International Union Against Tuberculosis and Lung Disease

Operational Research

A Guide to Country Level Implementation and Programme Support

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International Union Against Tuberculosis and Lung Disease

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PREFACE

The International Union Against Tuberculosis and Lung Disease strives to bring innovation, expertise, solutions, and support to address health challenges in low- and middle-income populations. With more than 10,000 members and subscribers from 152 countries, The Union has its headquarters in Paris and regional and country offices serving the Africa, Asia Pacific, Europe, Latin America, Middle East, North America, and South-East Asia regions.

The Union is most widely known for the research that led to the global strategy for treating and controlling tuberculosis. Adopted by the World Health Organization in 1993, The Union model, based on the findings of operational research, is part of the internationally recommended Stop TB Strategy that has been used to treat 32 million people in 202 countries.

While working to improve lung health, The Union identified an urgent need to support and promote operational research (OR) in TB control efforts in low- and middle-income countries. The organization then worked closely with Ministries of Health, medical institutions, donors and other partners to support OR particularly in high-burden, limited-resource settings.

In October 2008, The Union launched the Technology, Research, Education and Technical Assistance for TB (TREAT TB) initiative, which designed research projects that would bring multiple stakeholders and several countries together to conduct OR at the international level. Through TREAT TB, The Union also implemented activities designed to support OR and build capacity at the country level. Although assistance for individual researchers is a necessary component of operational research, the country level activities described in this Guide refer to the broader support provided to stakeholders and partner institutions in several countries.

The purpose of this Guide is to describe The Union's experience in supporting country level OR activities, highlighting examples from the many Union-supported initiatives.

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1. Introduction

1.1 What is operational research (OR)?

OR has been defined with some variation depending on the setting, the researcher, and the nature of the research. The Union and many of its research partners adhere to a simple, straightforward definition of OR as: "research into strategies, interventions, tools or knowledge that can enhance the quality, coverage, effectiveness or performance of the health system or programme in which the research is being conducted."[1]

Supporting this practical definition are three basic principles that guide OR efforts:

1. The health programme/system under study should have well-defined goals/objectives.

2. Constraints and obstacles that prevent these objectives from being achieved must be identified, prioritized, and articulated.

3. Research questions must be asked to address these constraints.

Example 1.1: An Outcome of OR

In a basic, low-cost OR study, The Union demonstrated that the third sputum sample collected from patients with suspected TB added relatively little to the yield of detecting new TB cases. This research led to national and global policy changes recommending two sputum samples instead of three in many settings, resulting in significant savings in terms of expenses and human resources.[2]

1.2 What is an OR programme?

An OR programme is composed of the broader infrastructure and resources through which individual research activities are conducted. It includes resource mobilization and management, priority setting, essential research support and monitoring and evaluation of all OR activities.

1.3 Why focus on OR programme support?

The importance of high-quality, programmatically-relevant, country level OR is increasingly being recognized. Despite impressive gains in global tuberculosis control over recent years, several challenges remain. Much of current policy lacks the rigorous evidence that is now necessary to back it up. Increasing access to early diagnosis and successful treatment for all tuberculosis cases, implementing programmatic management of multidrug-resistant tuberculosis (MDR-TB) and the efficient and informed introduction of new diagnostic tools are examples of priority issues that could benefit from timely, pragmatic OR

[1] Zachariah R, Harries D, Ishikawa N, Rieder HL, Bissell K, Laserson K, Massaquoi M, Van Herp M, Reid T. Operational research in low income countries: what, why and how? Lancet Infect Dis 2009; 9: 711-717

[2] Katamba A, Laticevschi D, Rieder HL. Efficiency of a third serial sputum smear examination in the diagnosis of tuberculosis in Moldova and Uganda. Int J Tuberc Lung Dis 2007; 11: 659-664.

intervention. Although a specific component of OR has been included in the most recent Global Plan to Stop TB (2006-2015), actual implementation of OR activities in the field present significant challenges, especially in many of the high-burden countries most in need of these efforts. To a large extent, these challenges in OR implementation relate to the development and support of an overall programme of operational research.

1.4 What are the barriers to optimal OR programme implementation at the country level?

Challenges to successful implementation of a comprehensive OR programme at country level are numerous. In particular, many countries still operate in the absence of a detailed, systematic plan of research with clear linkages to programme priorities thus limiting the impact of any research efforts.

Similarly, the implementation of OR training, as well as the actual research projects, in the absence of a carefully conducted situational analysis prevents many countries from achieving their desired goals.

Thirdly, the appropriate external sources of support – both financial and technical – must be in place at all stages of planning and implementation. The Union has observed that such resources are insufficient or absent at some or all stages of OR implementation in many countries.

Other barriers to programme implementation include a lack of appreciation of the need for OR by programme directors, a lack of clear focal points to move the OR agenda forward, a lack of skills to properly conduct OR and see it through to completion and publication and a lack of knowledge and experience about how to translate research results to policy and practice.

Finally, for maximal impact, a well-constructed monitoring and evaluation plan is essential to assess performance and direct future OR activities. Even in countries that have successfully moved forward with OR implementation, the evaluative component of the OR programme is minimal or absent.

1.5 What is The Union's experience in OR?

The Union has always placed great emphasis on OR as an integral component of successful tuberculosis control programmes. In fact, the development of the now widely implemented global tuberculosis control strategy, i.e., DOTS, arose from Union-supported, country level OR. Over many years of supporting country level OR, we find that several necessary foundations for successful OR programmes and research implementation are lacking. These are:

- Clear understanding of existing strengths, weaknesses, stakeholders, and past performance with respect to OR;
- Primary and direct links to programme priorities as a starting point for OR planning and implementation;

- Development of a range of training and mentoring opportunities that match local needs and include attention to capacity for research management at the central level;
- Sufficient technical and financial resources at each stage of OR programme implementation; and the
- Inclusion of impact assessment and policy transfer frameworks as necessary features of OR planning, monitoring and evaluation, in addition to an overall evaluation framework.

Based on these foundations, The Union has developed a comprehensive framework for OR programme implementation and support at the country level (Figure 1).

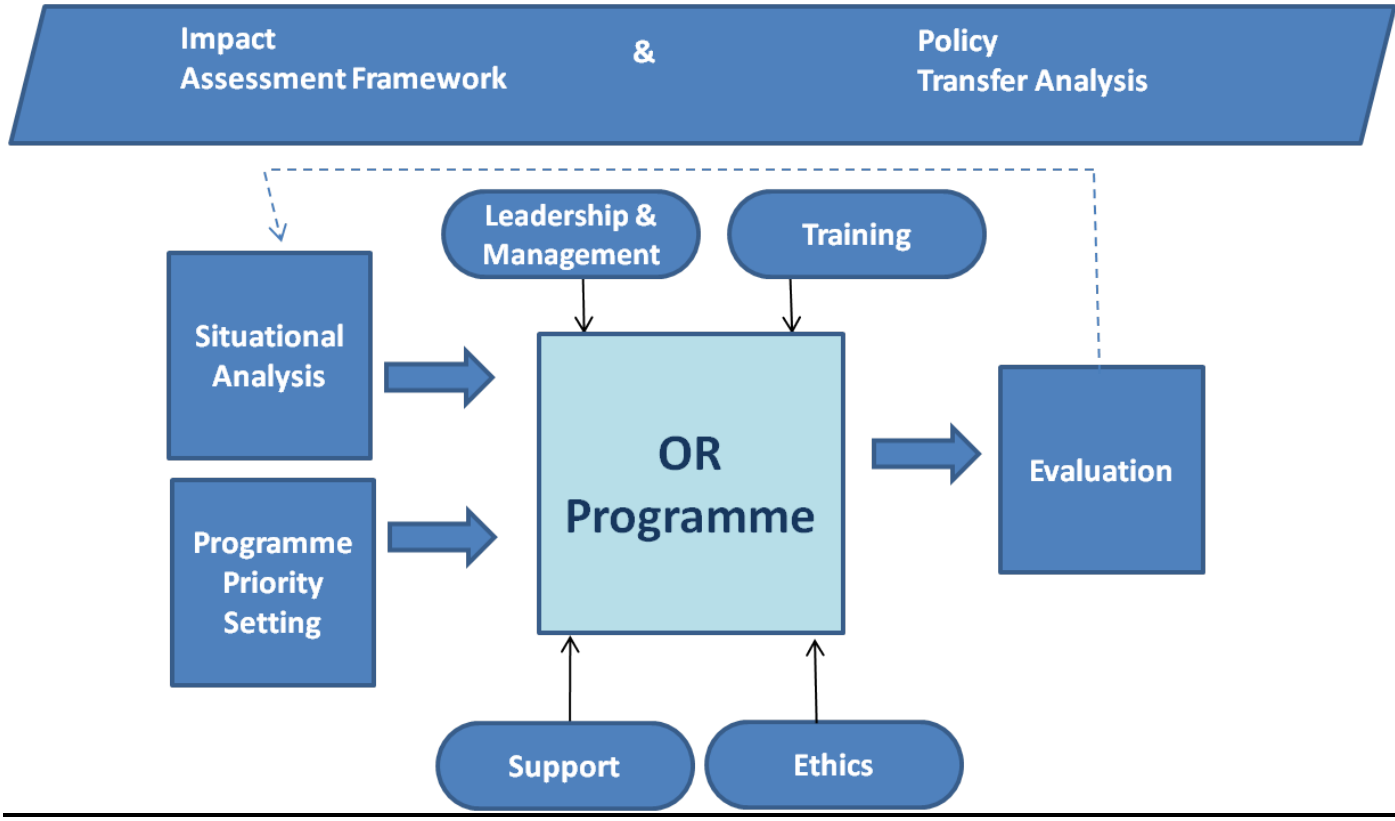

Figure 1. The Union's OR programme support framework

While some countries may be further along in the process of OR implementation, renewed consideration of each component will ensure that each necessary stage has been adequately addressed. Simultaneous consideration of various components of the framework will be needed; for example, consideration of policy transfer themes or issues suggested by the impact assessment framework may provide guidance for situational analysis, reveal priority questions for the OR programme and elicit measurable objectives for the evaluation.

