

Review Article

# Intersectoral and Translational Medicine: Bridging Research, Health Systems and Community Action for Sustainable Health Outcomes

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## I N F O

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## A B S T R A C T

Health problems in the twenty-first century increasingly arise from interconnected biological, environmental, social, economic and behavioural determinants and therefore cannot be adequately addressed by the health sector alone. Intersectoral medicine provides a framework through which health authorities, environmental agencies, educational institutions, agricultural and veterinary services, urban planners, social organisations, private-sector stakeholders and communities can collaborate to prevent disease and improve population health. Translational medicine complements this approach by facilitating the movement of scientific discoveries and evidence through clinical evaluation, implementation, policy adoption and population-level impact. Although these concepts have frequently developed along separate disciplinary pathways, their integration provides an opportunity to shorten the distance between scientific knowledge, health-system action and measurable community outcomes. The World Health Organization's One Health framework similarly emphasises collaboration among human, animal, plant and environmental sectors, while contemporary implementation science focuses on translating evidence into routine practice. This review examines the conceptual foundations of intersectoral and translational medicine, their relationship with preventive and community medicine, mechanisms for effective cross-sector collaboration, implementation barriers, digital and data-driven opportunities, and potential applications to infectious diseases, antimicrobial resistance, non-communicable diseases, environmental health and climate-sensitive conditions. A practical integrated framework is proposed in which evidence generation, stakeholder engagement, implementation, evaluation and community feedback operate as a continuous cycle. The review argues that intersectoral and translational medicine should be treated not merely as complementary academic concepts but as operational components of modern health-system design.

**Keywords:** Intersectoral Collaboration, Translational Medicine, Implementation Science, One Health, Community Medicine, Public Health, Health Systems, Knowledge Translation, Health Equity, Preventive Medicine

## Introduction

Health is determined by considerably more than access to clinical services. Social circumstances, education, employment, housing, food systems, transportation, environmental exposure, climate, behaviour and economic conditions influence the risk of disease and the capacity of individuals and communities to respond to health threats. Consequently, many important health problems cannot be solved by medical interventions operating in isolation. Effective prevention increasingly requires collaboration between health and non-health sectors, including education, agriculture, environment, veterinary services, transport, urban development, social welfare and local governance.<sup>1</sup>

The concept of intersectoral action for health emerged from recognition that determinants of health frequently fall outside the formal responsibilities of health ministries. Intersectoral collaboration may involve joint planning, shared resources, coordinated surveillance, integrated service delivery, common policy objectives and collective accountability. A recent scoping review identified funding, governance and leadership, structural mechanisms, process tools, and formal models and frameworks as important components of intersectoral collaboration.<sup>2</sup>

At the same time, medicine has undergone a transformation in how scientific discoveries are moved into practice. Translational medicine seeks to reduce the distance between scientific discovery and improvements in human health. Contemporary translational frameworks describe a continuum extending from fundamental research through human studies, clinical effectiveness, implementation and ultimately population-level outcomes.<sup>3,4</sup> However, the generation of evidence does not automatically result in its adoption. Implementation science has therefore emerged as an important bridge between evidence and routine healthcare practice.<sup>5</sup>

The relevance of these concepts is particularly strong for preventive and community medicine. The *International Journal of Preventive, Curative and Community Medicine* explicitly includes intersectoral and translational medicine within its scope, alongside public health, health management, health informatics, environmental health, climate change and disease management.<sup>6</sup> The integration of these domains therefore represents a direct thematic fit for the journal.

This review examines how intersectoral collaboration and translational medicine can be integrated into a unified

approach to health improvement, with particular attention to community-level implementation and population health.

## Conceptual Basis of Intersectoral Medicine

Intersectoral medicine refers to organised collaboration between different sectors whose activities influence health outcomes. These sectors may include healthcare, education, agriculture, animal health, environmental protection, water and sanitation, transport, housing, urban planning, social protection, finance and civil society.

