



Review Article

Making the most of natural experiments: What can studies of the withdrawal of public health interventions offer?



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ABSTRACT

Many interventions that may have large impacts on health and health inequalities, such as social and public health policies and health system reforms, are not amenable to evaluation using randomised controlled trials. The United Kingdom Medical Research Council's guidance on the evaluation of natural experiments draws attention to the need for ingenuity to identify interventions which can be robustly studied as they occur, and without experimental manipulation. Studies of intervention withdrawal may usefully widen the range of interventions that can be evaluated, allowing some interventions and policies, such as those that have developed piecemeal over a long period, to be evaluated for the first time. In particular, sudden removal may allow a more robust assessment of an intervention's long-term impact by minimising 'learning effects'. Interpreting changes that follow withdrawal as evidence of the impact of an intervention assumes that the effect is reversible and this assumption must be carefully justified. Otherwise, withdrawal-based studies suffer similar threats to validity as intervention studies. These threats should be addressed using recognised approaches, including appropriate choice of comparators, detailed understanding of the change processes at work, careful specification of research questions, and the use of falsification tests and other methods for strengthening causal attribution.

Evaluating intervention withdrawal provides opportunities to answer important questions about effectiveness of population health interventions, and to study the social determinants of health. Researchers, policymakers and practitioners should be alert to the opportunities provided by the withdrawal of interventions, but also aware of the pitfalls.

1. Introduction

Understanding the effectiveness of interventions is a key step in evidence-informed decision-making (WHO, 2007). Evidence-based medicine has emphasised the central role of randomised controlled trials (RCTs) in producing robust evidence of effectiveness (Guyatt et al., 2008), and the use of trials is strongly advocated in other fields such as poverty relief and social policy-making (Haynes et al., 2013; Tollefson, 2015). At the same time, there are concerns that many interventions are not amenable to experimental manipulation (Barrett and Carter, 2010; Deaton, 2009; Victora et al., 2004), and that an exclusive focus on RCTs will mean that interventions with substantial direct or indirect impacts on health and health inequalities – such as health system reforms, population-wide prevention measures (e.g. sugar and alcohol taxation) and non-health sector changes (e.g. welfare reforms) – will escape robust evaluation (Craig et al., 2017; House of Commons Health Committee, 2009; Katikireddi et al., 2011; Katikireddi et al., 2014).

The United Kingdom (UK) Medical Research Council (MRC) guidance on the evaluation of natural experiments (Craig et al., 2012) argues that we can robustly study interventions that are not under the direct control of researchers, but warns that good natural experiments are scarce, and that ingenuity is needed to identify the available opportunities. Although the importance of planning evaluation alongside the introduction of an intervention is increasingly appreciated by decision-makers and researchers (Cabinet Office, 2003; Trevisan, 2007), in practice this is difficult to achieve (House of Commons Health Committee, 2009). While there has been a renewed emphasis on evaluation recently, there is an historical accumulation of policies and practices supported by precedent or tradition, rather than by evidence of effectiveness. In this paper we argue that there is value in identifying and exploiting opportunities for evaluation of public health policies and interventions which arise from intervention withdrawal as well as from intervention introduction. Studies of intervention withdrawal are widely dispersed across the public health literature and there has been no previous attempt to summarise their contribution. We start by

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defining ‘withdrawal’ for the purposes of this paper and describe a number of exemplar studies. In the following two sections we summarise the reasons for studying intervention withdrawal, then consider possible drawbacks of the approach and some solutions. We finish by identifying lessons for the future and discussing some implications of this methodological perspective.