1.6 What does this Guide offer?

This Guide describes The Union's efforts to support OR at the country level and provides the reader with a recommended approach to all components of the comprehensive OR framework. The provision of country examples at various stages of implementation will help readers to consider their own situation and setting against this backdrop. Where possible, estimates of the necessary inputs for various pieces of work are provided to assist in planning and budgeting. The Guide, and particularly this resource estimation also provides countries with the necessary direction to propose and secure resources from other sources (e.g., the Global Fund to Fight AIDS, Tuberculosis and Malaria).

1.7 How does this Guide fit with other OR resources?

This Guide is complementary to other available guides and resources related to OR. In particular, the recently released Stop TB Partnership document, "*Priorities in Operational Research to Improve Tuberculosis Care and Control"*, provides a comprehensive overview of OR, including the identification of priority research areas. Another TREAT TB-supported publication entitled, "*Operational Research to Improve Health Services*" offers a particular focus on methodology related to individual proposal development. In contrast, rather than focusing on specific research priorities or methodological issues for individual research efforts, this publication focuses on the broader perspective of supporting a country level OR programme.

1.8 Who may benefit from the Guide?

The main benefactors of this Guide are National Tuberculosis Programmes striving to address this often neglected component of the Stop TB Strategy. The Guide will provide the programmes with the 'how to' for certain key components of OR programme implementation, in addition to guidance on the needed inputs for these activities. While the Guide has been developed with tuberculosis control in mind, the principles of OR programme support and implementation apply to public health programmes in general. As a result, other programmes in the Ministries of Health may also benefit from its guidance. A second potential benefactor of this resource is global technical agencies providing assistance in Stop TB Strategy implementation. Thirdly, individual researchers may benefit from the broader perspective provided by the Guide, though their focus may remain on individual research activity. Finally, bilateral, multilateral and other donors may find utility in the Guide as they determine the best approaches for OR support at the country level, while also ensuring careful OR evaluation.

1.9 How can The Union assist?

The Union has the necessary skills and experience to support countries in each of the framework components, although the specific support required will vary from country to country. Nonetheless, The Union is well positioned to offer direct technical assistance as dictated by country needs. This assistance may take the form of external direction and support for all components of the OR framework. The Union can also assume an evaluative role when national or international

partners have addressed the other components. Wherever possible, the Guide provides the likely inputs required, including costs related to the engagement of an international agency, such as The Union, should countries adopt that approach for some or all framework components.

2. Situational analysis for OR at the country level

2.1 What is situational analysis?

Situational analysis is a broad process by which the major needs of communities or specific public health programmes are identified. In relation to country level OR planning, situational analysis is a vital starting point to determine the key stakeholders, resources (financial and human) presently in place, and activities and investments that have been employed in the past in addition to those that are currently operating.

2.2 How can situational analyses contribute to the development of national research priorities?

Situational analyses aim to provide decision-makers with objective, independent information, which is a prerequisite for successful, evidence-based planning that accurately targets the programmatically-based research needs of public health programmes. With respect to country level OR, situational analysis offers necessary documentation of baseline or starting status. It also ensures that the right people are at the table to develop the research priorities. Demonstrating the past performance of OR to support programme priorities and needs (both successes and failures) can provide important direction to the priority setting exercise.

2.3 How are situational analyses conducted?

Situational analyses for public health should be focused on individual public health programmes (such as tuberculosis, HIV/AIDS, asthma, or childhood pneumonia), interconnected public health issues (such as tuberculosis and HIV/AIDS) or crosscutting issues in health services (such as human resources, diagnostic facilities and information services). In order to ensure that the task can be carried out, background information that is collected should ideally be no more than a decade old. Occasionally, when recent information is not available, it may be necessary to look for information or relevant publications that date back more than 10 years.

Comprehensive situational analysis involves a combination of document reviews including carefully conducted literature searches (published and unpublished alike), key informant interviews and field visits. Interviews should be conducted with key national stakeholders, including focal OR persons within public health programmes (i.e., persons within local and international academic institutions conducting OR within the country, as well as personnel in local and international non-governmental organizations undertaking and/or supporting OR activities within public health programmes). Ideally, these interviews take place in person, but logistics and limited resources may make it necessary to communicate by other means. Where possible, field visits should be conducted to the primary institutions implementing/supporting OR in the country.

Reviewed documents should include: previous situational analysis reports; planning documents, records of implementing and/or evaluating OR in the country; and guidance/references to OR implementation in country level strategic

and operational plans. Finally, the information collected should be reviewed, summarized and reported in a clear and concise manner.

2.4 What should the situational analysis provide for those who need it?

Regardless of the approach used, situational analysis should yield information that is easily understood by policy-makers and programme managers, as well as a collection of information that can be used effectively by a multidisciplinary audience. A situational analysis report must highlight the strengths and accomplishments of country level OR in recent years, as well as the weaknesses or gaps that must be addressed to strengthen this area within the health system. As noted earlier, the situational analysis and subsequent report should identify the key stakeholders that should be involved in priority setting exercises and should also help direct approaches to capacity building for OR at all levels.

2.5 What tools can be used to perform situational analysis?

Several tools exist for performing situational analyses in different sectors, including the health sector. Adaptation of a general situational analysis template or other tools to the country setting is a necessary starting point. The specific tool used is less important than ensuring that vital pieces of information are captured during the process.

2.6 What resources are required to conduct a situational analysis?

The resources required to conduct a thorough situational analysis will vary greatly from one country to another. Nevertheless, some general guidelines on requirements may assist programmes in planning for this activity. Initial estimates for a basic review of the current situation and direction for future programme development should include the following (**Table 1**).

Table 1		
Resource	**Time estimate**	**Qualifications**
Technical consultant	15 to 20 days of work	• Consultant should ideally be experienced in both OR and public health services, including tuberculosis. • Selection of national versus international consultant may be based on complexity of analysis, capacity of local consultants and preference of national programme and/or donor.
Administrative support	4 days of work	• Support for both literature searches and document reviews may be an efficient approach, in addition to provision of word processing and report formatting support. • In-kind contribution of services from government programme and/or local NGOs may provide this service at no charge.
Communication and supplies	Depends on local settings and home city of consultants selected.	Depends on local settings and home city of consultants selected.
Travel and related costs	Depends on local settings and home city of consultants selected.	Depends on local settings and home city of consultants selected.

2.7 How often should situational analysis be performed?

It is imperative that the information gathered through situational analysis be as current as possible. For this reason, it is recommended that situational analysis be conducted, at a minimum, every two years to ensure that current OR programme plans and activities accurately reflect the needs of the health sector it is serving. However, in many settings, regular technical assistance that includes the review and revision of OR plans provides an interim update meaning that formal situational analysis may only be required every five years. In some instances, a more concise review of OR related to a specific focal area, e.g., adherence to treatment, may take place in between the more comprehensive, system-wide reviews. Furthermore, information collected as part of the overall evaluation of country level OR programme contains many of the same elements that comprise the situational analysis. As a result, such routine evaluation of

activities will also lead to a revised/updated situational analysis as part of the comprehensive framework of OR support.

3. Programme development and priority setting for country level OR

3.1 Why should countries develop national priorities for OR?

The goal of public health programmes is to improve the health of the communities they serve. However, The Union has observed that the path to meeting public health targets and objectives is not always straightforward. Very frequently, the knowledge needed to improve health is lacking, particularly at the level of implementation. Inevitably, questions arise as to how to improve the effectiveness and efficiency of public health programmes. OR can contribute to the development of more effective programmes at the national level by examining programme-based obstacles as well as identifying and testing new interventions and strategies. The ultimate role of OR (as stated by the International Commission on Health Research for Development) is to synthesize the new knowledge needed to create action toward improving the health of the communities in which it is carried out.[3] The product of such research is, therefore, the action created by the new knowledge.

For National Tuberculosis Programmes, questions arise as to how to ensure early detection of all TB cases, particularly those that are infectious, and also to ensure the successful completion of treatment for these cases. While routine programme data can provide useful information related to the performance of the programme, carefully conducted OR can reveal the key barriers to improved programme performance and help direct the necessary changes to be made within TB control services. The Union has found that the specific questions that are most appropriate to improve services are those that arise within the services themselves and that address the key constraints that health services personnel face on a daily basis and for which 'global' answers are not necessarily appropriate.

The precise problems to be addressed, as well as the priority questions among all those potentially undertaken, need careful consideration. In particular, given the limited fiscal and human resources available, OR that is undertaken should be research that is most relevant to the programme and is most likely to have a direct impact on programme performance. Furthermore, careful grouping of key questions can identify the most efficient means of responding to research priorities. The Impact Assessment Framework (IAF) described below is a tool to assist in organizing key research questions into various research activities or tracks, and ensures that important questions will not be omitted in the process.