The fundamental principle is that responsibility for health is distributed across society. A hospital can diagnose and treat asthma, for example, but sustained reduction in respiratory morbidity may also require improved air quality, transport planning, occupational regulation, housing standards and public awareness. Similarly, controlling zoonotic diseases requires cooperation among clinicians, veterinarians, laboratories, environmental authorities and communities.

Intersectoral action therefore differs from simple multidisciplinary practice. Multidisciplinary care commonly involves several professional groups working around the same patient or problem, whereas intersectoral action extends collaboration beyond the healthcare system itself. It introduces shared governance, shared objectives and shared accountability between organisations that may have different mandates.

Evidence from the literature suggests that successful intersectoral collaboration depends on mechanisms that include political commitment, appropriate leadership, stakeholder participation, sustainable financing, information sharing and organisational structures that enable cooperation (Table 1).<sup>2</sup>

## Translational Medicine and the Evidence-to-Impact Continuum

Translational medicine is concerned with moving knowledge across different stages of research and healthcare application. Although terminology varies, a commonly used model describes stages from T0 to T4.<sup>3</sup>

- **T0** represents fundamental discovery and preclinical research.
- **T1** involves translation into initial human studies and proof of concept.
- **T2** addresses clinical efficacy, effectiveness and development of evidence-based recommendations.
- **T3** concerns dissemination and implementation into routine healthcare and policy.
- **T4** examines population-level outcomes and the broader effects of health interventions.<sup>3,4</sup>

The distinction is important because many health interventions demonstrate efficacy under controlled research conditions but produce substantially different

outcomes when implemented in real-world settings. Context, resources, workforce capacity, organisational culture, patient behaviour and policy environments can all influence implementation.<sup>5</sup>

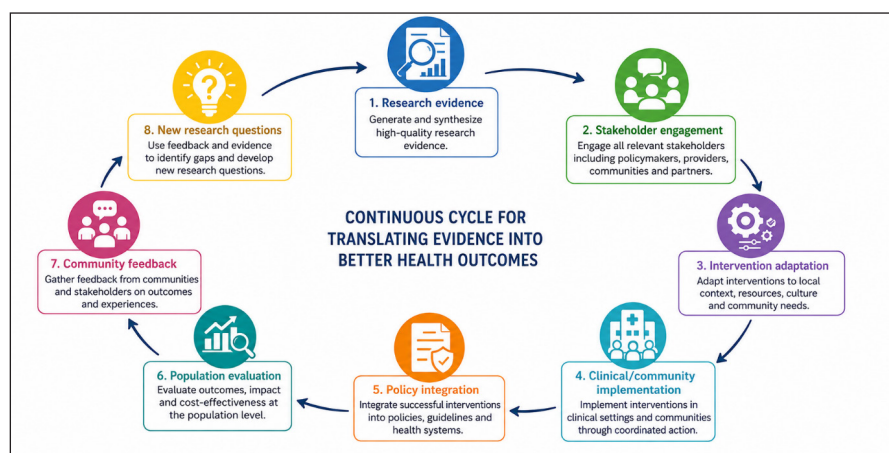
Translational medicine therefore should not be conceptualised merely as the movement of a laboratory discovery into a hospital. In preventive and community

medicine, translation must extend from research to health systems and ultimately to communities.

This circular model (Figure 1) emphasises that translation is not a one-directional process. Evidence informs policy and practice, while community experience and implementation data generate new research questions.

**Table 1. Major sectors contributing to population health**

| Sector                  | Principal contribution to health                                            |
|-------------------------|-----------------------------------------------------------------------------|
| Health services         | Prevention, diagnosis, treatment, surveillance and rehabilitation           |
| Education               | Health literacy, behavioural development and school health                  |
| Agriculture             | Food security, nutrition and control of agricultural exposures              |
| Veterinary services     | Zoonotic disease prevention and animal health surveillance                  |
| Environment             | Pollution control, ecosystem protection and environmental monitoring        |
| Water and sanitation    | Safe water, sanitation and hygiene                                          |
| Urban planning          | Healthy housing, transport, green spaces and walkability                    |
| Social welfare          | Poverty reduction, social protection and support for vulnerable populations |
| Transport               | Road safety, mobility and reduction of transport-related exposures          |
| Digital technology      | Surveillance, data integration, communication and decision support          |
| Community organisations | Participation, local knowledge and implementation support                   |



