The Australian Prevention Partnership Centre

POLICY BRIEF: NATURAL EXPERIMENTS

Using natural experiments to evaluate public health interventions

Key messages

- Natural experiments are an increasingly valued approach for assessing the health impact of health and non-health interventions when planned and controlled experimental research designs may be infeasible or inappropriate to implement.
- We investigated how natural experiments have been used in obesity prevention to understand more about their value for informing evidence-based policies and practice.
- We found that natural experiments may be underutilised as an approach for providing evidence of the effects of interventions, particularly for evaluating health outcomes of interventions when unexpected opportunities to gather evidence arise.
- Greater recognition of the utility and versatility of natural experiments in generating evidence for complex health issues like obesity prevention is needed.

What are natural experiments?

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Natural experiments are described as a research approach to understanding the impact of public health policies or interventions in situations where it is impossible, infeasible or unethical for a researcher to manipulate the exposure or intervention of interest.[1]

We can think of natural experiments as opportunities rather than a type of study design. Sometimes natural experiments are confused with quasi-experiment designs; and while quasi-experiments make for good designs for conducting natural experiments, such level of control over the research conditions may not always be possible. Sometimes a researcher can gain some control over when and where an intervention occurs, such as arranging with relevant authorities to obtain data before the intervention takes place. More often the researcher does not have the ability to influence the research conditions determining exposure and its measurement and control of confounding variables.[2]

There are many situations where more public health research is needed but researchers may not have the ability to control and measure how, where or when a population is exposed to an intervention or event. This includes establishing research evidence on policies or population interventions. For example, to determine the impact of a new sugar taxation policy, examining how daylight-saving affects the time people spend doing physical activity, or exploring how access to healthy food affects child obesity. In such instances, planned and controlled research is rarely appropriate or possible and often too late or inopportune in resolving research gaps.

A Prevention Centre funded study aimed to investigate how natural experiments have been used in the area of obesity prevention. The study intended to understand more about the value of natural experiments for informing evidence-based policies and practice.[3]

What did we find?

We conducted a literature search of published research articles which had self-identified as a natural experiment in the period between 1997–2017.

We identified and examined 46 studies reported as natural experiments. The majority of these were policies (41%) or environment-based interventions (37%). A smaller number of studies were community-based interventions (11%); and only a few were of economic or individual behaviour change interventions. Policy interventions were usually measured at a state or national scale while the other intervention types were typically conducted at the neighbourhood level.

The studies identified explored various types of intervention including food labelling and taxations, built infrastructure developments, transport interventions, food accessibility, clinical and screening procedures, social environment changes, physical activity programs and equipment, transport interventions and exposure to economic and climate events.

A range of data collection and study design methods have been used to measure natural experiments including longitudinal study designs (with or without a control and comparator group), repeated cross-sectional surveys and interrupted time-series designs. However, we also found over a quarter of self-identified natural experiment studies used non-experimental designs and unable to provide any evaluation evidence.

Natural experiments are often criticised for their inability to eliminate bias in the research conditions. But their strength is in their ability to provide evidence quickly and delivery of scale, allowing exploration of a wide range of research questions to be investigated at a population level (Table 1). To improve research study designs the UK Research and Innovation Medical Research Council provides good guidance on how to improve exposure measures and statistical methodologies.[4]

Table 1: Summary of strengths and weaknesses of natural experiments

Strengths	Weaknesses
• Useful for examining processes and outcomes of policies and interventions within the real-world complex social and political conditions interventions and policies naturally operate (increases external validity) • Offer pragmatic evidence where planned controlled study methods may be impossible due to timing or exposure • Flexible to use for a range of research questions, intervention settings, scale and research methods • Findings can provide *indicative* (but not conclusive) evidence of causality.	• Often criticised for their inability to eliminate bias (especially confounding) as controlled environment conditions can't be replicated • When weak study designs are used this impedes the ability to make any causal inferences.

Why does it matter?

