A census of economic evaluations in health promotion

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Abstract

While policy makers argue for a greater share of health resources to go to health promotion, action is stalled by, among other things, the perception that little is known about which interventions offer the best health returns. Additionally, what is missing is any sense of what the economic literature in health promotion looks like overall. Where is the economic evidence plentiful and where is it scant? The project described here compiled a census of economic evaluations in health promotion. Studies were classified according to a four-part typology that documented the strategic intent of the intervention, the risk factor being addressed, the population most affected and the setting in which the intervention took place. Since 1990, there have been over 400 economic evaluations of health-promoting interventions in the peer review and grey literatures. Of these, 90% address biological or behavioral determinants of health. Relatively little is known about the economics of population health advocacy or interventions to tackle the social and economic determinants of health. Initiatives are in place to increase the availability of economic evidence. Research is also needed into how to support decision makers’ use of imperfect, incomplete and uncertain information.

Introduction

Policy makers are increasingly arguing that a greater share of health resources should go to health promotion (Select Committee on Health, 2001; Romanow, 2002). Action is frequently stalled, however, by the perception that not enough is known about what types of intervention offer the biggest health returns for their cost and what effects each might have on the distribution of health. The lack of information on cost-effectiveness is seen as a barrier to policy (Syme et al., 2002).

This position is changing. Following the lead provided by the Canadian Task Force on the Periodic Health Examination, the US Preventive Services Task Force (USPSTF) has reviewed preventive services provided in clinical settings (i.e. screening, counseling, immunization and chemoprevention). The establishment of the Task Force on Community Preventive Services (TFCPS) has extended this initiative into services provided in community settings. Initially, the USPSTF focused only on the effectiveness of preventive services, but evidence on the economic efficiency of the services recommended by the first and second Task Forces has since been synthesized independently (Stone et al., 2000; Coffield et al., 2001), and the terms of reference of the third Task Force specifically include economic evaluation (Saha et al., 2001). Its community counterpart, the TFCPS, has also made assessment of economic efficiency integral to its program of work (Carande-Kulis et al., 2000; Zaza et al., 2000). Systematic reviews of the economic evidence in tobacco cessation, vaccine-preventable disease and reducing injury to motor vehicle occupants have since been published (Briss et al., 2000;...
Hopkins et al., 2001; Zaza et al., 2001). In the UK, the Centre for Reviews and Dissemination (CRD) manages an extensive database of economic evaluations of health service interventions, including health promotion. This contains over 7100 citations, of which more than 2300 records are identified as economic evaluations. The CRD is not undertaking systematic reviews of this evidence, but is subjecting each study to a critical appraisal. A structured abstract for each study summarizes the reviewer’s assessment of how well the evaluation meets the methodological standards set out by the CRD (Centre for Reviews and Dissemination, 1996).

However, while these initiatives are welcomed, they are limited in scope. The CRD provides a critical appraisal of economic evaluations, but its focus is not solely on population health. The number of evaluations of health-promotion practice that is included in the CRD’s database is correspondingly limited. The TFCPS has the required focus on health promotion, but it has restricted itself to economic evaluations based on high-quality evidence (predominantly randomized controlled studies) of effectiveness.

What is missing is any sense of what the economic literature looks like in total. That is, where is the economic evidence plentiful and where is it deficient? What types of health promotion practice do we know most about and what types the least? The aim of the project described here was to compile a census of the evidence on the economic efficiency of health promoting interventions. [In keeping with practice in Europe, Canada, Australia and Asia, we use the term ‘health promotion’ to refer to ‘the process of enabling people to increase control over the determinants of health and thereby improve their health’ (WHO, 1998), i.e. it includes what is commonly referred to as ‘health education’ in the USA.] We set out to compile a map of the field for policy makers using a broader conception of health promotion than that used by the aforementioned task forces so as to reflect more accurately the totality of health promotion activity. We see this census as the first stage of a process to determine where new evaluative efforts in health economics might be best directed in future.

### Methods

To compile the census, we searched the main health related, electronic databases including PubMed, Health Promis, EconLit, Embase, PsychInfo and Web of Science. The search for gray literature included a scan of the World Wide Web including the sites of known health economic research units and searches of two registries of gray literature (maintained by the New York Academy of Medicine and the University of Laval). The bibliographies of review articles were also examined for references that had not been identified in the original searches.

