the CAHS model’s congruence with the activities and accomplishments reported by AIHS grantees and its applicability to AIHS programs. Figure 2 summarizes the results of the II Program retrospective review (unpublished data): investigator’s capacity building records were mapped to the CAHS subcategories of personnel (e.g., 1,076 trainees supported), infrastructure (e.g., 15 laboratories established and 14 new pieces of equipment procured), and additional funding leveraged (e.g., approximately $210 million). Similarly, the traditional output measures of grantees’ research activity (e.g., 3,901 publications, 4,280 abstracts, etc.) aligned to the CAHS model’s advancing knowledge indicators. The results obtained from the II review also revealed that grantees had produced a number of guidelines, research tools, data repositories, etc. These results would seem to be in line with Tassey’s (2008) work on ‘infratechnologies’ which he describes as the research tools (measurement and test methods), scientific data, quality control techniques, and industry standards etc., that are generated from research. Given their broad potential for application and use, these types of ‘infratechnological’ results may have more potential to lead to innovation. This is a new concept for AIHS that will be explored further.

2. To meet AIHS business requirements, additional impact categories, and measures would be required to capture the full spectrum of impact. Over 320 examples and supporting statements identified in the review referred to research that was ‘first of its kind’, ‘the first time to...’, and ‘a novel finding’, etc. As a result, AIHS identified a need for a new category to capture information about net new discoveries or innovations. In addition, the annual reports originally developed by AHFMR captured data on researchers’

![Figure 2](image_url)
As a result of the retrospective reviews, the CAHS model was determined to be applicable to AIHS. The results of a second retrospective study confirmed that the model could be applied more broadly within the organization and was deemed sufficiently feasible to implement. Despite these results, it was recognized that further modification of the model would be required given AIHS’ business needs (e.g. different program objectives), and that existing data collection instruments would have to be re-designed to align to the model’s measurement requirements.

### 3.2 Prospective review: process and results

The next stage in the framework’s development involved applying the CAHS model prospectively during the early implementation phase of two programs: the AHFMR Interdisciplinary Teams Grant (ITG) program and the Polaris award. For illustrative purposes, only the results of the ITG program will be reported here.

The ITG Program was created as a strategic initiative that provided opportunities for high quality, internationally recognized teams of investigators to address complex health issues with the goal of producing solutions for improved health benefits. The objectives of the ITG program are to: (1) support interdisciplinary and multi-institutional research teams; (2) provide interdisciplinary training and mentorship opportunities; (3) support quality research that addresses complex health issues by using a collaborative team approach; and (4) facilitate the timely exchange of knowledge with end users to improve health/health-care systems.

The ITG program was chosen for the prospective review for two reasons: (1) it offered further opportunities to test the CAHS model using a collaborative group-type funding program; and (2) it met a business need to initiate data collection on a new program. The data collection forms, analysis, and reporting processes were intentionally designed a priori for this project.

Table 1 outlines the indicators identified by applying the CAHS model prospectively to the ITG program goals and objectives. Included in the table are additional indicators identified by AIHS as a result of incorporating knowledge gained through its practice-based approaches. Of particular importance was the addition of ‘Reach’; a concept that extends beyond the traditional notion of ‘participation’ to include ‘interactions’ (e.g. the collaborations and partnerships one engages in) and the ‘who’, or target audiences one is wanting to effect change in. The importance of building reach into program theory is the subject of a new article by Montague and Porteous (2012), who state that including the ‘who’ promotes the notion of ‘engagement’ which has been suggested to be key to facilitating uptake in knowledge translation practices (Davison 2009). Another new subcategory in capacity building included measures for training and mentorship. A progress ladder was added to the informing decision making category that outlined the steps or stages in research-related decision making processes from point of engagement to change. Another progress ladder was also developed for the economic impact category; an example of progress markers for the technology transfer subcategory included: filing, issuing, publishing and citing of patents. Also included were standardized health indicators as per the CAHS health impact category and subcategories (e.g. effectiveness, efficiency, etc.).

Finally, the integration of performance management concepts into the AIHS impact framework resulted in the inclusion of a number of organizational (i.e. balanced scorecard) indicators that were not proposed in the CAHS model including: percentage (%) of variance to budget; the value ($) of the organizational partnership expenditures; a count (#) of programs and services delivered, etc.