3.2 Which groups should be convened to help set research priorities for the programme?

Key stakeholders should be convened to help set programme priorities for OR. In particular, adequate representation from those directly involved in service provision, be they in government health programmes, or private sector health care services, is of utmost importance. These service providers will benefit from the advice and assistance of personnel from non-governmental sector and academic institutions.

[3] Evans JR, Castillo GT, Abed FH, et al. *Health Research: Essential Link to Equity in Development*. New York: Oxford University Press, 1987; 1-136

Example 3.2: Convening stakeholders to set research priorities

The Desmond Tutu TB Centre, an academic research institution at Stellenbosch University, South Africa and a regional partner of The Union in the USAID-funded TREAT TB initiative, assisted the National Tuberculosis Control Programme in South Africa to convene a meeting of TB Control Program provincial managers to present and discuss key challenges in implementation of tuberculosis control in their facilities. This consultation provided an interactive forum in which issues could be raised, discussed, and debated. From this process, the National Department of Health drew together, from the list of topics developed in the consultation, a document outlining priorities for OR aimed to evaluate challenges and improve services within the Programme. Following this experience, the Program convened follow-up meetings to refine and revise the document as well as to provide guidance for all partners to facilitate OR throughout South Africa.

International partners, especially those involved in support of country research activities may bring a global dimension to the discussions. Representatives of the communities most affected by the health problems under study play a crucial role in the discussion of research priorities for public health programmes (see *Example 3.5* below).

3.3 How can research priority setting activities contribute to the identification of training needs?

Public health research priorities identified through priority setting exercises together with the capacity assessment (as part of situational analysis) can help determine specific training needs associated with OR. In addition to the content and methodological skills required, the specific research priorities will dictate the technical level of research to be implemented and the corresponding training needs at various levels of the system.

For example, within a national TB programme, research priorities related to new diagnostic tools or the management of drug-resistant TB may dictate the OR-related training that must be undertaken. At the same time, research priorities related to central or national areas of responsibility will have different training requirements than questions targeting peripheral sites of programme implementation.

3.4 How should funding for OR priorities be addressed?

The priority setting exercise for research questions should identify the estimated costs for all research needs, including costs for training, protocol development, research logistics (e.g. ethical reviews, statistical consultations), research implementation (including mentoring and monitoring) and the translation of research results into policy and practice (including costs related to peer-review publication).

In addition to providing a cost estimate, the necessary support/mentoring for research implementation and follow up must be ensured. This must always incorporate local capacity strengthening and should, as a first step, draw on local expertise, while calling on external partners for assistance when needed. The priority setting exercise should include discussions and action plans related to securing these necessary resources.

3.5 What level of community engagement should be expected?

Although the nature of partnerships between communities and researchers varies, it is expected that affected communities play a significant role in the setting of a programme's research priorities. Community representatives can provide an important perspective of programme-based challenges that need to be addressed through OR, such as the major impediments to accessing services. They can also identify approaches to research questions that may be most acceptable to affected populations. The Union recommends that programmes engage the community early on in the priority setting process in order to build productive, mutually beneficial partnerships.

Example 3.5: The Role of Community Advisory Boards (CABs) in OR

A Community Advisory Board (CAB) is an independent committee consisting of community representatives, healthcare workers, and members of the research team. In TREAT TB's Policy Relevant Outcomes from Validating Evidence on Impact (PROVE IT) study in Brazil, The Union and its local partner, Rede-TB, felt it was important to establish CABs at each study site. Through the CABs, people affected by TB, healthcare managers, other professionals, and site staff work together to facilitate the study. Examples of the CAB contribution to the success of the study include production of helpful information for patients, suggesting better ways to explain the study and obtain informed consent, and improving patient recruitment and enrolment procedures.

The most defining and important outcome of establishing CABs within the PROVE IT study was the empowerment of community members. These individuals were made aware of the benefits of rapid TB diagnostic methods and shared the research team's commitment to identifying the most effective diagnostic tool for their community. These CAB members are now well positioned to communicate with academia, health professionals and other stakeholders and advocate for the needs of their community.

3.6 How should the results of research priority setting activities be communicated?

At a minimum, reports of priority setting exercises, including clear outlines of programme research priorities, should be completed and disseminated in a truly open manner. Key audiences for these priority-setting outputs include senior staff in the Ministry of Health and other relevant government departments, health workers, academic institutions, non-governmental organizations, international partners, and the private sector. Because OR is a critical component of the Stop TB strategy, it is essential that a programme research priorities also be conveyed through the medium- and long-term operational plans. Mechanisms to communicate priority-setting results include public reports, peer-reviewed

publications, national meetings/fora, and other national conferences/meetings with relevant target audiences.

3.7 What resources are required to conduct priority setting exercises?

The Union has found that the resources required to conduct research priority setting exercises vary greatly from one country to another. However, some general guidelines on resource requirements may assist programmes in planning for this activity. Initial estimates should include the following (**Table 2**).

Table 2.
1. Input from key contributors.
• Health services personnel responsible for carrying out public health activities are crucial to defining the key questions to be addressed in order to improve services. • Technical experts from academic institutions within the communities who have expertise and experience in OR are key partners to ensure that the research is designed and carried out correctly. • The focal person/lead institution identified to coordinate the OR agenda plays an important facilitating role. • Representatives of the communities for which the services are provided will inform the discussions to ensure that the new knowledge is appropriate for local customs and requirements. • Other partners from the communities, technical agencies and supporting partners offer beneficial assistance.
2. Technical consultant(s)
• Programmes should consider the engagement of technical consultants to assist in the development of priority setting exercises. • Consultants should ideally be experienced in both OR and the specific public health services in question. Consultants should also be experienced in planning and facilitating large-scale meetings involving multiple stakeholders. • Decisions to select national versus international consultants may be guided by a number of factors including the complexity of the tasks, capacity of local consultants, preferences of national programmes, preferences of donors or funders, and availability of resources.
3. Administrative support
• Effective priority setting activities require administrative support to address basic requirements such as logistics, meeting preparations, and report writing. • In-kind contributions from governmental programmes and/or local non-governmental organizations may be available to support these requirements at little or no charge.
4. Meeting and travel costs
• Meeting costs will include meeting room facilities and local travel and related costs for local participants; international travel costs will depend heavily on the selection of the consultants.

3.8 How often should programme priorities for OR be re-evaluated?

OR priorities should be re-evaluated on a regular basis to ensure they accurately reflect programme needs. Moreover, OR priorities should routinely be discussed and assessed as part of ongoing discussions such as programme management meetings.

3.9 How do programme priorities link to global research priorities?

While the primary emphasis of priority setting and research implementation should have direct relevance to, and impact on local programmatic issues, consideration of global-level priorities should also be a consideration. Many, but not all of the global priorities may mirror the issues raised at the local level. Consultation regarding key global resources, such as the Stop TB Partnership *Priorities in Operational Research to improve Tuberculosis Care and Control* will ensure awareness of global research priorities during the country level programme priority setting process.

4. OR training at the country level

4.1 What type of training activities should be considered?

Experience at The Union has shown that the training required for a given public health programme will become evident during situational analysis, the research priority setting process and during routine programme monitoring. Capacity building requirements include training opportunities for individual researchers/health workers (covered here), as well as broader capacity building for the overall programme. In response to these identified needs, The Union offers a range of OR-related training activities, including country-based protocol development workshops and individual mentoring within specific public health projects. Training sessions are tailored to specific setting and needs. One particular Union model, The Union and Médecins Sans Frontières (MSF) OR Course, incorporates three sequential modules: protocol development, data quality assurance and scientific article writing. These sessions have clearly specified milestones required for successful course completion. A related fellowship programme offers intensive training, mentoring and support over an extended period with a focus on research carried through to peer reviewed publications as a key output (**see Appendix A**).

Example 4.1: Training for health services personnel in ORAP

The importance of health services personnel engagement in priority setting is supplemented by the need for technical assistance in formulating a research question related to the challenges experienced, writing a research proposal, and carrying out the research. In the case of the Operational Research Assistance Project (ORAP), a South Africa-based initiative of TREAT TB, this need is met by establishing partnerships between health services personnel from within the TB Control Programme and academic staff from local academic institutions. These partners jointly develop the research proposal during a five-day workshop. The proposal is then implemented together as a joint project in the respective provinces from which the team comes. Each team is mentored throughout the process by an experienced researcher.

For each country, the intensity of training, the location (national, regional, or international) and the focus of the training must be determined. Continually ensuring that the proposed training meets the gaps identified in the situational analysis and required skills identified in the research priority setting process will ensure that training is carefully targeted and that the most essential training activities are conducted.

Please see **Appendix B** for an agenda from a recent country level, modular training programme. Detailed training materials from this course are available at www.sun.ac.za/tbtraining.

4.2 What methodology should be incorporated into training programmes?

Details regarding OR methodology are beyond the scope of this Guide and covered comprehensively in several documents, including the recently released "*Operational Research to Improve Health Services*". Curriculum from this

document is also available online. It is important to recognize that a wide range of methods can support OR programme goals and objectives and that the selection of approaches will be setting specific. This may include systematic use of routine programme data which can be extremely valuable and forms the basis of many local OR initiatives. On the more complex side, the stepped-wedge design may be particularly valuable as an intervention design and an integral part of programme implementation. Such a design may provide the strongest evidence to facilitate policy change. The stepped-wedge design, given its complexity, requires more 'centralized' input and participation. On the other hand, observational studies are much more feasible at the local level and provide additional evidence, albeit lower quality; nevertheless, the observational studies are more efficient in addressing local challenges to health services implementation and form the bulk of OR activities.