2. Defining intervention withdrawal

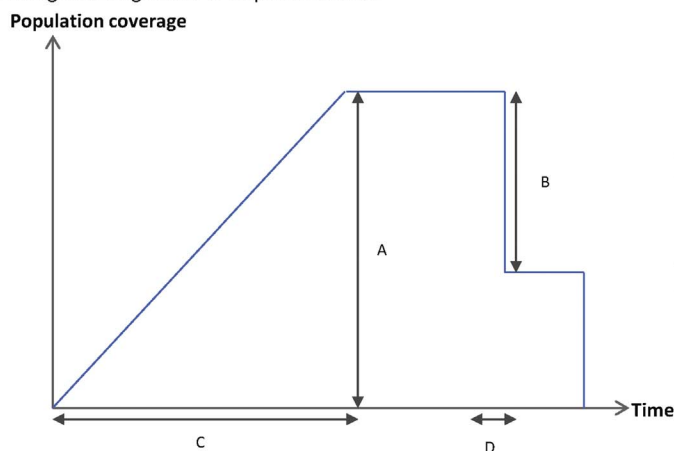
We define interventions broadly to include any kind of law, policy, programme or other action which impacts, positively or negatively, on a social, economic or health outcome. We define withdrawal as the complete or substantial reduction in provision of a longstanding intervention. Withdrawal may result from a deliberate policy change, but may also be an unintended consequence of a decision or event (such as a strike or legal judgement) motivated by other reasons. This definition of withdrawal encompasses a spectrum of processes, which may be abrupt or gradual, partial or complete. Abrupt and complete withdrawal of an intervention is most straightforward to evaluate, but gradual withdrawal or partial replacement also provides useful opportunities for evaluation. The nature of the withdrawal process has implications for the causal effect being evaluated (see Fig. 1). If an intervention that affected the whole population is partially withdrawn, this may limit the generalisability of evaluation findings (Fig. 1a). Similarly, the effectiveness of an intervention may differ over time

(Fig. 1b). For example, it is quite common for learning effects to lead to improved delivery as practitioners become more familiar with an intervention over time. Interventions may also be wholly or partly replaced with alternative interventions, rather than simply withdrawn. Just as pragmatic effectiveness studies must take account of ‘treatment as usual’ (Roland and Torgerson, 1998; Zwarenstein et al., 2008), studies of intervention withdrawal must take account of the precise nature of the comparison condition and extent of replacement.

To help understand the potential contribution of research investigating the withdrawal of interventions, we conducted a structured literature search to identify exemplar studies. We initially identified a number of topics that we were aware had been the subject of withdrawal studies, including hospital closures, alcohol tax reductions, regulatory policies, and welfare reform. We searched Web of Science, PubMed, OVID and Google Scholar using search terms developed with the assistance of an information scientist (CF).

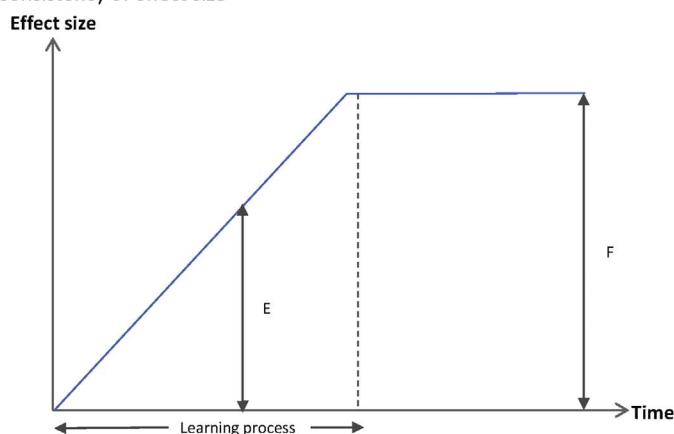
As intervention withdrawal has not been categorised in a standardised way in the literature, we were unable to use study design terminology and instead included the words “abolition”, “closure”, “cut”, “cutback”, “spending cut”, and “tax cut”. Due to the challenges identifying relevant literature and poor indexing of papers, we did not attempt to conduct a comprehensive search to identify all existing literature on withdrawal studies. Instead, we elected to focus on a selection of exemplar studies, chosen to illustrate the diverse range of topics studied and the various analytical approaches employed to

a) Timing and magnitude of implementation



Scenario 1: Evaluating the intervention’s introduction provides a causal estimate that is more generalisable due to larger population coverage than studying partial withdrawal (A vs B). However, evaluating withdrawal provides a causal estimate that may be less prone to confounding than gradual introduction, since there is less chance of a large change in confounders over a shorter time period (D vs C).

b) Consistency of effect size



Scenario 2: Evaluating the intervention’s introduction estimates the causal effect before the intervention is optimised, whereas studying withdrawal allows the optimised causal effect to be estimated (E vs F).

Fig. 1. An illustration of how causal effects may differ between evaluations of intervention introduction and withdrawal.

Scenario a: Evaluating the intervention’s introduction provides a causal estimate that is more generalisable due to larger population coverage than studying partial withdrawal (A vs B). However, evaluating withdrawal provides a causal estimate that may be less prone to confounding than gradual introduction, since there is less chance of a large change in confounders over a shorter time period (D vs C).

Scenario b: Evaluating the intervention’s introduction estimates the causal effect before the intervention is optimised, whereas studying withdrawal allows the optimised causal effect to be estimated (E vs F).

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