**Figure 1. Integrated intersectoral and translational health pathway**

## Intersectoral Medicine and One Health

One Health provides one of the clearest examples of intersectoral medicine in practice. The World Health Organization defines One Health as an integrated approach recognising the interdependence of human, animal, plant and ecosystem health.<sup>1,7</sup>

The importance of such collaboration has become increasingly apparent because emerging infectious diseases, antimicrobial resistance, food safety risks, climate-related hazards and ecological disruption frequently cross conventional administrative boundaries. WHO notes that effective One Health implementation requires collaboration,

communication, coordination and shared governance across relevant sectors.<sup>1</sup>

The Quadripartite One Health Joint Plan of Action, developed by WHO, the Food and Agriculture Organization, the United Nations Environment Programme and the World Organisation for Animal Health, identifies priorities including emerging zoonoses, endemic zoonotic diseases, food safety, antimicrobial resistance and integration of environmental considerations into One Health.<sup>7</sup>

The One Health approach therefore represents an important operational bridge between intersectoral medicine and translational public health.

For example, rabies prevention cannot rely exclusively on post-exposure prophylaxis in humans. Sustainable prevention requires vaccination and surveillance in animal populations, veterinary services, community education, responsible dog ownership, laboratory capacity and coordinated reporting systems. Similar principles apply to avian influenza, antimicrobial resistance and vector-borne diseases.

Evidence from India and other settings demonstrates that One Health initiatives can involve different forms of collaboration, including level-based, solution-based and third-party-supported models.<sup>8</sup> Comparative research has further shown that governance structures and institutional arrangements are central to operationalising intersectoral One Health action.<sup>9</sup>

### **From Research Discovery to Community Impact**

The greatest value of translational medicine is realised when evidence changes health outcomes outside the research environment. However, substantial barriers may occur between evidence generation and implementation.

A systematic examination of research translation frameworks identified numerous approaches for moving evidence into policy and practice, including RE-AIM, Knowledge-to-Action, PARIHS and other implementation frameworks.<sup>10</sup> These frameworks emphasise that interventions must be considered within their organisational, social and policy contexts.

Implementation science consequently provides an important bridge between translational medicine and community medicine. It investigates how evidence-based interventions can be adopted, adapted, implemented and sustained in real-world environments.<sup>11</sup>

Recent work has highlighted the importance of incorporating implementation science into clinical research so that interventions are designed with their eventual clinical and population applications in mind.<sup>12</sup> This is especially important in preventive medicine, where interventions often involve complex interactions between individuals, organisations and communities.

### **Intersectoral Collaboration as an Enabler of Translation**

Intersectoral collaboration can strengthen every stage of the translational continuum.

At the research stage, collaboration with policymakers and communities can help researchers identify questions that have practical relevance. At the development stage, stakeholders can contribute information about feasibility,

cost, cultural acceptability and infrastructure. At the implementation stage, health and non-health sectors can coordinate resources and responsibilities. At the evaluation stage, administrative, clinical, environmental and community data can be combined to assess outcomes.

Participatory approaches are particularly useful because they allow researchers, community members, implementers and other stakeholders to jointly integrate different forms of evidence.<sup>13</sup>

## **Applications in Preventive and Community Medicine**

### **Infectious disease prevention**

Intersectoral surveillance can improve early detection of infectious disease threats by integrating information from hospitals, primary care facilities, laboratories, veterinary services, environmental agencies and communities. Such systems are particularly relevant to zoonoses and vector-borne diseases.

The COVID-19 pandemic demonstrated the importance of coordination among healthcare providers, laboratories, public authorities, educational institutions, workplaces and communities. Lessons from the pandemic reinforce the need for systems capable of rapidly translating emerging evidence into operational guidance.