4.3 Who within the national settings should be targeted for training?

Situational analysis may identify specific country needs for OR training. Health services personnel such as health care professionals, laboratory experts and other public health programme staff (e.g., district programme coordinators) may benefit from training in operational research. Preferably, they should be paired with academic staff from a local university or research unit experience in carrying out research. The Union highly recommends that efforts be made to ensure that those who attend specific training are the individuals most likely to implement the research and utilize the specific skills that are being emphasized.

4.4 What are the intended outputs from the OR-related training?

The Union has found that the intended outputs of OR-related training will depend heavily on the nature, scope, and purpose of the specific training activity or event. In any case, all training must be tied directly to follow-up research implementation with the necessary funding and support and that 'stand alone' training is avoided. Output of the training activity is completed and published research that is linked to the programme priority research questions. The protocol should be ready for implementation soon after completion of the protocol development workshop. The final result is translation of the research findings into policy discussions and practice within the communities where the research is carried out.

In order to ensure that research is of high quality and is conducted efficiently, The Union's experience has shown that continued support is needed during the course of the study. This will normally include a session, early in the research implementation process, regarding quality assurance of data management; later in the course of the research, scientific writing should be taught to ensure that the research results are submitted for publication. The importance of publishing research findings must be emphasized. Training participants should also be oriented to additional mechanisms of research output dissemination, e.g. scientific conferences, programme meetings, and other locally appropriate research communication activities.

Example 4.4: The TREAT TB-NTI protocol development workshop

In September 2009, The Union's TREAT TB initiative partnered with the National Tuberculosis Institute (NTI) of India to implement the week long "Operational Research Protocol Development Workshop" in Bangalore. This training assisted more than 25 participants from several Indian states, working in 3-4 member teams, to develop seven research protocols addressing needs identified by the national agenda for operational research. During that workshop, participants learned several key skills including how to define the variables to be measured, how to outline the way the information will be collected, and how to estimate the cost of the research project. The majority of protocols developed during this training event were ready to begin shortly after the workshop ended. Recognizing that continued support is a prerequisite for successful research, The Union's Southeast Asia office and its Research Department provided guidance and technical assistance to the participants during the course of the project implementation. Since 2009, workshop participants have completed and published one research project and two other projects are in various stages of completion.

4.5 What are the costs associated with OR-related training?

The costs will vary considerably according to the details of the training required. It is important that an appropriate and adequate funding source is identified to meet training and implementation needs. Assistance in budgeting and planning for these training needs is available from many sources, including The Union. The budget categories for a typical Union-led protocol development workshop include:

1. Venue expenses
Venue expenses will vary greatly according to location but should include budgeting for sufficient space for large group and small group sessions, appropriate audiovisual capacity, as well as costs for meals and refreshments.
2. Consultant fees, travel, and expenses for faculty
Utilization of national faculty will reduce the personnel costs, although participation of international faculty already providing assistance through other mechanism may also reduce the training budget.
3. Funds for protocol implementation
Sufficient funds for research implementation should be secured prior to OR training. As a general rule, $10,000 USD per protocol should be the maximum required/allotted to each OR study. Many OR protocols can be successfully implemented for much less.
4. Supplemental training
Supplemental training about data quality, scientific writing or other specialized areas may enhance basic training and increase the likelihood of successful implementation and publication of research activities. Where possible, these costs should be built into the initial training plans.
5. Follow up and mentoring costs
It is essential that all training programmes ensure adequate follow up and support for participants as they move from protocol development to research implementation. The specific setting and local capacity will determine the need for international support versus local mentoring and the scope and intensity of the required support. Follow-up costs should include costs related to publishing in peer-reviewed publications and other dissemination efforts.

5. OR management and leadership capacity at the country level

5.1 Why is management and leadership capacity a key ingredient in successful OR programmes?

Successful OR programmes require specific skills at all levels. While analytic and statistical expertise are essential, an often overlooked and underestimated role is that of OR management. The Union has determined that it is essential to have strong country level management capacity to direct the design, implementation and follow-up of programmatically-relevant OR.

5.2 Who should be managing or leading OR programmes?

As OR is an essential component of the Stop TB strategy, OR management is an integral part of National Tuberculosis Programmes (as indeed, for all public health programmes). The Union's experience has shown that it is important for the NTP to identify a focal person for OR management and that the ideal candidates to manage or lead OR programmes are public health professionals with a research background and familiarity with the related stakeholders and institutions (e.g., academic institutions, regulatory bodies). It is essential that OR managers have the necessary time and resources to support such active research. In some programmes, it may be practical to outsource this function to a collaborating university or research institute with a direct reporting line back to the NTP. Ideally, health programme staff themselves should lead and direct all OR activities.

5.3 What resources are needed for building national management capacity?

While OR management is ultimately a programme responsibility, collaborative linkages with academic institutions, non-governmental organizations (NGOs) and other partners often facilitate the process. This is developed, as with much else in public health programmes, in a step-wise fashion.

1. From situational analysis, an evaluation of the academic and research resources relevant to OR within the country and the individual communities will be developed.
2. Also as part of situational analysis, it should be possible for the NTP to identify a focal person/lead institution to assist in process management.
3. Management expertise may exist within the programme itself or with one of the partners in the process.
4. As situational analysis leads to the research priority setting process, the focal person/lead institution will play a key role in this process as well.
5. The lead institution (along with key partners) is then in a position to undertake mentoring and monitoring of the research being carried out and to set the stage for monitoring and facilitating translation of research results into policy discussions and then into practice; in addition these leaders will assist with revisiting the research priority setting as the process continues.

As OR is a part of the Stop TB strategy, it would be most effective if these activities were built into the national planning and budgeting process. It may be necessary to call on experienced facilitators from outside the country and to establish mechanisms for professional development for key staff with collaborating institutions both inside and outside the country to ensure that this is carried out in an efficient and high-quality manner. An example of a process by which this can be accomplished is the fellowship programme of the Centre for OR within The Union (Example 5.3 below).

Example 5.3: The Centre for Operational Research

The Union founded the Centre for Operational Research (COR) in 2009 to address the need to strengthen low- and middle-income country capacity in OR and in the collection and use of strategic information. The COR provides technical assistance and develops education and training programmes among other activities. One of its most important educational initiatives is the Operational Research Fellowship Programme, which provides a select group of young researchers with training and mentorship from experts at The Union in collaboration with their country colleagues. This intensive programme of training, research, and publishing is designed to produce OR trainers and leaders who will in turn strengthen capacity in their own programmes and countries.

6. Impact Assessment in OR Implementation

6.1 What is impact assessment and how does it relate to OR for TB control?

Impact assessment extends beyond standard evaluation methods for OR activities. It involves: the extent to which an intervention has met its stated aims; the cost effectiveness of interventions from patient and health system perspectives; the impact on changing patterns of access; the likely future impacts of the intervention (for example through modelling the impact of increased access to TB diagnosis and treatment on reducing transmission of TB); and how OR changes national and international practices.

Impact assessment aims to measure successes and challenges of the research programme in developing and/or implementing new tools, technologies and strategies that can improve TB control and be translated into policy, applied and made accessible to affected communities. The Impact Assessment Framework (IAF) provides a guide for ensuring that research questions are grouped where possible to enhance the cost effectiveness of the research itself; for example there may be questions regarding effectiveness of a new approach, the degree to which it is equitable or its health system requirements. The IAF provides a framework for identifying such knowledge gaps.

The IAF can thus be useful in defining specific OR questions as well as for assessing the impact of the OR process. The Union's experience has shown that evaluation of the overall process will be much more accurate, and indeed feasible, if data collected from different research activities is aligned to a common set of benchmarks agreed at the priority setting stage. This does not mean that all OR studies have to report according to a set of specific benchmarks; it simply means that where an indicator is selected, it has a common definition for all OR studies using it. For example, if two studies are collecting data on the costs to the health system of sputum collection, a common set of types of cost should be collected for each.

6.2 What specific skills are required to conduct impact assessment?

Impact Assessment is typically conducted by a multidisciplinary team that includes clinicians, epidemiologists, and health economists. The Union realizes, however, that these skills are not always available within country programmes or research institutions. For any specific OR activity, the necessary skills will depend on the questions to be answered. For instance, specialist technical support may help to define the questions and provide guidance on data collection and analysis, but researchers with numeracy competence may be sufficient to conduct the basic research and analysis. To assess the impact of the overall OR programme, a broad skill set would be required, since the collation of data and the analysis will require an appropriate aggregation of the results from individual studies within the OR programme.

6.3 How should impact assessment be conducted within research studies?

The methods for collecting impact data for individual studies will depend on the purpose of that specific study. For many, effectiveness will be the primary outcome variable, thus the data will be collected in line with the study protocol, often coming from routine programme registers. If data on patient costs are to be collected, a separate patient survey may be required. Health system cost data are likely to involve interviews with providers and an analysis of project budgets and health worker time and salary data.

In order to assess the impact of the overall OR programme, The Union and its partners have found it helpful to have agreement on a common set of indicators. Ideally, the impact assessment team would be involved at the priority setting stage to ensure that there is a common agreement of key indicators. They would also be involved in training to support local researchers in the design of data collection tools to ensure indicators are reported as consistently as possible across different research activities.

