Policies to prevent the spillover of zoonotic diseases: protocol and preliminary results from a systematic scoping review of evaluative evidence

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Introduction

The increasing incidence of zoonotic emerging infectious diseases (EIDs) has been attributed to ecological, behavioural and socioeconomic change, and is predicted to continue in the coming years (1). Higher levels of anthropogenic activity, including agricultural intensification, urbanisation and other forms of land use change, have led to increased interactions between wildlife, humans and livestock, increasing the risk of cross-species transmission (2). Existing policy responses are predominantly reactive, focusing on preventing person-to-person transmission of EIDs after they have entered human populations through vaccination programmes; hand washing; face masks; school closures; and contract tracing and case isolation (3–9). While such measures are crucial, a call has been issued by leading organisations and experts, including the United Nations Environment Programme, the International Livestock Research Institute and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, to complement reactive policy responses with policies that prevent zoonotic EIDs by reducing the likelihood of zoonotic disease spillover events (1,10–13).

A number of approaches have been implemented to reduce the risk of disease spillover events, including surveillance of the pool of viruses in wildlife (14); enhanced food safety measures in both the livestock and wildlife value chain (15); controls on wildlife hunting, trade and consumption; and phasing out unsustainable agriculture practices (12). Given the range of possible risk factors that might contribute to emerging zoonoses, a 'One Health' response has been advocated, requiring coordination between institutions and government departments involved in health, trade, agriculture and the environment (16).

A comprehensive understanding of how policies to prevent zoonotic spillover have been evaluated and their effectiveness is lacking. Given the range of risk factors, government actors and policy measures involved in implementing these policies, as well as the range of academic disciplines involved in evaluating them, we expect the evaluative literature around this topic to be highly diverse. In order to inform the design and evaluation of future policies, this review represents an attempt to catalogue existing policies and evaluations across the spillover pathway, and present a comprehensive overview of this complex area of disease prevention.

With these considerations in mind, our objectives are to:

1. Identify evaluative evidence of population health policies that aim to prevent zoonotic spillover;
2. Synthesise the nature of how the policies were evaluated; and
3. Examine the effectiveness of the policies and identify gaps in the literature.

Our approach to identifying and analysing this literature will be informed by a One Health lens, acknowledging the inter-connectedness of human, animal and environmental health.

Methods

We are conducting a systematic scoping review of evaluations of policies aimed at preventing zoonotic spillover events. The scoping review will be conducted in line with guidelines published by Arksey and O'Malley and refined by Levac and colleagues (17–19), which emphasise an iterative approach suited to an exploratory research question.

A systematic search of four electronic databases (Medline, Scopus, Web of Science, Global Health) is currently underway. Records identified through the searches are being collated and double screened using the online platform Covidence (20) and will be included where they meet the following criteria:

1. Primary empirical study from any country or region;
2. Report empirical findings from a process evaluation or outcome evaluation; and
3. Focus on a policy implemented by government with the aim of preventing the spillover of zoonotic.

We will chart study characteristics relevant to the research questions and summarise them numerically. We will also conduct a thematic analysis of included papers to identify challenges encountered while evaluating policies to prevent zoonotic spillover.

Preliminary results

In order to pilot the search strategy and data charting process, an initial set of indicator papers that met the inclusion criteria were identified (n=10). We are presenting preliminary results based on analysis of these indicator papers, which will also be included in the final set of papers.

The majority of studies were conducted in countries and territories in East Asia and the Pacific (n=8). The most frequent disease focus was avian influenza (n=7). Policies targeted sectors including conservation, agriculture and livestock, trade and retail. Policy types included habitat protection (21); information campaigns for livestock owners (22); mandatory livestock vaccination (23); supplemental feeding of wildlife to draw them away from livestock (24); quarantine of livestock during international trade (25); and measures to manage risk in live animal markets, including market closure (26,27), limits on market size (28), and the introduction of rest days where markets were emptied and cleaned (29,30).

MULTI-SECTORAL POLICIES

While the overlapping drivers of zoonotic spillover might make coordination between government agencies useful, only one included paper evaluated a policy that was initiated by different government departments: the evaluation of supplementary feeding grounds for wild elk in the Greater Yellowstone Area as a means of reducing contact between grazing herds of elk and livestock (24). This policy was initiated jointly by the departments for agriculture, and for parks and conservation (24). The remaining policies were either initiated by a single department (departments for health (n=2), animal health (n=1) and agriculture (n=1)); did not state which department they had been initiated by (n=3); or were modelling studies and had not been implemented by a government (n=2).

UNINTENDED CONSEQUENCES OF POLICIES TO PREVENT ZOONOTIC SPILLOVER

A small number of papers examined the unintended consequences of policies to prevent zoonotic spillover (n=3). These unintended consequences included changes in disease dynamics in wildlife populations, potentially leading to increased spillover risk (24), as well as counter-productive changes in human practices (26) and attitudes (22) in response to policies. For example, local closure of live poultry markets in China in response to an outbreak of avian influenza led vendors to sell their animals in neighbouring areas without existing human cases, leading to additional instances of spillover between livestock and people (26). In a different context, a government information campaign for

horse owners in Australia, providing advice to reduce the risk of horses contracting Hendra virus from bats, led to horse owners feeling frustrated and alienated, stating that the government should focus on controlling bat populations instead (22). Given the complexity of risk factors leading to spillover events, considering unintended consequences is important in designing effective preventive policies.

CHALLENGES AND OPPORTUNITIES

Study authors noted a number of challenges encountered while evaluating policies to prevent zoonotic spillover. One study noted the difficulty of determining the impact of policies aiming to reduce spillover events between wildlife, livestock and humans, as the number of spillover events is often relatively small (24). This highlights the importance of considering upstream determinants and risk factors as outcome measures in attempting to evaluate these policies: where spillover events may happen infrequently or not at all during the period of observation, studying changes in risk factors for spillover can provide insight around the effectiveness of different policies in tackling spillover risk.

Three studies reflected on the value of routinely collected data, which was used in a number of studies (21,24,26), for policy evaluation. As policies to prevent zoonotic spillover are often reactive, being implemented in response to an outbreak among livestock or wildlife, routine data may often be the only data collected prior to policy implementation. However, in some contexts, for example in low- and middle-income countries, routine data on livestock health is not collected (25). As a result, integrating a plan for policy evaluation prior to implementation is essential for ongoing monitoring and surveillance of the policy's impact. Routine testing data from livestock can sometimes be used for evaluation where it exists, but it does not always provide sufficient detail for examining the potential for a policy to prevent zoonotic spillover. For example, some tests do not differentiate between current and past infection, making it difficult to identify where and when spillover occurred (24), and animal health data may not be granular enough for policy evaluation, particularly in terms of evaluating local policies (26).

Study significance

To our knowledge, this is the first attempt at systematically identifying and documenting evaluations of policies that aim to prevent spillover of zoonoses into human populations. Identification and analysis of all relevant papers will provide a comprehensive picture of the range of policies that have been evaluated, approaches to their evaluation, and evidence of their effectiveness, as well as identifying knowledge and methodological gaps in the current body of literature.

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