The choice of search terms involved trading off sensitivity against specificity (Lefebvre and Clarke, 2001). If search terms are defined too broadly, then too many studies are identified and time has to be spent culling records. If search terms are defined too narrowly, then relevant studies are excluded and a biased opinion of the availability of evidence is generated. After performing several searches of the PubMed database, refining the terms each time, we came up with a final list of terms that seemed to exhaust the available evidence (see Appendix).

To ensure relevance and feasibility, the scope of the census was limited to studies that (1) were published in English between 1990 and 2001 inclusive, (2) reported an economic evaluation of primary health promotion and (3) were pertinent to practice in a developed country as defined by the World Bank (www.worldbank.org). Economic evaluations of secondary and tertiary prevention were excluded.

Having completed the searches and eliminated all duplicate records, the remaining references were subjected to a two-stage screening process to determine final eligibility. At Stage 1, the title and abstract of each record was reviewed to rule out studies that did not report the economic evaluation of a health-promoting intervention. Following Drummond et al. (Drummond et al., 1997), we regarded as an economic evaluation any study that sought to compare at least two interventions, one of which was primary prevention, in terms of both their costs and their effectiveness. If there was any
doubt about eligibility, the study passed on to Stage 2. The second stage involved reviewing each paper in full to confirm that it did indeed report an economic evaluation of health promotion.

To ensure that the eligibility of studies was being assessed consistently, two batches of 60 studies were chosen at random and were classified by two authors independently. Agreement was tested with a $\kappa$ statistic, which assesses the degree of agreement between the two raters over and above that expected by chance alone (Norman and Streiner, 2000). Agreement for the first batch was reasonable ($\kappa = 0.64$) and for the second batch was excellent ($\kappa = 0.92$).

To organize the census and identify gaps and areas of strength in the evidence, we classified eligible references according to a four-part typology. This covered the type of health promotion intervention, the risk factor being tackled by the intervention, the setting in which the intervention was situated and the population most affected by the intervention.

Types of intervention were classified according to the areas of health promotion practice specified by the WHO in its Ottawa Charter (WHO, 1986). This identifies five areas of practice: building healthy public policy, creating supportive environments, strengthening community actions, developing personal skills and reorienting health services. The distinctions between these categories are not obvious. To classify studies, we focused on the verbs in each of the priority areas. Thus, a paper that reported the effect of an increase in the rate of taxation on tobacco was considered to be implementation of policy rather than building public policy. Since the intention of the policy was to make the healthier choice the easier one, the citation would have been classified as ‘creating a supportive environment’. In contrast, a paper that described the economic aspects of the process of creating a constituency of public support prior to the introduction of the tax increase would be classified as ‘building healthy public policy’. As a single citation might report many interlinked interventions, it was possible for a paper to be placed in multiple categories.

While the Ottawa Charter covers most areas of health promotion practice, it does not relate well to clinical interventions that have a health-promoting objective. These are defined as any ‘clinician/patient interaction that promotes health and prevents illness or injuries’ (Stachenko, 1997). We therefore added a sixth category ‘clinical—preventive’ to the areas of practice specified in the Charter to cover interventions such as vaccination.

The second element in the typology was the risk factor being addressed. The WHO defines risk factors as the ‘social, economic or biological status, behaviors or environments that are associated with or cause increased susceptibility to a specific disease, ill health, or injury’ (WHO, 1998). This definition identifies five categories of risk factor. Others have used the term ‘risk condition’ to distinguish social, economic and environmental determinants from biological and behavioral ones, but for the purposes of the typology we have retained the WHO approach.

The third element of the typology was the setting in which the intervention took place. Settings are defined as ‘the place or social context in which people engage in daily activities in which environmental, organizational and personal factors interact to affect health and well being’ (WHO, 1998). The concept of setting is fundamental to both health promotion theory and practice (Green et al., 2000). The main settings identified in the research literature were schools, worksites, health care settings, and geographically defined communities such as neighborhoods and cities.