6.4 What are some helpful resources to better understand impact assessment?

More information about the Impact Assessment Framework can be found in the article[4] included in **Appendix C**.

A description of the role of the Impact Assessment Framework in research implementation can be found in **Appendix D**[5].

[4] G.Mann et al/"Beyond Accuracy: Creating a Comprehensive Evidence Base for TB Diagnostic Tools"/The International Journal of Tuberculosis and Lung Disease/2010/14/1518-152.

[5] S.B. Squire et al/"Making Innovations Accessible to the Poor Through Implementation Research"/2011/15/862-870

7. Policy transfer analysis

7.1 What is policy transfer analysis and how does it relate to OR for health programmes?

Policy transfer concerns the process by which policies (or programmes or ideas) move from one time and space to another time and space. It can span the phases of development, adoption, adaptation and expansion of policy. Policy transfer analysis sets out to explore how and why transfer occurs. It aims to understand who learns what from where and from whom, what gets taken up, and how things get adapted, or not. A common approach is to analyse facilitators or constrainers of policy transfer.

In the context of OR, policy transfer analysis looks at: the process of generating knowledge about a policy issue through OR; how policy and ideas from various places affect the research; the roles and perceptions of various actors; how learning and communication occurs; what influences decision-making about the evidence; and how this process and knowledge results in changes in policy and practice, or not.

Some policy transfer concepts may in fact be useful not only for individual research efforts but also for routine work in OR programmes. Policy transfer can offer tools that help to plan and evaluate efforts that translate research into policy and practice. Policy transfer concepts can help to generate important process and policy-related questions that OR programmes need to tackle in order to maximise the relevance and impact of their research. Policy transfer can also act as a prompt for a programme to undertake strategic thinking about OR, for example, whom to involve, how to obtain and communicate the type of evidence that will facilitate policy decisions and translation into practice, and what obstacles may be preventing OR project completion and translation to policy and practice.

7.2 How should policy transfer analysis be conducted within research studies?

Policy transfer analysis uses qualitative research methodologies. Social scientists apply methods such as document analysis, semi-structured in-depth qualitative interviews with key informants, focus groups and process evaluation. Findings are often written as case studies and ‘lessons learned’.

Within individual OR studies, policy transfer analysis typically examines the process of selecting OR priorities, as well as testing, introducing and expanding a new intervention, tool or policy. Ideally, analysis is set up at the beginning of a project so that it can document and analyse the whole OR process. Such policy transfer analysis can then inform decision-makers and implementers about the policy, product or intervention in question, as well as the process of testing, implementation or expansion.

Policy transfer analysis also plays an important role in various stages of overall OR programme activity. For example, it can involve informing situational analysis and priority-setting activities, or analysis of international and national policy development on a particular theme, or tracking policy and practice outcomes of a programme’s various projects.

7.3 What specific skills are required to conduct policy transfer analysis?

Whenever policy transfer is used as a research approach, whether within an individual study or as a means to analyse an overall OR programme, it needs to be performed by qualified social scientists, experienced in qualitative research and policy-making, with expertise in health services and health service communities, who has knowledge of health policy, public health in low- and middle-income settings and related fields. Comprehensive analysis is complex, time-consuming and requires experienced researchers, so it is not recommended for all OR studies. Programmes interested in including policy transfer research can seek partnerships with organisations that have this research expertise. It is, however, recommended that all OR studies and programmes incorporate the concepts and some basic tools inspired by policy transfer analysis, in order to improve their focus on policy processes, and to document and evaluate their ability to produce OR that changes policy and practice.

7.4 What are some helpful resources to better understand policy transfer analysis?

More information about policy transfer analysis can be found in **Appendix E**[6].

[6] K.Bissell, K. Lee, and R. Freeman/"Analysing Policy Transfer: Perspectives for Operational Research"/2011/15/1140-1148

8. Ethics and OR at the country level

This section is devoted to ethics and the consideration of ethical issues in research. OR, as defined and discussed in this Guide, often involves reviews of existing data and records. However, such OR can also include contact with human participants through interviews and other research methods.

Ethics is considered here in broad terms to cover different types of operational research. This section will:

- Outline the recent history of research ethics
- Describe key ethical principles and how each should be applied in research
- Outline how ethical principles are applied in developing countries
- Explain why study design has ethical implications
- Describe what ethics reviews entail and some of the challenges at country levels
- Describe the relationship between reviews by country level ethics committees and The Union's Ethics Advisory Group (EAG)

8.1 What is the history of research ethics?

Research ethics were formalised after the exposure of several shockingly unethical interventions and practices in the conduct of research. As result of these and other events, a number of codes, declarations and guidelines outlining ethical principles and practices were produced. These include the Nuremberg Code, the Universal Declaration of Human Rights, the Declaration of Helsinki (latest version 2008), the Belmont report, the International Ethical Guidelines for Biomedical Research involving Human Subjects, and the International Ethical Guidelines for Epidemiological Studies (the last two promulgated by the Council for International Organisations of Medical Sciences (CIOMS)) among others. In addition to international declarations and codes, many countries have their own ethics guidelines.

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8.2 What are the underlying key ethical principles for research?

Respect for persons	The autonomy of every individual must be respected. Those with diminished autonomy require additional protection.
Beneficence and	Research must result in maximum benefits with non-maleficence minimum harm.
Distributive justice	Researchers must ensure fair and equitable distribution of the benefits and the risks of research.

8.3 Are ethical principles created in developed countries necessarily applicable to all countries?

Ethical principles are universal as all people and all study participants are "born free and equal in dignity and rights," as written in Article One of the Universal Declaration of Human Rights.
See http://www.un.org/en/documents/udhr/index.shtml#a1 .

Challenges may arise in the formulation of country guidelines from the international principles. Variability in the cultural and social context of different communities requires researchers to be sensitive to issues in study design and procedures, including selection of participants who may be marginalised, vulnerable or involved in illegal activities.

8.4 How is 'respect for persons' applied in research?

This principle requires that researchers must avoid exploitation of study participants, especially vulnerable groups; they must also: provide information about the study to potential participants in a form and style that they can understand, obtain signed consent appropriate for the social and cultural environment in which the research will be performed; must obtain consent of parents or legal guardians for research on children below the legally defined age of consent of the country; and assent from children themselves if they are old enough to understand details of the study. Confidentially of all results must be ensured and results of the study must be available to participants and their communities if they so desire.

8.5 How are 'beneficence' and 'non-maleficence' applied in research?

This principle requires careful consideration of the following issues:

- Is the research justifiable?
- Are there risks associated with participation? If yes, how will these be managed? What social, political or cultural factors could cause harm?
- Have community groups been consulted to avoid that harm?
- Will direct costs for participants be reimbursed?
- How are any benefits ensured for study participants or their communities?
- Have researchers accepted responsibility for promoting actions shown by the research to be useful? In operational research, application of beneficence/maleficence usually involves policy and practice changes and is achieved through facilitation and capacity development.
- Are there any risks for researchers? If yes, how will these be prevented or managed?

8.6 How is 'distributive justice' applied in research?

Issues involved in distributive justice include:

- Do country stakeholders identify the research topic as a priority?
- Have local stakeholders (health authorities, organisations and communities) been consulted about the topic, objectives and

research methods? Have they given permission for the research to be conducted?
- What are the expected benefits for study participants, their communities and the country in which the research is conducted?
- Is the cost benefit ratio acceptable?
- Will the research, either directly or indirectly, highlight disparities in health and health services between resource-poor countries and other countries? How will the research contribute to appropriate changes in such disparities?
- Will future publications be co-authored by the appropriate individuals, based on their roles in the studies?
- Are there groups that will be included in the research that may suffer discrimination, coercion or other risks?
- Is there a plan to disseminate the results of the study to all concerned stakeholders including participants?

8.7 What are the other ethical requirements for research?

The following questions may help scientists determine if they have met the requirements for research:

- Have all the appropriate local/national/institutional ethics committee approvals been obtained?
- Does the study include or have the support of health managers and others in positions that will enable appropriate policy and practice changes to be made?

8.8 What does ethics have to do with research design?

Studies with inappropriate or poor designs are unethical as they result in the misuse of resources.

All researchers external to the country in which the research is to be done must collaborate with local researchers and with communities at all stages (planning, implementing, reporting and dissemination of results).

8.9 What is an ethics review of research proposals?

An ethics review is an objective review by a defined group who has experience in identifying ethical issues. The process is essential to ensure that researchers avoid unethical practices. Ethics reviews are a requirement for most institutions, funders, health authorities and journals to which research studies/publications are submitted.

8.10 Do studies of existing data or records require ethics review?

Yes, studies involving routinely collected data or patient records do require ethics review. It is usually impractical if not impossible to obtain consent from the people from whom the data has been documented, but an ethics committee will want assurance that there can be no identification of individuals through their records at all stages (data collection, data entry, storage and analysis). In such cases, there are no risks to

individuals except possible breaches of confidentiality. In certain situations (small data sets, localised study sites, collecting identifying variables), special precautions may be required.

Other ethical requirements apply to studies involving retrospective medical records reviews, including study justification, permission of relevant authorities and approval of the appropriate ethics committees.

8.11 What do ethics committees look for?

Ethics committees examine the following criteria when conducting their reviews:

- the research setting
- justification of the research
- scientific merit
- knowledge and agreement of local communities
- approval of other appropriate ethics committees (country-based and external)
- risks and benefits
- informed consent, with special attention to the content, language and style
- protection of privacy and confidentiality
- plans for ensuring any benefits of the research for participants and communities in which research has been conducted

8.12 What are some of the challenges in implementing appropriate ethics reviews of research proposals?

In some countries, ethics committees do not exist. Some low-income countries lack resources to organise training for researchers and field workers; some even lack essentials, for example, the ability to provide written copies of information sheets.