### **Antimicrobial resistance**

Antimicrobial resistance represents a classic intersectoral problem because antimicrobial use occurs in humans, animals and agriculture, while environmental contamination can contribute to dissemination. The One Health Joint Plan of Action specifically identifies antimicrobial resistance as a major priority.<sup>7</sup>

A translational approach requires evidence generation, surveillance, antimicrobial stewardship, prescribing interventions, infection prevention, veterinary regulation, environmental monitoring and community education.

### **Non-communicable diseases**

Non-communicable diseases also require action beyond clinical treatment. Tobacco control, obesity prevention, cardiovascular disease prevention and diabetes control depend on education, food systems, urban design, transport, taxation, regulation and community engagement.

For example, increasing physical activity cannot be achieved simply by advising patients to exercise. Safe walking infrastructure, accessible recreational spaces, school policies, workplace environments and urban planning may be necessary to translate behavioural recommendations into sustainable population-level change.

## Environmental and climate-sensitive health

Environmental health provides another strong application of intersectoral medicine. Air pollution, heat exposure, water insecurity, flooding and changing vector ecology require coordination between public health agencies and environmental, meteorological, agricultural, water and urban planning authorities.

The translational pathway begins with environmental and epidemiological research and proceeds through risk assessment, early warning systems, policy development, community communication and evaluation.

## Digital Health as a Translational and Intersectoral Platform

Digital technologies can provide infrastructure for intersectoral collaboration by enabling information exchange between otherwise fragmented systems.

Integrated surveillance platforms can combine clinical notifications with laboratory, environmental, veterinary and meteorological information. Geographic information systems can identify spatial relationships between disease occurrence and environmental or social determinants. Artificial intelligence can assist with pattern recognition, risk prediction and resource allocation, although its application requires appropriate validation, governance and protection of privacy.

Digital health should therefore be regarded as an enabling technology rather than an independent solution. Technology is unlikely to overcome fragmented governance if sectors lack shared objectives, compatible information systems or mechanisms for accountability.

## The Role of Community Participation

Intersectoral and translational medicine should ultimately be accountable to communities. Community members possess contextual knowledge that may not be captured by conventional biomedical research.

Community participation can improve intervention acceptability, identify barriers to implementation, support behaviour change and increase local ownership. Participatory implementation science similarly emphasises collaboration between researchers, communities and implementers during the translation process.<sup>13</sup>

Community health workers can serve as important intermediaries between scientific evidence, health systems and households. Their role may include health education, surveillance, referral, follow-up, behavioural support and communication of community concerns to health authorities.

Thus, translation should not be viewed as merely a transfer of knowledge to communities; it should also involve transfer

of knowledge from communities into research and policy.

## Governance Requirements for Intersectoral Translational Medicine

A functional intersectoral system requires governance arrangements that clarify responsibilities and accountability.

### Shared objectives

Different sectors should define measurable health-related objectives that complement their individual mandates.

### Joint leadership

Leadership should extend beyond a single ministry or professional discipline where the health problem requires broader responsibility.

### Sustainable financing

Short-term project funding may initiate collaboration but rarely ensures long-term sustainability. Shared financing mechanisms may therefore be required.<sup>2</sup>

### Data-sharing mechanisms

Data standards, interoperability, privacy safeguards and agreed reporting pathways are necessary for integrated decision-making.

### Community accountability

Communities should have meaningful opportunities to participate in planning, monitoring and evaluation.

### Continuous evaluation

Implementation should be evaluated not only according to whether an intervention was delivered but also according to reach, equity, effectiveness, sustainability and population impact.

## Relevance to the Omani Health-System Context

The intersectoral and translational model is also relevant to health-system development in Oman. The Omani Ministry of Health identifies health promotion, disease prevention, research, health-system sustainability, coordination among public entities and integration across healthcare institutions among its strategic responsibilities.<sup>14</sup>

The Ministry's current health-governance structures also emphasise intersectoral integration and evidence-informed decision-making.<sup>15</sup> This provides an appropriate institutional environment for strengthening the connection between research, health policy, clinical services and community interventions.