Natural experiments offer policy decision makers a way to improve policy and practice-based impact and effectiveness evidence or investigate other 'difficult to measure' events and interventions including social or environmental determinants which are under researched. In some situations, a natural experiment may be the only realistic option for obtaining research evidence because the intervention is so unique, it is too hard to find a suitable comparison group, or the timeframe is too short to allow a planned research study to be implemented or at least preclude pre-intervention data collection. This may be the case when a new policy is implemented quickly.

Some research questions necessitate a long lag time between exposure and outcome. For example, one study used historical data to determine how school education influences obesity. In other cases, a planned experiment would be unpractical because the nature of the intervention necessitates a whole-of-population approach or unethical if it restricts people from receiving care or likely to create harm if implemented intentionally.

We developed a short guide to help decisionmakers and researchers in determining when a natural experiment may be appropriate (Table 2) in the hope that this will improve the generation of evidence about the impact and effectiveness of policy strategies and implementation of population interventions in future.

Table 2: A guide to determine when to use a natural experiment[3]

Is there a need to generate population health research evidence about this issue?[5, 6] Does it provide evidence on the impact or effectiveness of a policy or environmental intervention, address health inequalities in the population or how to change behaviour?
Is a planned researcher-controlled study possible?[2] a. No ability to control where the intervention occurs, whom it affects or when it starts or finishes b. Partial ability to influence exposure timing or location (i.e. able to arrange with the relevant authorities to obtain comparative baseline data).
Is a planned researcher-controlled study ethical?[2, 4] a. Creating the conditions for an experiment to determine this issue would be unethical (e.g. where it may create more harm) b. Random assignment to the intervention would be unethical (e.g. withholding the only known cure for a disease).
Is a planned researcher-controlled study practical?[6-8] a. Sufficient population available for randomisation: total number of planned exposed/unexposed clusters required would be unrealistic to achieve b. Time for follow-up: unlikely a researcher-driven study could accommodate the prolonged periods necessary for outcomes to establish across entire populations c. Representativeness of the population: threat to applicability of a study if the population sample is too different to the population it was intended to represent d. Relative costs: sufficient sample and time lag before health impacts evolve would be costly to implement e. Program complexity: the intervention is so complex that a controlled study environment would be infeasible f. Intervention scale-up: an intervention is known to be efficacious/effective but requires demonstration of its effectiveness on a scale unlikely in a researcher driven context g. Real-world conditions: purpose is to document contextual factors constituting 'real-world' implementation conditions - experimental approach is antithetical to this purpose.

References

1. Craig P, Cooper C, Gunnell D, Haw S, Lawson K, Macintyre S, Ogilvie D, Petticrew M, Reeves B, Sutton M, Thompson S. Using natural experiments to evaluate population health interventions: new Medical Research Council guidance. J Epidemiol Community Health. 2012 Dec 1;66(12):1182–6.
2. Dawson A and Sim J. The nature and ethics of natural experiments. J Med Ethics. 2015 Oct 1;41(10):848–53.
3. Crane M, Bohn-Goldbaum E, Grunseit A, Bauman A. Using natural experiments to improve public health evidence: a review of context and utility for obesity prevention. Health Res. Policy Syst. 2020 Dec;18(1):1–3.
4. Craig P, Katikireddi SV, Leyland A, Popham F. Natural experiments: an overview of methods, approaches, and contributions to public health intervention research. Annu. Rev. Public Health. 2017 Mar 20;38:39–56.
5. Ogilvie D, Adams J, Bauman A, Gregg EW, Panter J, Siegel KR, Wareham NJ, White M. Using natural experimental studies to guide public health action: turning the evidence-based medicine paradigm on its head. J Epidemiol Community Health. 2020 Feb 1;74(2):203–8.
6. Petticrew M, Cummins S, Ferrell C, Findlay A, Higgins C, Hoy C, Kearns A, Sparks L. Natural experiments: an underused tool for public health? Public Health. 2005 Sep 1;119(9):751–7.
7. Sanson-Fisher RW, Bonevski B, Green LW, D'Este C. Limitations of the randomized controlled trial in evaluating population-based health interventions. Am. J. Prev. Med. 2007 Aug 1;33(2):155–61.
8. Victora CG, Habicht JP, Bryce J. Evidence-based public health: moving beyond randomized trials. Am. J. Public Health. 2004 Mar;94(3):400–5.

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