In some countries, ethics committees are dominated by national governments or other authorities, meaning that ethical standards required of ethics committees may be overridden. Problems can arise when researchers are required to submit to both country level and for external institutional, sponsor(s) or funder(s) review, especially if there are disagreements between the varied review bodies.

Further, local ethics committees may lack authority or autonomy and may feel forced to approve proposals that are externally funded. Properly constituted ethics committees should have, in addition to people with medical and scientific backgrounds, some members from non-scientific fields and individuals from communities. Members should be carefully selected to avoid dominance of medical experts and to maintain objectivity.

8.13 Which research projects need to be reviewed and approved at country level <u>and</u> by The Union Ethics Advisory Group (EAG)?

Ethics committees at country level must review studies in their countries. They may be institutional (University or Research council), organisational (non-government and other), or government district or national committees directed.

The Union has its own ethics committee - the Ethics Advisory Group (EAG) - the approval of which is required for studies in which The Union and its staff members are involved in any of the following roles: principal investigator, named collaborator, intended co-author, sponsor or funder. More information on the EAG can be obtained at http://www.theunion.org/index.php/en/what-we-do/ethics.

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The Union and Médecins Sans Frontières approach to operational research

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SUMMARY

Operational research (OR) has become a hot topic at national meetings, international conferences and donor fora. The International Union Against Tuberculosis and Lung Disease (The Union) and Médecins Sans Frontières (MSF) Operational Centre Brussels strongly promote and implement OR with colleagues in low- and middle-income countries. Here we describe how the two organisations define OR, and explain the guiding principles and methodology that underpin the strategy for developing and expanding OR in those countries. We articulate The Union's and MSF's approach to supporting OR, highlighting the main synergies and differences. Then, using the Malawi National Tuberculosis Control Programme as an example, we show how OR can be embedded within tuberculosis control activities, leading to changes in policy and practice at the national level. We discuss the difficult, yet vitally important, issue of capacity building, and share our vision of a new paradigm of product-related training and performance-based OR fellowships as two ways of developing the necessary skills at country level to ensure research is actually performed. Finally, we highlight the need to consider and incorporate into practice the ethical components of OR. This is a key moment to be involved in OR. We are confident that in partnership with interested stakeholders, including the World Health Organization, we can stimulate the implementation of quality, relevant OR as an integral part of health service delivery that in turn will lead to better health for people, particularly for those living in the poorer parts of the world.

KEY WORDS: operational research; tuberculosis; HIV/AIDS; The Union; Médecins Sans Frontières

DEFINING THE TERM 'OPERATIONAL RESEARCH'

If 10 different people are asked to define operational research (OR), there will probably be 10 different answers. 'Operational research', also sometimes known as 'operations research', has been variously defined as an interdisciplinary branch of applied mathematics or formal science that uses advanced analytic methods to make better decisions or research that provides optimal solutions to complex decision-making.[1,2] The term 'implementation research' is also commonly used, and has been defined by some as the scientific study of methods to promote the systematic uptake of clinical research findings and other evidence-based practices into routine practice, and hence to improve the quality (effectiveness, reliability, safety, appropriateness, equity, efficiency) of health care.[3,4] These various definitions have a certain commonality.

At the International Union Against Tuberculosis and Lung Disease (The Union) and the Médecins Sans Frontières (MSF), based on our shared experience, we have developed a more simple and pragmatic understanding of these types of research. We prefer the term 'OR', which we define as research into strategies, interventions, tools or knowledge that can enhance the quality, coverage, effectiveness or performance of the health system or programmes in which the research is being conducted.[5] We see OR as a spectrum of activities that encompasses reviews of registers and treatment cards, minor modifications and

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evaluations of operational practices to field testing new technologies.

GUIDING PRINCIPLES AND RESEARCH METHODOLOGY

We have three guiding principles that underpin our way of conducting OR and help us to set up a research agenda and determine research priorities. The first principle is that a health programme (or health system) should have well-defined goals and objectives. For example, for a tuberculosis (TB) control programme, these goals will often focus around case finding and case holding/treatment, with objectives directed towards better and more equitable diagnosis, improved cure rates, low death rates, uninterrupted drug supplies and reliable monitoring. The second principle is that constraints and obstacles that prevent these objectives from being achieved must be identified, prioritised and articulated. The third principle is that research questions need to be asked to address these constraints. The avenues of enquiry are usually of three main types—is there a lack of knowledge? a lack of a suitable tool or intervention or the possibility of a better tool or intervention being used? or an inefficient use of a tool or intervention? Table 1 provides an example of how these guiding principles might work in a number of different programme settings.

OR is often observational in nature, and involves three main types of methodology: descriptive studies (sometimes called 'cross-sectional research' if it includes a strong analytic component), case-control studies, and retrospective or prospective cohort analysis studies. We do not regard basic science, experimental research or classical randomised controlled clinical trials (RCTs) as OR. Most RCTs determine the efficacy of an intervention in a strictly controlled environment with inclusion and exclusion criteria, while OR assesses effectiveness within the routine programme setting. However, pragmatic randomised controlled designs, such as a cluster-randomised trial of community support for human immunodeficiency virus (HIV) care,[6] carried out within routine programme settings, might be included as OR.

Table 1 An example of the process of developing an operational research study

Type of setting	TB programme HIV treatment programme Smoking cessation intervention
Objective	85% treatment success in TB programme 80% retention on antiretroviral treatment 90% successful completion in smoking cessation cohort
Constraint	High rates of loss to follow-up
Research question	Why are patients lost to follow-up?
Research methodology	Involves identifying and tracing patients lost to follow-up: • Review of clinic and laboratory registers • Active tracing to determine how many of those lost to follow-up are unreported deaths, un-notified transfer outs, patients who have stopped treatment or patients who are still on treatment but from other sources • Qualitative research to determine why patients have stopped treatment—Payment for medication? Cost of transport to clinic?
Answers to the question	The programme seeks to solve the problems and reduce losses to follow-up and ultimately improve treatment outcomes.

TB = tuberculosis; HIV = human immunodeficiency virus.

Both OR and the classical RCT play an important part in the generation of new knowledge: the RCT provides clear-cut data on efficacy in identified groups of patients, while OR determines the effectiveness of interventions in the real world of routine patient care. OR is often regarded as second best to the RCT, but each contributes to better patient care in its own way; in fact, they are complementary. Recent guidelines for the reporting of observational studies (the Strengthening the Reporting of Observational Studies in Epidemiology [STROBE] statement) will help towards improving the scientific credibility and value of this type of research.[7]

Well-performing TB control or antiretroviral treatment (ART) delivery programmes are well adapted for OR because of their strong, inherent standardised monitoring and evaluation systems. These systems routinely track the number of patients enrolled for treatment over defined periods, key demographic and clinical characteristics, types of treatment and treatment outcomes. Such data, documented in treatment cards and facility-based registers and sometimes within electronic data systems, are ideally suited for OR. Furthermore, conducting OR using programme data invariably has a beneficial effect on data collection and quality. Linking monitoring and evaluation data to OR is thus a win-win situation, which should lead to better quality monitoring and research and ultimately to improved programme performance.

THE UNION'S APPROACH TO OPERATIONAL RESEARCH SUPPORT IN TB CONTROL

In the last 10–15 years, there have been impressive gains in global TB control, with gradual increases in case detection and treatment success rates.[8] However, many challenges remain, including access to early diagnosis, implementing programmatic management of multidrug-resistant TB (MDR-TB) and HIV-associated TB and the efficient and informed introduction of new diagnostic tools into routine programme settings. These are all priority issues that could benefit from timely and pragmatic OR studies. While OR has been included in the most recent Global Plan to Stop TB (2006–2015),[9] actual implementation of research activities in the field for various reasons, such as lack of capacity and difficulty in formulating research

questions, has not been systematically developed in many of the high-burden countries most in need of these efforts.

The Union is currently trying to address these deficiencies through two independent, yet interlinked, research initiatives. In September 2008, through resources awarded by the United States Agency for International Development (USAID), The Union launched the TREAT TB (Technology, Research, Education and Technical Assistance for TB) Initiative. This initiative aims to address specific research gaps globally in the area of diagnosis and treatment of TB, and build OR and programme assessment capacity at country level among ministries of health and their National TB Programmes (NTPs) in USAID-priority countries. Through this five-year initiative, The Union is engaging with numerous technical partners working at international, regional and national levels to achieve a number of objectives. One of these is to define and address priority needs for OR among NTPs and their local partners. In January 2009, through generous philanthropy, The Union was able to found the Centre for Operational Research, which aims to strengthen OR capacity and the collection and use of strategic information in low- and middle-income countries. Its focus is on TB and HIV/AIDS (acquired immune-deficiency syndrome), key non-communicable diseases such as diabetes and hypertension, and monitoring methods that include the use of electronic medical records to track chronic disease and village-level vital registration.

OR is not new to The Union, however. Founded in its present form in 1920, The Union has had a long history of engagement in OR.[10] The Union's Board of Directors in 1987 approved the prioritisation of three main activities: education, research and technical assistance. OR features in each of these priority activities. Consultants, with their colleagues in country programmes, currently publish about 50 OR articles per year. The Union also provides a platform for exchanges about OR through its international and regional conferences and through the scientific journal, the *International Journal of Tuberculosis and Lung Disease* (IJTLD).