The fourth element of the typology was the population targeted in the intervention. Populations affected by the intervention were identified and then classified into one of three groups: Life Stage such as age or biological status (e.g. infants or pregnant women); Social, where the population of interest has been defined by factors such as behavior, economic or social status, culture or sexuality (e.g. travelers, smokers or gay men); and, finally, Whole Population, where the intervention does not have any specific population as a target but is aimed at everybody in a given setting, (e.g. all residents in a specified geographic area).
Results

Our search identified 4200 records that were candidates for inclusion in the census. Of these, 1404 were duplicates, 1877 were not related to primary prevention, 105 were not relevant to practice in developed economies and 400 were excluded for not reporting an economic evaluation. Thus, 414 references were included in the census, each of which is described in an accompanying bibliography (Rush et al., 2003). An indication of the growth in the number of economic evaluations over the 12 years surveyed is shown in Figure 1.

Most of the economic evidence published between 1990 and 2001 relates to interventions designed to develop personal skills or to provide an evidence base to clinical—preventive measures (Table I). Despite the importance of building healthy policy, we know nothing of the cost-effectiveness of public health advocacy. In terms of the type of risk factor being addressed, 90% of citations refer to interventions that address biological or behavioral determinants of health (Table I). Nearly one-half of the studies address some aspect of infectious disease, predominantly vaccination (Table II). Very little analysis has been reported in the past 12 years examining the costs and effectiveness of intervening to address the social and economic determinants of health or to promote mental health.

Turning to the settings in which the interventions take place and the populations targeted, most evaluations relate to interventions being delivered in community-based locations or in health care settings including family practitioner clinics (Table I). Populations targeted in the interventions were defined mainly in terms of life stage, such as infants or pregnant women (Table I).

There is some correlation between elements of the typology. Interventions designed to develop personal skills tend to address behavioral determinants of health, while clinical—preventive interventions

<table>
<thead>
<tr>
<th>Category of typology</th>
<th>Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
</tr>
<tr>
<td>Type of health promotion activity</td>
<td></td>
</tr>
<tr>
<td>building healthy public policy</td>
<td>0 (0)</td>
</tr>
<tr>
<td>creating supportive environments</td>
<td>98 (21)</td>
</tr>
<tr>
<td>strengthen community actions</td>
<td>6 (1)</td>
</tr>
<tr>
<td>develop personal skills</td>
<td>159 (34)</td>
</tr>
<tr>
<td>reorient health services</td>
<td>5 (1)</td>
</tr>
<tr>
<td>clinical—preventive</td>
<td>193 (42)</td>
</tr>
<tr>
<td>totala</td>
<td>461</td>
</tr>
<tr>
<td>Risk factor</td>
<td></td>
</tr>
<tr>
<td>biological</td>
<td>200 (45)</td>
</tr>
<tr>
<td>behavior</td>
<td>192 (44)</td>
</tr>
<tr>
<td>environment</td>
<td>43 (10)</td>
</tr>
<tr>
<td>social</td>
<td>4 (1)</td>
</tr>
<tr>
<td>economic</td>
<td>1 (&lt;1)</td>
</tr>
<tr>
<td>totala</td>
<td>440</td>
</tr>
<tr>
<td>Setting</td>
<td></td>
</tr>
<tr>
<td>schools</td>
<td>25 (6)</td>
</tr>
<tr>
<td>worksites</td>
<td>61 (15)</td>
</tr>
<tr>
<td>health care settings</td>
<td>107 (25)</td>
</tr>
<tr>
<td>community based</td>
<td>133 (32)</td>
</tr>
<tr>
<td>other</td>
<td>3 (&lt;1)</td>
</tr>
<tr>
<td>none specified</td>
<td>91 (22)</td>
</tr>
<tr>
<td>totala</td>
<td>420</td>
</tr>
<tr>
<td>Population</td>
<td></td>
</tr>
<tr>
<td>life stage</td>
<td>308 (75)</td>
</tr>
<tr>
<td>social</td>
<td>75 (18)</td>
</tr>
<tr>
<td>whole of population</td>
<td>28 (7)</td>
</tr>
<tr>
<td>totala</td>
<td>411</td>
</tr>
</tbody>
</table>

*The number of citations in each part of the table is greater than the number of references or studies in the census (414) since a single study might report on interventions that apply to more than one area of practice.*
are focused mainly on the biological determinants of health (Table III). The ‘creating supportive environments’ strategy relates to interventions aimed at making healthy choices easy ones, and, as such, it covers both environmental measures such as changes in food supply and interventions aimed more directly at changing health behaviors such as taxes on tobacco or alcohol.