In the Omani context, potential applications include integrated approaches to non-communicable disease prevention, heat-related health risks, environmental health,

occupational health, food safety, antimicrobial resistance and emerging infectious diseases.

Rather than creating isolated programmes for each health problem, an intersectoral translational framework could facilitate common surveillance infrastructure, shared research priorities, coordinated implementation and population-level evaluation.

## Barriers to Intersectoral and Translational Medicine

Despite its potential, several barriers can limit implementation.

### Institutional fragmentation

Organisations may have separate budgets, reporting systems, professional cultures and performance indicators. Such fragmentation can discourage collaboration.

### Competing priorities

A health objective may not always correspond to the immediate priorities of another sector. Successful collaboration therefore requires identification of mutual benefits.

### Weak communication

Differences in professional terminology and institutional expectations can create misunderstandings. Regular

communication and clearly defined responsibilities are essential.

### Insufficient implementation capacity

Evidence-based interventions may fail when frontline personnel lack training, time, equipment or organisational support.

### Limited evaluation

Many programmes measure activities rather than outcomes. Counting meetings, training sessions or distributed materials does not necessarily demonstrate population health impact.

### Sustainability

Pilot programmes may succeed under intensive research conditions but fail after external funding ends. Sustainability should therefore be incorporated from the beginning of programme design.

## Proposed Integrated Framework

Based on the reviewed evidence, an integrated Intersectoral Translational Health Framework (ITHF) can be proposed as shown in Table 2.

This framework (Figure 2) combines the strengths of translational science, implementation science, intersectoral action and community participation.

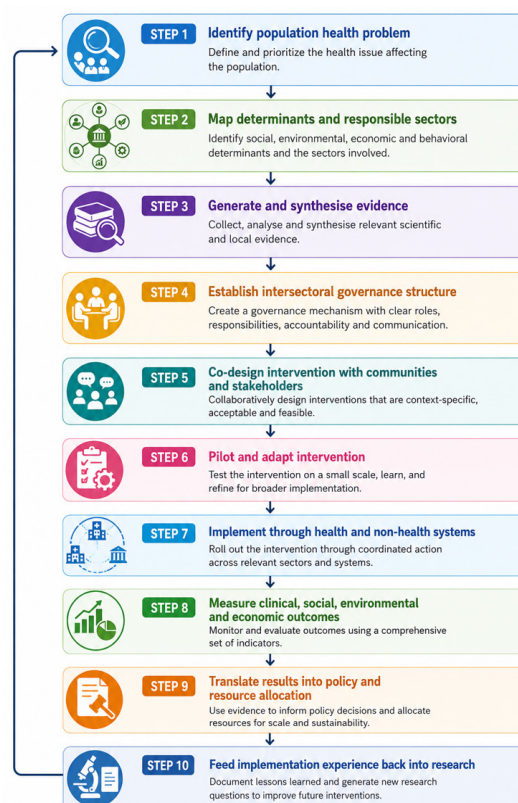


Figure 2. Integrated intersectoral and translational health pathway

**Table 2. Components of the proposed integrated framework**

| Component              | Core question                                      | Key stakeholders                    | Example indicator          |
|------------------------|----------------------------------------------------|-------------------------------------|----------------------------|
| Problem identification | What health problem requires collective action?    | Community, clinicians, policymakers | Disease burden             |
| Evidence generation    | What intervention is supported by evidence?        | Researchers, clinicians             | Evidence quality           |
| Stakeholder mapping    | Which sectors influence the problem?               | Government and civil society        | Number of relevant sectors |
| Co-design              | How should the intervention be adapted locally?    | Communities and implementers        | Acceptability              |
| Implementation         | Can the intervention operate routinely?            | Health and non-health services      | Adoption and reach         |
| Evaluation             | Does it improve health?                            | Researchers and policymakers        | Health outcomes            |
| Policy translation     | Can successful interventions be institutionalised? | Government                          | Policy adoption            |
| Sustainability         | Can the programme continue?                        | Funders, institutions, communities  | Long-term maintenance      |

## Implications for Medical Education

Medical education should evolve to prepare healthcare professionals for collaborative health-system environments. Students and trainees should receive exposure to epidemiology, health policy, environmental health, health economics, implementation science, data science, communication and community engagement.