When the CAHS model was integrated into the AIHS impact framework for the ITG program, a matrix was developed to map the AIHS impact framework to the objectives of the program to facilitate the selection of meaningful measures: Fig. 3 displays an example of a report prepared for external stakeholders to highlight ITG program performance annually. The report reflects how AIHS and the ITG grantees’ research activities jointly contributed to the goals of the program. Each goal has a number of associated metrics and indicators. Additionally, for each goal, an impact story is reported to illustrate the goal’s intent and provide a concrete example of the results achieved by program grantees. Inclusion of impact stories along with key performance indicators was intentional as AIHS recognizes that both quantitative and qualitative information is required to tell the full impact story. This report was created as part of an overall reporting strategy to respond to stakeholder requests for more timely and meaningful information that highlighted key program results in a simpler fashion.
Table 1. Sample of categories, subcategories, and indicators from the AIHS health research to impact framework

<table>
<thead>
<tr>
<th>Balanced scorecard categories</th>
<th>Logic model categories</th>
<th>Subcategories</th>
<th>Sample of indicators/measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organizational performance:</strong></td>
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<tr>
<td>Financial Inputs</td>
<td>Invest in human resources</td>
<td></td>
<td>Staff recruitment and retention</td>
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<td></td>
<td>Investment management</td>
<td></td>
<td>Percentage (%) variance to budget</td>
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<tr>
<td>Enablers</td>
<td>Information management</td>
<td>Percentage (%) reliability of technology use</td>
<td></td>
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<tr>
<td>Internal processes Activities</td>
<td>Plan and strategize</td>
<td>Strategic, business and operational plans developed</td>
<td></td>
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<tr>
<td></td>
<td>Support focused research activity</td>
<td>Programs and initiatives developed and implemented</td>
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<tr>
<td></td>
<td>Optimize processes</td>
<td>Increased value-added time and quality</td>
<td></td>
</tr>
<tr>
<td>Stakeholder Outputs</td>
<td>Plan and strategize</td>
<td>Number (#) and percentage (%) of strategic/plans completed and milestones met</td>
<td></td>
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<tr>
<td></td>
<td>Support focused research activity</td>
<td>Number (#) and type of programs/initiatives/services (active and new)</td>
<td></td>
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<tr>
<td></td>
<td>Optimize processes</td>
<td>Percentage (%) overtime accrued by AIHS staff</td>
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<tr>
<td>Reach</td>
<td>Target groups</td>
<td>Target audiences identified and grouped (e.g. health industry, government, researcher, public, etc.)</td>
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<tr>
<td></td>
<td>Push</td>
<td>Number (#) and type of AIHS media events</td>
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<td></td>
<td>Pull</td>
<td>Number (#) of AIHS website hits</td>
<td></td>
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<td></td>
<td>Referrals</td>
<td>Number (#) of visitors to the AIHS website by other websites</td>
<td></td>
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<tr>
<td></td>
<td>Participation</td>
<td>Number (#) and type of target groups attending AIHS events</td>
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<tr>
<td></td>
<td>Interactions</td>
<td>Number (#) and type of target groups utilizing AIHS services</td>
<td></td>
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<tr>
<td>Short-term outcomes</td>
<td>Stakeholder reactions</td>
<td>Percentage (%) satisfied with programs/services</td>
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<tr>
<td></td>
<td>Effective collaborations and partnerships</td>
<td>Type of AIHS partnerships (e.g. purpose, characteristics, outcomes, etc.)</td>
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<tr>
<td></td>
<td>Influence innovation</td>
<td>Number (#) of newly established committees/working groups/networks, etc., that enable organizational outcomes</td>
<td></td>
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<tr>
<td>Research and innovation outcomes:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Recognition and reputation</td>
<td></td>
<td>Number (#) and type of research honors and awards given to supported researchers</td>
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<tr>
<td></td>
<td>Capacity building</td>
<td></td>
<td>Number (#) and type of HSP supported</td>
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<tr>
<td></td>
<td>Support development of HSP</td>
<td></td>
<td>Description of the breadth and depth of training and mentoring opportunities provided (qualitative indicator)</td>
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<tr>
<td></td>
<td>IP/infrastructure</td>
<td>Number (#) and type of guidelines, standards, and protocols developed</td>
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</tr>
<tr>
<td></td>
<td>Leverage external funding</td>
<td>Total external funding dollars ($) attracted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advancing knowledge</td>
<td>Dissemination of research findings (e.g. number (#) of publications and type: articles, presentations, books, conferences papers, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Research activity</td>
<td>Number (#) and percentage (%) of peer-reviewed journal articles by research program</td>
<td></td>
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<tr>
<td></td>
<td>Research quality</td>
<td>Collaborations types, purpose, activities, target audiences</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reach</td>
<td></td>
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<tr>
<td></td>
<td>Outreach</td>
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HSP: highly skilled people; IP: innovation platforms; IDM: inform decision making