Relatively little is known about the economics of intervening in schools other than as venues to deliver clinical or behavioral interventions such as vaccination (Tables IV and V). There are very few studies that have examined the cost-effectiveness of using the school as a setting for addressing the environmental or social determinants of health of school-aged children.

### Discussion

#### Improving the search process

One immediate observation is just how laborious our search turned out to be. We identified a large number of references, but most of these turned out to be irrelevant. This inefficiency was not caused by a misguided search strategy, however, and others who have searched the literature for economic studies have encountered the same difficulty (Sassi et al., 2001). The reason lies in part in the assignment of MESH terms in the databases. The MESH term ‘cost benefit analysis’ assigned to a citation does not necessarily signify that this particular economic method, or indeed any economic method, was used to evaluate an intervention. The term is also assigned to articles that simply mention the need for an economic appraisal.

Even so, not all economic evaluations were captured by the ‘cost benefit analysis’ search term. We found two economic evaluations only by reviewing the bibliographies of other articles. Each reference did appear in the PubMed database, but neither was identified in our search. Each article had in fact been tagged as ‘cost and cost analysis’ rather than as ‘cost benefit analysis’. Extending the search strategy to include the former term would have

### Table II. Breakdown of risk factor or target of intervention

| Risk factor or target of intervention | References | N  | %
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious disease (excluding HIV/AIDS)</td>
<td>158</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>HIV/AIDS (including needle exchange)</td>
<td>42</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Tobacco control</td>
<td>41</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>41</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Injury prevention (including domestic violence)</td>
<td>37</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Childhood development (including healthy birth)</td>
<td>23</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Comprehensive risk factor interventions (e.g. worksites)</td>
<td>18</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Cancers other than related to tobacco use</td>
<td>11</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Preventive dentistry</td>
<td>9</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Alcohol and drugs other than tobacco</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Nutrition including food safety</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Physical activity</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>18</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>414</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table III. Number of citations cross-classified by type of health promotion activity and risk factor

<table>
<thead>
<tr>
<th>Type of health promotion activity</th>
<th>Biological</th>
<th>Behavior</th>
<th>Environment</th>
<th>Social</th>
<th>Economic</th>
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<tbody>
<tr>
<td>Building healthy public policy</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Creating supportive environments</td>
<td>12</td>
<td>68</td>
<td>40</td>
<td>2</td>
<td>0</td>
<td>122</td>
</tr>
<tr>
<td>Strengthen community actions</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Develop personal skills</td>
<td>6</td>
<td>154</td>
<td>14</td>
<td>2</td>
<td>1</td>
<td>177</td>
</tr>
<tr>
<td>Reorient health services</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Clinical—preventive</td>
<td>193</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>198</td>
</tr>
<tr>
<td>Totals</td>
<td>211</td>
<td>234</td>
<td>58</td>
<td>8</td>
<td>1</td>
<td>512</td>
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resulted in nearly 10,000 extra references being identified. Most of these would have been rejected as ineligible during the screening process as they would not be economic evaluations by Drummond’s definition. However, to reach this decision we would still need to review each article, making the task of compiling the census prohibitively expensive.

The problem of misclassification is not unique to economics. The same issue was encountered by those engaged in the early Cochrane reviews of randomized controlled trials. Many thousands of studies had been erroneously tagged as randomized trials in the electronic databases before the establishment of the collaboration. To improve the efficiency of the search process, Cochrane collaborators examined over 300,000 citations, re-tagging the study type as a trial only where it was appropriate to do so (Egger and Davey Smith, 2001). Given the growth in the number of economic evaluations and the efforts being devoted to include economic studies in the Cochrane database (Mugford, 2001), perhaps it is time to consider something similar in health economics. Reserving the term ‘economic evaluation’ in the study type field only for studies that make a comparative evaluation of cost and outcome would greatly improve the efficiency of future searches.

Despite the breadth of our searches, some citations were undoubtedly missed. The obvious gaps relate to evaluations published as books or book chapters, or as reports to funding bodies and government agencies, which are excluded from some, but not all, electronic databases. The Internet makes it possible to identify some of this material, but the search process is haphazard and time consuming. While we did capture a number of ‘grey literature’ reports through our web searches, we cannot be confident that we have captured them all.