Interprofessional education can provide opportunities for medical, nursing, pharmacy, veterinary, public health and allied health students to understand the responsibilities and perspectives of other professions.

Future clinicians should therefore be trained not only to ask:

**“How do I treat this patient?”**

but also:

**“What system-level factors produced this health problem, which sectors influence those factors, and how can evidence be translated into sustainable prevention?”**

This broader perspective aligns clinical medicine with population health.

## Future Research Priorities

Future research should move beyond describing the importance of collaboration and investigate how collaboration produces measurable health outcomes.

Priority areas include development of standardised measures of intersectoral collaboration, evaluation of governance models, cost-effectiveness analysis, implementation

strategies, digital interoperability, community participation, climate-health surveillance and evaluation of One Health programmes.

Research should also address equity. An intervention that improves average population health but disproportionately benefits affluent populations may widen health inequalities. Translational research therefore needs to examine who receives an intervention, who benefits, who is excluded and why.

There is also a need for more research examining the later stages of the translational continuum. Existing evidence has historically concentrated on clinical efficacy, while comparatively fewer studies evaluate implementation and population-level impact.<sup>16</sup>

## Discussion

Intersectoral and translational medicine should be understood as complementary dimensions of contemporary health practice. Intersectoral medicine answers the question of who needs to work together, whereas translational medicine addresses how evidence can move from discovery to measurable health benefit.

The combination is particularly important because complex health problems are characterised by multiple interacting determinants. A scientifically effective intervention may produce little population benefit if it cannot be implemented within existing systems. Conversely, strong community partnerships without scientifically sound interventions may produce limited health gains.

The most effective model is therefore neither purely biomedical nor purely social. It is an integrated system in which scientific evidence, health services, public policy, environmental action and community knowledge continuously interact.

The evidence also suggests that collaboration should be institutional rather than dependent on personal relationships between individual professionals. Formal governance, financing, information systems and accountability mechanisms are needed to make intersectoral action resilient to staff turnover and political changes.<sup>2</sup>

One Health demonstrates how this principle can operate across human, animal and environmental systems.<sup>1,7</sup> However, the concept can be extended beyond infectious diseases. Non-communicable diseases, climate-related health threats, occupational health, food systems and health inequities all require collaboration across institutional boundaries.

Implementation science further strengthens the model by ensuring that interventions are evaluated in the environments where they will ultimately be used.<sup>12</sup> Translation should therefore begin early in the research process rather than being considered only after a discovery has been completed.

A major implication for community medicine is that the endpoint of translational medicine should not be publication or clinical adoption alone. The ultimate endpoint should be measurable improvement in health, equity, resilience and quality of life at the population level.

## Conclusion

Intersectoral and translational medicine provides a practical framework for connecting scientific discovery, clinical practice, health policy and community action. The increasing complexity of health determinants means that healthcare institutions cannot independently address many contemporary health challenges. Effective prevention requires collaboration with sectors responsible for education, environment, agriculture, urban development, social protection, transport, technology and community development.

Translational medicine provides the pathway through which scientific evidence can move toward clinical and population application, while implementation science helps ensure that evidence-based interventions are feasible, adaptable and sustainable in real-world settings. One Health provides a prominent example of this integrated approach by connecting human, animal and environmental health.

For preventive and community medicine, the integration of these approaches offers an opportunity to shift from fragmented programmes toward coordinated systems of

health action. Future health systems should therefore invest not only in generating evidence but also in the governance, workforce, data infrastructure, financing and community partnerships necessary to translate that evidence into sustainable population health gains.

Intersectoral and translational medicine should ultimately be viewed as a continuous cycle of evidence generation, collaboration, implementation, evaluation and learning, with communities positioned at the centre of the process.

## Declarations

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**Conflict of interest:** None

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**Author contribution:** Conceptualisation, literature synthesis, drafting and critical revision were undertaken by the authors.

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