(continued)
### Table 1. Continued

<table>
<thead>
<tr>
<th>Balanced scorecard categories</th>
<th>Logic model categories</th>
<th>Subcategories</th>
<th>Sample of indicators/measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium-term outcomes</td>
<td>IDM</td>
<td></td>
<td>Dissemination and interactions: number (#) and percentage (%) of public and/or outreach presentations given provincially, nationally, and internationally by supported researchers, broken down by research program&lt;br&gt;An IDM rubric was developed to monitor and evaluate activities and outcomes from point of engagement to adoption&lt;br&gt;Engagement (e.g. number (#) of teams engaged in policy or program groups/committees)&lt;br&gt;Dissemination (e.g. number (#) of teams whose research and/or results were communicated generally to key audiences in relevant fields)&lt;br&gt;Use (e.g. number (#) of teams whose research and/or results were used to inform the development of recommendations for the health system)&lt;br&gt;Adoption (e.g. number (#) of teams whose research and/or results were used to inform a change in policy, program, or service delivery, etc.)</td>
</tr>
<tr>
<td>Long-term outcomes</td>
<td>Health and well-being</td>
<td></td>
<td>Number (#) and proportion (%) of grantees engaged in health status-related research projects, by type and target groups&lt;br&gt;Number (#) and description of health status outcomes reported as achieved by grantees, by type, and target groups</td>
</tr>
<tr>
<td></td>
<td>Determinants of health: modifiable risk factors, social determinants, etc.</td>
<td>Number (#) and proportion (%) of grantees engaged in determinants of health related research projects, by type, and target groups&lt;br&gt;Number (#) and description of determinants of health outcomes reported as achieved by grantees, by type, and target groups</td>
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</tr>
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<td></td>
<td>Healthcare system: acceptability, accessibility, appropriateness, etc.</td>
<td>Number (#) and proportion (%) of grantees engaged in healthcare system-related research projects, by type, and target groups&lt;br&gt;Number (#) and description of healthcare system outcomes reported as achieved by grantees, by type, and target groups</td>
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<tr>
<td></td>
<td>Social well-being</td>
<td>Number (#) and proportion (%) of grantees engaged in research projects related to social benefits and well-being, by type, and target groups&lt;br&gt;Number (#) and description of social benefits and well-being outcomes reported as achieved by grantees, by type, and target groups</td>
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<tr>
<td></td>
<td>Broad economic</td>
<td></td>
<td>Number (#), type, and progress of patent activity (e.g. patents applications, issued, published, cited, etc.)&lt;br&gt;Licensing returns ($)</td>
</tr>
<tr>
<td></td>
<td>Technology transfer</td>
<td></td>
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<tr>
<td></td>
<td>Commercialization</td>
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</table>

HSP: highly skilled people; IP: innovation platforms; IDM: inform decision making
4. The AIHS impact framework

An image of the AIHS impact framework is presented in Fig. 4. Despite its linear appearance, research and innovation systems, as with any eco-system, are dynamic and interactive with interdependent, simultaneously occurring, feedback loops. The framework aligns to the Alberta Health Research Innovation Strategy (AHRIS) (Government of Alberta 2010) through which AIHS undertakes a number of actions that contribute to anticipated system-level outcomes. The pathway to impact uses the same logic flow as the CAHS model.

As illustrated in Fig. 4, AIHS' mission and vision is the overarching driver of the impact framework. At AIHS, organizational planning and development is supported by broad stakeholder engagement approaches (e.g. cross-sector community consultations) and/or evidence. These activities result in the implementation and delivery of organizational programs and services (depicted by the gray arrow).