It is also possible that public health agencies are generating their own economic evidence or are basing their policy decisions on evidence provided to them by private interests, and that this evidence is

<table>
<thead>
<tr>
<th>Type of health promotion activity</th>
<th>Setting</th>
<th>Schools</th>
<th>Worksites</th>
<th>Health care settings</th>
<th>Community based</th>
<th>Other settings</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building healthy public policy</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>Creating supportive environments</td>
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<td>19</td>
<td>20</td>
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<td>93</td>
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<td>0</td>
<td>0</td>
<td>6</td>
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<td>32</td>
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<td>Reorient health services</td>
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<td>1</td>
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<td>5</td>
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<td>18</td>
<td>51</td>
<td>42</td>
<td>1</td>
<td>126</td>
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<tr>
<td>Totals</td>
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<td>27</td>
<td>69</td>
<td>117</td>
<td>154</td>
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<table>
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<th>Setting</th>
<th>Category of risk factor</th>
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</tr>
<tr>
<td>Community based</td>
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<td>72</td>
<td>25</td>
<td>4</td>
<td>1</td>
<td>147</td>
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<tr>
<td>Other settings</td>
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<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>133</td>
<td>173</td>
<td>43</td>
<td>4</td>
<td>1</td>
<td>354</td>
</tr>
</tbody>
</table>
not being made more widely available (we are grateful to a reviewer for pointing out this possibility). Strictly, therefore, we cannot conclude from the results of the census that there is a lack of economic evidence, only that there is a lack of publicly accessible, peer-reviewed evidence. If this evidence exists and remains invisible, then one cannot assess its quality or apply it more widely. As we discuss below, we have reservations about the quality of even some of the peer-reviewed studies and so the value of any invisible evidence must be regarded with some suspicion. With the advent of the Internet, there is certainly no financial barrier to making such evidence available to a wider audience.

**Reflections on the results**

Our census provides a simple count and classification of the available evidence on the economic efficiency of population health interventions published between 1990 and 2001, and acts as a basis upon which to plan future evaluative effort. We have not summarized the results of the studies and have said nothing about the conclusions the authors of these works draw about the economic efficiency of health-promoting interventions. Several texts describing the methods of economic evaluation are available to the reader interested in learning more about the techniques (Gold *et al.*, 1996; Drummond *et al.*, 1997) or their application to health promotion (Tolley, 1992; Godfrey, 2001).

Care needs to be taken in interpreting the results of the studies since they vary enormously in quality. Ambitious claims have been made about the economic value of some health promotion interventions that on closer scrutiny are found to be unjustified (Warner and Bertera, 1992). A critical review of the economic studies contained in the census lies beyond the scope of this paper, although reviews are planned as the next stage of our research. Reviews of some of the studies contained in the census are included in the NHS Economic Evaluation Database (Centre for Reviews and Dissemination, 1996). The Harvard University, Cost-Effectiveness register (www.hsph.harvard.edu/cearegistry/) also identifies studies that adhere to the criteria laid out by the Washington Panel on Cost-Effectiveness (Weinstein *et al.*, 1996). Many of these refer to clinical treatments, but there are some health-promoting examples [see, e.g. (McIntyre *et al.*, 1994; Graham *et al.*, 1997; Sisk *et al.*, 1997)].

Notwithstanding the concern about the in-house economic evaluations that we may have missed, the most notable feature of this census is how concentrated the economic evidence is in a few established areas of health promotion practice, i.e. clinical prevention and behavioral programs. Well-represented areas include worksite health promotion (Pelletier, 1999) and smoking cessation (Buck, 1994; Warner, 1997; Lantz *et al.*, 2000). Much less is known about the cost-effectiveness of other aspects of health promotion such as community development and mental health promotion, for example. There is no recent evidence on the cost-effectiveness of interventions designed to build healthy public policy or those designed to address the economic determinants of disease and only scant evidence relating to interventions aimed at strengthening community action or those that address the social determinants of health. Little is known about the cost-effectiveness of social interventions in schools, despite the importance of school climate on child and adolescent health (Kasen *et al.*, 1990), and the scope to intervene effectively at this level (Patton *et al.*, 2000; Bond *et al.*, 2001).

In part, this is probably a reflection of the state of the evaluative literature in health promotion more generally. Economic evaluations must be based on good effectiveness data or be run alongside studies designed to provide this information. While we have not examined the quantity or quality of the evidence on effectiveness, we expect it to be more plentiful in the established areas of population health practice (International Union for Health Promotion and Education, 1999; Health Canada, 2000).