Country-level needs have always been paramount in The Union's thinking, and a comprehensive approach to support OR has been the predominant strategy. Figure 1 illustrates the comprehensive support package articulated by the TREAT TB Initiative. A necessary starting point is a situational analysis that provides a clear understanding of the existence or not of a research agenda; past and present OR activities, including the identification of key national and international partners involved in OR; linkages between national academic institutions and government programmes; human and financial resource capacity to undertake OR; and past publications and policy changes related to national research efforts.

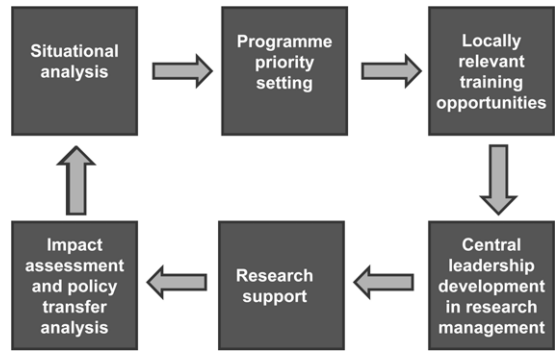

Figure 1 The Union's operational research support package.

Countries and programmes vary in their OR achievements at the time that this analysis is undertaken, with some programmes having virtually no OR capacity while others may be fairly experienced. This analysis also serves as a baseline against which annual evaluations and assessments of OR activities can be conducted, and it also allows for the development of a coordinated plan for OR.

The next important step is the clarification of programme objectives and the development of clearly defined priorities, which often require a broad consultation process with local and international partners. Where a priority setting exercise has already taken place, updates may be necessary at regular intervals to ensure the greatest relevance of OR activities on an ongoing basis. Situational analyses, clarification of programme objectives and priority setting activities are helpful steps to identify OR agendas and training plans that are tailored to national needs. Related to, yet distinct from the broad training requirements for successful OR at country level, is the need for leadership in the management of research programmes. This capacity can be developed through a variety of international training and mentoring opportunities, including support and training for OR fellows.

The presence of clearly established research priorities and adequate human resources at all levels are necessary, but not sufficient, components for successful OR implementation. Funding is required, and The Union supports countries and programmes in identifying and securing the necessary financial resources to address national research priorities. Moreover, The Union provides comprehensive guidance for all aspects of OR, including protocol development, ethics review processes through to peer-reviewed publications and presentations and knowledge translation.

A unique aspect of The Union's OR package is the inclusion of two new frameworks in its training and OR initiatives. The impact analysis framework (IAF) developed by the Liverpool School of Tropical Medicine and partners, and being tested, in part, through The Union-led TREAT TB Initiative, examines new tools and approaches through a broad lens.[11] It moves

beyond simply an analysis of efficacy, adding further analyses related to equity, health systems, scale-up and policy. It is accompanied by a policy transfer analysis framework developed by The Union. Policy transfer analysis adds a further dimension to OR by assessing the factors that affect uptake into policy and practice and the impact of OR on national policy.

MÉDECINS SANS FRONTIÈRE'S APPROACH TO OPERATIONAL RESEARCH

MSF is an international medical non-governmental organisation (NGO) that works in many countries and provides medical assistance to vulnerable populations living in difficult and resource-limited settings. Over the past 10 years, the organisation has become increasingly involved in disease control programmes such as HIV/AIDS, TB and malaria. Unlike at The Union, OR in MSF is rather new. There was a time when research was considered taboo by senior managers, who felt it to be in conflict with the core 'implementation' mandate of the organisation and a possible diversion of operational resources. However, this attitude has changed with the realisation that research can be complementary to project goals and can support the mandate of the organisation.

The three main reasons why MSF now embraces OR are 1) to assess the effectiveness of treatment or prevention interventions in projects, thereby leading to improvements in the quality of the assistance; 2) to assess the feasibility of implementing new models of care; and 3) to gather evidence to support advocacy for health policy change.[12] Although the basic principles upon which The Union and MSF have built their research foundations are synergistic, there are some differences related to the mandates of the two organisations that are worthy of note.

First, as an implementing organisation, MSF directly implements research on the ground. The project medical coordinator is held responsible, enhancing ownership and helping to make research an integral part of routine operational activity.

Second, programme officers help to define the research questions based on monitoring and evaluation data. Studies are therefore often descriptive or cohort in nature, and involve routine programme data.[12] Eight of 10 studies conducted by MSF fall into this category, with prospective studies and clinical trials constituting a minority of 6%.[12] MSF rarely conducts clinical trials, as it is not resourced to do so and has no comparative advantages over academic or other research institutions in this regard. Previous experience with RCTs within MSF has also shown that these can become a parallel activity with routine operations, and this risks a conflict with the core implementation mandate of the organisation.

Third, research studies generated from programme data are incorporated into annual project planning exercises where funding is an integral component. This facilitates administrative aspects, and means that researchers do not have to worry about securing external funding.

Fourth, MSF's research agenda is more diverse than that of The Union, as it is driven by changing operational projects. Until now, the focus at The Union has been centred on TB and respiratory disease, although this is changing. While a dynamic OR agenda in MSF keeps the focus congruent with operations, the downside is that research activities in specific domains might not be sustained, and the expertise needed might not necessarily be available within the organisation. Fifth, operational activity and capacity building are primarily focused at the district or project level, rather than at the national level as with The Union. However, it is through such decentralised modus operandi that technical and advocacy links are made to the central level and beyond.

Finally, The Union hosts the IJTLD and disseminates knowledge on TB, lung health, HIV and tobacco control in this and a number of other journals. MSF also disseminates knowledge through publications in a variety of journals, but it also hosts the *MSF Field Research Repository*[13] and conducts annual scientific days.[14,15] The *Field Research Repository* makes all MSF-authored, peer-reviewed publications available free-of-charge online thanks to permission granted by over 100 journals. A recent analysis of the repository showed that close to 130 peer-reviewed publications are downloaded each day from different countries around the world, indicating the relevance and public demand for these publications. Table 2 highlights a number of examples of research conducted by MSF, their main findings and implications for policy and practice.[12,16–22] Table 3 highlights some key enabling factors that have permitted the development of research in MSF. However, it is important to note that this has not always been smooth sailing, and several barriers have been encountered along the way. Table 4 highlights some of these barriers, the possible reasons and lessons learnt.[12] It is only by addressing such challenges and persevering that one can continue to 'learn by doing', and in this way find solutions.

AN EXAMPLE OF INVESTING IN OPERATIONAL RESEARCH: THE MALAWI NATIONAL TB PROGRAMME

Between 1996 and 2004, the Malawi NTP, with support from the international donor community, invested in OR as an integral part of its activities. A partnership was set up whereby research ideas from within the NTP, from local institutions (such as the Malawi Medical School, NGOs such as MSF and the National AIDS Programme) and from international organisations (such as the World Health Organization

Table 2 Examples of operational research studies published by Médecins Sans Frontières and their contributions to policy and practice. Adapted from Zachariah et al.[12]

Operational research studies, author, reference, title	Main finding(s)	Contribution(s) to policy and practice
Improving effectiveness of medical interventions		
Zachariah et al.[16] Payment for antiretroviral drugs is associated with a higher rate of patients lost to follow-up than those offered free-of-charge therapy in Nairobi, Kenya	58% higher risk of loss to follow-up associated with payment for ART; ART dose dilutions by patients who had to pay for ART	Policy makers accepted the detrimental effect of ART payment on outcomes and the service began to be offered free-of-charge to all patients in Mbagathi Hospital Led to policy changes in the Kibera ART programme design and implementation to enhance ART uptake
Massaquoi et al.[17] Patient retention and attrition on antiretroviral treatment at district level in rural Malawi	Relatively high levels of loss to follow-up at district hospital level and mortality at primary health centres while scaling up ART for universal access	Provided policy recommendations to reduce attrition rates
Assessing feasibility in specific populations or settings		
O'Brien et al.[18] Universal access: the benefits and challenges in bringing integrated HIV care to isolated and conflict-affected populations in the Republic of Congo	Integrated ART can be offered in a conflict setting with good outcomes	Provided knowledge on how to implement an integrated HIV/AIDS programme in a rural conflict-affected setting to achieve universal access
Zachariah et al.[19] VCT and adjunctive cotrimoxazole reduces mortality in TB patients in Thyolo, Malawi	VCT and adjunctive cotrimoxazole shown to be feasible, safe and associated with reduced mortality in TB patients under programme conditions	Provided evidence on feasibility and effectiveness to support countrywide expansion of HIV testing and cotrimoxazole for TB patients in Malawi
Wilson et al.[20] HIV prevention, care and treatment in two prisons in Thailand	Describes the experience of offering HIV/AIDS care in two prisons in Thailand	Provided knowledge on how to implement HIV/AIDS care in prison settings
Advocating for policy change		
Van Griensven et al.[21] High prevalence of lipoatrophy among patients on stavudine-containing first-line ART in Rwanda	Showed that lipoatrophy was an important complication of WHO recommended first-line ART regimens	Highlighted the urgent need for access to more affordable and less toxic ART regimens in Africa
Grais et al.[22] Unacceptably high mortality related to measles epidemics in Niger, Nigeria and Chad	Demonstrated unacceptably high measles-related case fatality in the three countries	Provided evidence to advocate for improving measles vaccination programmes in the affected countries.