Moving to the right of the figure, AIHS supports strategically focused research through its various funding programs. The organization manages its research investments and delivers value-added services to its end users including skills training and relationship brokering. Such activity contributes to the development of highly skilled health researchers and trainees, as well as core infrastructure established in priority areas and improved decision-making capacity in the health sector. As a product of research activity, new knowledge is added to the global pool of knowledge. This knowledge may be mobilized through a process of interactions, feedback, and engagement using a variety of mechanisms (e.g. collaborations, partnerships, networks, knowledge brokering, etc.) with relevant target audiences (i.e. actors and performers) across the health sector. According to the model, the push of knowledge from the organization and its researchers and the pull of information from target audiences will contribute to more use (Sullivan, Strachan and Timmons 2007). The intent is that investments in health research will result in more appropriate interventions for the health system. AIHS' ultimate goal is to contribute to improved health and well-being and greater socioeconomic prosperity for Albertans and people throughout the world.

Research and innovation impacts are realized over time. Outcomes of research may be short term such as publishing research results, medium term such as a change in a health service delivery process, or long term such as the development of new health-care products and technologies. A number of feedback mechanisms occur throughout this process. For example, the results of health research investments feedback to inform future research activity (i.e. program planning, investment
strategies, etc.) and, through linkage and exchange mechanisms, research and innovation is diffused into the system for decision making, health, and/or socioeconomic uptake.

Using the AIHS impact framework as a guide, performance management, and evaluation methods (e.g. cascaded logic models) are used to inform the selection of appropriate progress markers and indicators. A set of tools for monitoring and evaluating the extent to which AIHS’ strategies and investments are contributing to its mission are used (e.g. grantee progress and final reports, bibliometric and econometric records, etc.). Ongoing organizational assessment, including the evaluation of AIHS’ contribution to the Alberta Innovates system, and the collection of evidence to inform organizational decision making continues to evolve.

5. Discussion: challenges and lessons learned

There have been a number of challenges in developing and applying the impact framework at AIHS. The process was resource intensive. A considerable amount of time and dedication was required to integrate the CAHS model into AIHS operations. Both human resources as well as technical infrastructure (e.g. web-based portals for data capture) were necessary to implement the new methods and practices. Data capture and timely reporting of key information to different stakeholders still presents a challenge: the organization’s information management system was not designed with the AIHS impact framework’s data architecture in mind, and to date, data capture and reporting has been primarily manual. These limitations will be addressed with the new information management system under development at AIHS. In the future, a focus on implementing data sets with a minimal number of key performance indicators for each program will help alleviate this challenge and will help to optimize the ongoing management of performance monitoring and evaluation at AIHS.

Currently, administrative burden on the research community is also a challenge as most of the data sources used in the framework rely predominately on researcher self-report. There is a lack of consensus among health research funders and other system stakeholders regarding what information they should collect from grantees. However, there are some promising developments underway to address some of these administrative and standardization issues. On a national level, the Consortia Advancing Standards in Research Administration Information (CASRAI) is working with the research community in Canada and elsewhere (CASRAI 2012) to develop common data standards applicable throughout the research life-cycle and specifically in research impact. Internationally, the STAR Metrics initiative in the USA is
leveraging existing academic processes and administrative data to assess the impact of federal research and development investments (NIH, NSF, and OSTP 2010). Establishing data capture tools and processes in areas of shared interest with academic institutions in Alberta and Canada would help reduce the data capture burden.

Another challenge is the issue of value and measurement. Extending the impact framework beyond the collection of traditional scientific indicators (e.g. publication output) to include measures of greater interest to the broader stakeholder community (e.g. indicators of societal benefit) is challenging; societal benefits are difficult to measure directly. Compounding the issue is the lack of agreement on how nontraditional forms of measurement should be done. Agreement among those in the research and evaluation community about the most appropriate health research outputs and outcomes to measure over time, and the best ways to do so, would be of great value to those doing research evaluation and would help advance the ‘science of science policy’ practice.

Despite these challenges, the AIHS impact framework addressed some of the recommendations made in reference to the Payback model. The products and tools AIHS generated through the framework’s implementation included:

(1) a performance measurement system that tracks progress to impact;
(2) aggregated and pooled reporting capabilities through the standardization of indicators and metrics across programs, and
(3) The adoption of additional impact categories, indicators, and measures which improved the organization’s ability to assess and demonstrate its contributions to health system impacts in addition to the contribution of its grantees.