Clinical and behavioral interventions are typically the least challenging politically and the most likely to be implemented. Evaluation is also simpler and less expensive. The evaluation of community-based interventions brings with it logistical and study design problems (Koopsell *et al.*, 1992; Susser, 1995). It is harder to measure effectiveness...
and to attribute changes in outcome to the intervention in question, especially within the time frames set out by most funding bodies or political agendas. The evaluation design has to be more sophisticated to cope with social determinants that interact with each other (Ribisl et al., 1998) in ways that are a function of the context in which the intervention is delivered and evaluated (Manski, 1993; Hawe, 1998; McLeroy et al., 1988). The further one moves into the community, the more the evaluation design needs to be cognizant of political and cultural factors (Green and Kreuter, 2000).

Implications for future research

In short, complex health problems require complex interventions that in turn require complex evaluation designs (Wolff, 2001; Rychetnik et al., 2002). Some commentators have suggested that the health promotion field is now too complex and that efforts to evaluate the cost-effectiveness of population health interventions are futile (Burrows et al., 1995). Health economics is too linear, it is suggested, to deal with post-modern health promotion. We reject this suggestion whilst at the same time acknowledging that the application of economic methods needs to be improved to deal with complex interventions (Shiell and Hawe, 1996). We need to examine whether methods of outcome valuation that are based on individual ‘willingness to pay’ adequately capture the social benefit of interventions designed to improve sense of community, for example (Shiell and Rush, 2004). The application of economic costing methods may need to be refined to cope with capacity building efforts that are aimed at drawing in additional resources to an intervention and adding value to them (Trickett et al., 1985; Hawe et al., 2004). We must also examine whether the ‘ceteris paribus’ condition that somewhat silently underpins economic evaluation methods is tenable when community-based interventions aim to change social norms or community dynamics as a means of achieving their objective (Nyborg and Rege, 2003).

As the complexity of the problem and the sophistication of the research design increases, so it becomes imperative that economists who understand the theory underlying economic evaluation work together with experts in health promotion to ensure that all significant costs and benefits are included and suitably valued in the evaluation.

The need for primary evaluations in health promotion is not restricted to large-scale, complex programs, however. There is still much work that needs to be done to evaluate the economic efficiency of more mainstream health promoting interventions. Gaps in our understanding occur even within aspects of mainstream practice. Thus, relatively little is known about the cost-effectiveness of different forms of counter-marketing on tobacco use, for example (Warner, 2001). Neither is it always necessary to carry out new primary evaluations. Much useful information can still be gleaned from the available literature through the use of sensitivity analyses and computer-based simulations. Indeed, even very crude, desk-based estimates of cost-effectiveness can be a low-cost means of establishing whether or not a primary evaluation is likely to generate useful information (Shiell and Smith, 1993). More sophisticated simulation models are capable of generating a wider and more robust range of ‘what if’ estimates. However, their development of requires considerable investment of human resources (Gunning-Schepers et al., 1989; Tengs et al., 2001).

There is also work to be done to increase the use of economic evaluation by decision makers. The results of evaluations are always context specific since patterns of resource use and the baselines from which new interventions are evaluated rarely if ever correspond exactly with the circumstances in which the new evaluation might be implemented. Thus, effort is required to adapt available economic evidence in order to make it applicable locally and to synthesize the evidence to make it accessible to decision makers [see (Viney et al., 1996) for an example of work that was influential in guiding the Tobacco Cessation Policy for Central Sydney Health Service in Australia].

Furthermore, the economic evidence is rarely if ever definitive. The information it provides is typically incomplete, uncertain and contested.
The results require interpretation. Value-judgments always remain (Shiell, 1997). There is still much work to be done to translate the results of economic evaluations into practical policy recommendations. At this stage the economist usually backs off claiming that economic evaluation is only an aid to decision making. However, rather than ignoring the problem of how to use economic data, perhaps it is time that we worked with decision makers and helped to develop expertise in how to use this imperfect decision tool. Of relevance here is the experience that has been gained in research into priority setting approaches such as Program Budgeting and Marginal Analysis (PBMA). This has involved economists working intensively alongside health bureaucrats over long periods to distill the available evidence and translate it into policy [see, e.g. (Mitton and Donaldson, 2003)]. Research is still needed to determine the best way of working with policy makers to improve evidence-based decision making.