6. Conclusion

Publication of the CAHS framework was a much awaited development in the Canadian health research community as previous attempts to assess returns on investment lacked a nationally agreed upon standard. With the groundwork thus laid, system stakeholders (e.g. funding organizations, government, industry, and other decision makers) were presented with a common language and theory about the benefits of health research and how to evaluate them. Despite these advances, the CAHS model still a relatively new framework and requires further enhancement (i.e. implementing the aspirational indicators). AIHS, as an early adopter, has contextualized and modified the CAHS model and in doing so have made some small contribution to its evidence base.

The CAHS model proved to be useful given its standard approach to health research impact assessment. The model is sufficiently flexible to be customized to an organization’s needs. It offers practical guidance to move impact assessment forward: it is more actionable because it makes more explicit the ‘how’ to inform implementation. The model can be applied at multiple levels from the micro (e.g. individual grantee projects, research programs, etc.), meso (e.g. organization) to the macro (e.g. contribution to the provincial innovation and health systems, etc.) and across different time intervals. The framework is appropriate for evaluating impacts across the full spectrum of health research. Further assessment of research and innovation impact will continue to inform the use and evolution of the CAHS model and its subsequent applications.

Implementation of the impact framework has changed the way AIHS monitors and evaluates its research investments. The organization has extended the measurement and assessment of impact beyond scientific value to include social value and organizational performance. Return on investment is no longer conceptualized simply in terms of publications and capacity building, but also in how research contributes to informing decision making and improved practice in health and health systems, and the generation of products and services that contribute to economic growth. The frequency of data capture has also increased. Progress to impact is tracked annually and in some cases more frequently as per business requirements (e.g. quarterly progress reporting): waiting years for a final report is no longer feasible given the expectations for performance reporting and accountability. The increased frequency of data capture facilitates timelier reporting of investment outcomes which are of interest to AIHS stakeholders and the public.

As an organization undergoing change, AIHS will continue to refine its impact framework as needed. The next phase will focus on integrating the framework into new program opportunities at AIHS. Further investigation of the benefits that could be gained by incorporating additional theories and approaches (e.g. reach, use, etc.) into the AIHS impact framework is under development. Further exploration of the concept of ‘infratechnology’ seems warranted given the results of both the retrospective and prospective studies. The refinement of key performance indicators that are valid, reliable, and relevant to stakeholder needs will continue. Simplifying the model for ease of use and timely reporting is an ongoing quality improvement initiative. Further development of decision support tools to inform investment, practice, and policy-related decision making at AIHS is also required.

In conclusion, it is a substantial challenge to measure and assess the return on investments in health research and innovation. However, we hope this work contributes to addressing the challenge. Additionally, it appears that interest in the ‘science of science policy’ and practice is growing (http://scienceofsciencepolicy.net); this should also advance research evaluation practices. Consider for
example, the National Science Foundation awards dedicated to examining the impact of science investments as well as the growing communities of practices in this area (e.g. the Science of Science Policy interagency task group, Husbands Fealing et al. 2011; the American Evaluation Association’s Research, Technology and Development Evaluation Topical Interest Group, etc.). In our opinion, the optimization of research investments will continue to improve as implementation and testing of frameworks and tools, as well as the development of national research standards (CASRAI 2012), provide promising practices for the health research and evaluation community.

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We would like to acknowledge Amy Wong who was instrumental in the initial framework development, also to Amber Mellot and Liza Chan for their literature search and review; and again to Amber Mellot, Allen Tran, and Leigh Yang for their tireless work and input into the retrospective studies featured in this article. We would also like to acknowledge AIHS staff and researchers who were involved in the development and application of the AIHS impact framework. As well as to the anonymous reviewers and editor who helped further refine our article.

Notes

1. According to Morris, Wooding and Grant (2011), the average time it takes for research evidence to inform clinical practice is on average 17 years.

2. A description of select terms used in the AIHS impact framework is provided in the Appendix: Definitions of Select Terms.

3. For further information on Buxton and Hanney’s Payback model please see Appendix C, Describing the Payback Model, p. A232, Making and Impact, CAHS (2009).

4. The full literature review methodology has not been published and will be the focus of another article.

5. In 2007, a number of Canadian research organizations (including AIHS) commissioned the Canadian Academy of Health Sciences (CAHS) to recommend a framework and associated indicators for assessing the returns on investment in health research. Following an in-depth review of evaluation frameworks, the CAHS concluded that the Buxton–Hanney Payback model was the preferred approach to assess health research impact (2009).