Conclusion

In conclusion, there has been a steady increase in the number of studies reporting some aspect of the cost-effectiveness of population health interventions in the past decade. Reviews of the literature in the early 1990s typically concluded that there were very few studies available (Cohen and Henderson, 1990; Pruitt, 1992). New evaluations in primary prevention are now appearing in the peer-reviewed literature at a rate of 60 or more studies per year. The literature remains small relative to the number and the rate of growth in studies evaluating the cost-effectiveness of health services more generally, however (Elixhauser et al., 2001).

Much of this evidence is concentrated in the established areas of health promotion practice such as lifestyle interventions and vaccination. The shift that is evident in health promotion thinking towards an ecological and integrated approach that encompasses both upstream and downstream determinants of health has yet to have an impact on the associated economic literature.

The census provides a foundation for planning future economic research in the area of health promotion practice. We will all benefit from efforts to critically appraise and systematically review the available evidence. We should seek collaborations to accelerate the process and coordinate the research to avoid duplication. In addition, we need to continue contributing to the evidence base through the execution of primary economic evaluations of health-promoting interventions, especially those based in schools, those aiming to promote mental health, and those addressing social and economic inequalities. The provision of more economic evidence will never be enough though. Further research is needed to explore how best to use incomplete, uncertain or less than perfect quality evidence.

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Appendix: Search Terms

Listed below are the search terms used for each of the databases.
For each database, the search parameters were limited as follows:

- **Date range:** 1990–2001
- **Language:** English
- **Studies must have abstracts (except for Health Promis)**
- **Focus:** Human subjects

### Search terms used for PubMed
- Accident prevention
- Community mental health services
- Community networks
- Cost benefit analysis
- Diseases category/economics
- Diseases category/prevention and control
- Disease outbreaks/economics
- Disease outbreaks/prevention and control
- Disease transmission/economics
- Disease transmission/prevention and control
- Endemic diseases/economics
- Endemic diseases/prevention and control
- Environmental pollution/economics
- Environmental pollution/prevention and control
- Health education
- Health promotion
- Nutrition/education
- Nutrition/legislation and jurisprudence
- Population health practice
- Preconception care
- Preventive dentistry
- Preventive health services
- Preventive medicine
- Sanitation/economics
- Sanitation/prevention and control
- Social problems/economics
- Social problems/prevention and control
- Tobacco use cessation

### Search terms used for Health Promis
- Accident prevention
- Community networks
- Cost benefit analysis
- Cost effectiveness
- Disease prevention
- Economic value of life
- Health education
- Health promotion
- Nutrition education
- Preventive dentistry
- Population health practice
- Smoking cessation

### Search terms used for EconLit
- Accident prevention
- Community mental health services
- Community networks
- Community psychology
- Cost benefit analysis
- Cost effectiveness
- Disease/prevention and control
- Disease outbreaks/economics
- Disease outbreaks/prevention and control
- Disease transmission/economics
- Economic value of life
- Endemic diseases/prevention and control
- Environmental pollution/economics
- Environmental pollution/prevention and control
- Health education
- Health promotion
- Nutrition/education
- Nutrition/legislation
- Preconception care
- Preventive dentistry
- Preventive health services
- Preventive medicine
- Population health practice
- Sanitation/economics
- Sanitation/prevention and control
- Social problems/prevention and control
- Tobacco use cessation

### Search terms used for Embase
- Accident prevention
- Community care
- Cost benefit analysis
- Cost effectiveness analysis
- Disease transmission
- Economic evaluation
- Economic value of life
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Search terms used for PsychInfo

- Accident prevention
- Adolescent pregnancy
- AIDS prevention
- Community mental health services
- Community psychology
- Community services
- Cost analysis
- Cost benefit
- Cost effectiveness
- Costs
- Crime prevention
- Drug abuse prevention
- Drug education
- Economics
- Economic value life
- Fire prevention
- Health education
- Health promotion
- Infectious disorders
- Mental health programs
- Nutrition
- Pollution
- Population health services
- Prenatal care
- Preventive medicine
- Safety
- Sex education
- Smoking cessation
- Social issues
- Suicide prevention