6. Although highly desirable, some of the indicators identified in the CAHS model are aspirational in nature as the data sources required were either not available or are difficult to collect and/or analyze (CAHS 2009).

7. The AHFMR Independent Investigators Program was closed to new entry as of July 2010.

8. In 2011, AIHS began a formal engagement process with stakeholders from government, the research community, the health system, not-for-profit organizations, and private industry to collectively develop initiatives that would deliver on its mandate and that were based on quality and relevance to Alberta’s needs and opportunities. Resulting recommendations received feedback from across the broad stakeholder community. Stakeholder engagement to further develop initiatives and strategies will be ongoing as a new strategic process at AIHS.

References


Appendix

Definitions of select terms*

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<tr>
<th>Terminology</th>
<th>Definition</th>
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<tr>
<td>Outputs</td>
<td>The direct products and/or services that are generated as a result of AIHS' and supported research activities. Examples include research studies, plans, workshops, documents produced, etc.</td>
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<tr>
<td>Outcomes</td>
<td>Outcomes are a change in a condition or state that results from AIHS' and supported research activities and outputs. Examples of outcomes include changes in knowledge, awareness, skills, attitudes, opinions, practices, behaviours, decision making, policies, etc. Generally, outcomes fall along a continuum of time from short (e.g., 1–3 years), medium (e.g., 4–7 years) to long term (greater than 8 years). However, at AIHS time spans for outcomes are considered relative based on program/initiative goals and objectives (where appropriate) and are specified for each program/initiative. Short-term outcomes are considered to be in the organization/researcher’s direct influence, while medium- and long-term outcomes are considered more indirect and moderated by external factors.</td>
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- **Short-term outcomes** are under the influence of AIHS' program/initiatives and supported research generated outputs. Typical examples of short-term outcomes include changes in target audience awareness, knowledge, skills, attitudes, reactions, etc.
- **Medium-term outcomes** are a change that is considered to have occurred usually once one or more short-term outcomes have been achieved. Examples of medium-term outcomes can include changes in target audience behaviours, practices, decision-making (e.g. knowledge/information use among end users), as well as changes to policies or programs, etc.
- **Long-term outcomes** are considered to have occurred usually as a consequence of one or more medium-term outcomes having been achieved. At AIHS, long-term outcomes refer to system-level changes in states or conditions with the acknowledgement that influence is indirect, in addition to recognizing that a greater number of external factors come into play. Examples include changes in healthcare practices and socioeconomic conditions of the population.

Sample of AIHS additional outcome categories

- **Strategic collaborations and partnerships**: AIHS actively seeks out opportunities to work with others (e.g. other funding agencies, research institutions, community groups, etc.) that may result in new and unique program growth, sustainability, and diversification. The intent of AIHS' organizational collaborations and partnerships is to foster and encourage collective ventures and undertakings that advance a shared vision among our collaborators and partners and leverage existing resources to attain health outcomes for the benefit of Albertans.
- **Support research**: AIHS leads, develops, coordinates, and supports value-added initiatives integral to the health research enterprise.
- **Influence innovation**: AIHS contributes to improving the capacity of the Alberta health research and...
Continued

innovation enterprise to share and use knowledge arising from research. This facilitates positive returns from research investments.

Important note: at AIHS outcomes are considered interchangeable with impact. However, in the literature other logic models describe impact as only referring to the long-term outcome (or final, ultimate outcome), or impact is used in addition to the ultimate or final outcome. AIHS uses the five CAHS ‘impact’ categories to categorize research outcomes in addition to identifying other outcome categories that were derived from developing logic models for each program/initiative.

Payback The payback framework describes ‘payback’, or the benefits that result from investments in health research, across five categories: knowledge production; research targeting, capacity building, and absorption; informing policy and product development; health and health sector benefits; and broader economic benefits. In other words, ‘payback’ categories are interchangeable with ‘impact’, however, AIHS uses the CAHS impact categories descriptors.

*Please note that the logic model definitions (outputs and outcomes) make reference to what AIHS directly manages as well as the research it directly supports (either individually and/or in collaboration with support from its partners).

Sources: Adapted from Treasury Board of Canada Secretariat (2012) and Buxton and Hanney (1999).