ART = antiretroviral treatment; HIV = human immunodeficiency virus; AIDS = acquired immune-deficiency syndrome; VCT = voluntary counselling and HIV testing; TB = tuberculosis; WHO = World Health Organization.

Table 3 Enabling factors for building operational research into an implementing organisation such as Médecins Sans Frontières

- A critical mass of experienced and dedicated operational research staff who have programme skills and are available at headquarters and in the field
- Headquarters staff includes a research officer, a data manager and a medical editor, while in the field operational research staff includes a research officer or epidemiologist, a data manager and data entry clerks
- A clear institutional policy framework has been written clarifying the 'what, why and how' of operational research
- Research planning, agenda setting, objectives, targets and budgeting are included in annual country project planning exercises
- Research questions are generated from the programmes, and research is conducted within the framework of field operations and not run in parallel
- Training, strong mentorship and on-the-job supervision is provided to national staff, and close collaboration is established with local authorities and national partners
- Prompt feedback of research results is given to the programmes and disseminated through publications in peer-reviewed journals, booklets and the on-line MSF Field Research Repository
- An institutional ethics review board facilitates ethical review
- Outputs are evaluated on a 6-monthly basis to assess performance and monitor results of research activity.

MSF = Médecins Sans Frontières.

[WHO], The Union and the Liverpool School of Tropical Medicine) were discussed and endorsed at the six-weekly meetings of the Malawi TB Programme Management Group. After priorities were established, research activities were then implemented by the various stakeholders (Figure 2). Many were planned, initiated, completed and published within the Malawi NTP itself; the enabling factors that contributed to this achievement are listed in Table 5.[23] At the end of every year, a report was written on research undertaken, studies completed, studies published and the effect that these studies had on influencing policy and practice.[24,25]

The success of OR was judged in various ways: 1) whether proposed annual targets in terms of projects initiated, projects completed, papers written and papers published were met; 2) whether the research findings influenced policy and practice; and 3) whether the research helped to improve programme performance. The OR led to key changes in national policy and practice, examples of which included the creation of a prison tuberculosis control programme, which continues to this day,[26,27] improved recording and reporting of patients with previously treated TB,[28]

Table 4 Barriers to operational research in Médecins Sans Frontières, possible reasons and lessons learnt. Adapted from Zachariah et al.[12]

Barriers to operational research	Possible reasons	Lessons learnt
Perceptions and lack of awareness about the role of research		
Senior managers fear that operational research will divert resources from aid delivery	Lack of knowledge about the role and relevance of applied research to field operations Weak knowledge translation strategy for operational research within the organisation	Establishing an institutional policy framework and reference document for operational research reassures operations staff and guides research activities Research resources are complementary (e.g., a statistician or data clerk cannot do the work of a nurse) The MSF Field Research Repository (http://fieldresearch.msf.org) raises awareness about research activity and its impact on country health policies
Time and opportunity		
Operations field and headquarters staff have no dedicated time or opportunity for research activity, especially related to protocol development, data analysis or writing papers. No one to manage research activity at headquarters or in the field	Research is an additional responsibility for already overworked senior staff No dedicated budget or human resources for research implementation	Provide dedicated human resources for operational research at headquarters and in the field to support research activities Include budgets and additional human resources needed for research during the annual operational planning exercise Give staff dedicated time (e.g., 2 days per week) to conduct research
Lack of human resource capacity		
Inadequate research capacity among MSF staff	Individuals in charge of research have limited research or programme skills Capacity building efforts are targeted at the wrong people Rapid turnover of staff	Establish strict criteria for selection of potential candidates for training Persons involved with research have to accept contracts of at least 3 years Introduce the concept of research fellows
Study design and implementation		
The research question is not relevant to programme implementation Poor adherence to research protocol Poor quality of data or too much data	The researcher has inadequate understanding or experience working at programme level (programme skills) Inadequate on-the-job training and supervision Poorly designed data collection tools	Regularly provide ongoing mentoring and improved supervision in defining the study question, the studies themselves and data tools Review data on a regular basis
Ethics clearance		
No ethics clearance is sought or received	Programme staff conclude that no ethics clearance is required Perception that ethics committees are a burden No functional ethics review board exists in the setting	Establishment of an MSF Ethics Review Board facilitates ethical clearance Make ethics an essential part of training to promote the perception that ethical boards are allies and not adversaries
Writing skills for publication		
Failure of research to lead to publication	Poorly designed studies Inadequate writing and language skills No ethics clearance or exemption No interest in investing efforts for publication in scientific journals	Development of writing skills training for publication with the support of a medical editor(s) through workshops and mentoring Emphasis at senior level on the importance of research publications
Policy and practice		
Research findings are not translated into policy and practice at the field level	Key decision and policy makers are not involved from the start and thus lack ownership Study authorship is not inclusive of key decision makers MSF workers lack the skills to interact with national authorities and partners	Involve decision makers and local partners in developing studies from the beginning to encourage ownership of the results Selected operational research officers should have both research and programme management skills and have longer term contracts (e.g., 3 years) Introduce a clear performance framework with indicators to evaluate the impact of research on policy and practice over time

MSF = Médecins Sans Frontières.

a change of treatment regimens from hospital-based, 2-month intensive phase therapy centred around daily injections of streptomycin to oral, ambulatory treatment given from health facilities or from family-based guardians;[29] and a policy of routine HIV testing and counselling for all TB patients with provision of cotrimoxazole preventive treatment to those found to be HIV-positive.[30–33]

Despite the achievements, not all the OR was successful. Several projects started and implemented with the NTP funding were never completed because of poor study design or poor, unreliable data collection,

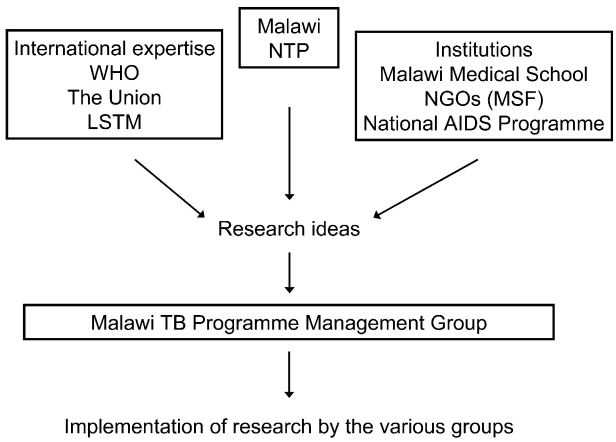

Figure 2 Research planning in the Malawi NTP. NTP = National Tuberculosis Programme; WHO = World Health Organization; LSTM = Liverpool School of Tropical Medicine; NGO = non-governmental organisation; MSF = Médecins Sans Frontières; AIDS = acquired immune-deficiency syndrome; TB = tuberculosis.

and there was sometimes a failure to translate completed but complex projects into understandable and readable papers. Sometimes the research was completed and published showing that an intervention was feasible and useful,[34] yet for various reasons, policy and practice remained unchanged. Failures are inevitable in any endeavour, but because these involve funds, human resource time and energy, it is important to learn from mistakes.

Table 5 Key factors that enabled operational research within the Malawi NTP

- There was a well-functioning TB programme with countrywide, standardised case finding, treatment and monitoring systems
- Research studies addressed constraints in TB control, and used established TB systems
- An annual research programme and research activities were planned within the NTP, included in the annual workplan and approved each year by the NTP Steering Group
- A good relationship was established with the Malawi National Health Science Research Committee that received and approved the annual research plan and programme before the start of the forthcoming year, and in turn expected an end-of-year report
- There was a Central Unit Officer responsible for operational research
- There was a dedicated budget line for research
- Resources were allocated to training that included an annual research training workshop, an annual writing skills workshop and an annual review meeting to disseminate research findings to national and international stakeholders
- Once research studies were completed, they were quickly translated into reports and papers, many of which were subsequently published in international peer reviewed journals
- Research publications from the Malawi NTP were collated each year into an annual report that was printed and disseminated to all districts in the country.

NTP = National TB Control Programme; TB = tuberculosis.

CAPACITY BUILDING

Translating an important research question into a published paper and using the findings to influence policy and practice is a long, hard journey that requires time, capacity and perseverance (Figure 3). In many programme settings this capacity and time are often lacking, but if they are included as an essential part of the programme they can be accomplished.

The Union has for many years modelled its OR training programmes on its successful guide 'Research Methods for Lung Health'.[35] Union training programmes have ranged from 3-day refresher training programmes on OR methods to 2-week protocol development workshops. These are similar in design to OR courses run by the US Centers for Disease Control and Prevention, where over the course of 10 years large numbers of TB programme and laboratory staff have been trained in OR methods.[36] However, questions are rightly being asked about whether these training methods lead to the creation of sustainable, research leadership in programmatic OR with publication of completed studies in peer-reviewed journals. For example, at the International TB Training Course in Japan, with the assistance of external facilitators 28 participants developed OR projects over a 7-year period between 2001 and 2007, none of which resulted in the publication of a scientific paper.[37] New paradigms are clearly needed, and The Union has previously experimented, and is currently experimenting, with several different approaches.

First, The Union used to run a junior consultant programme that included training on how to perform technical assistance, training and OR. Three physicians from low-income countries attended a Union-sponsored OR methods course, and were then linked to their NTP and tasked with developing an OR project that addressed country-relevant issues. However, given that they were not formally employed by the government, it was difficult to obtain country 'buy-in',

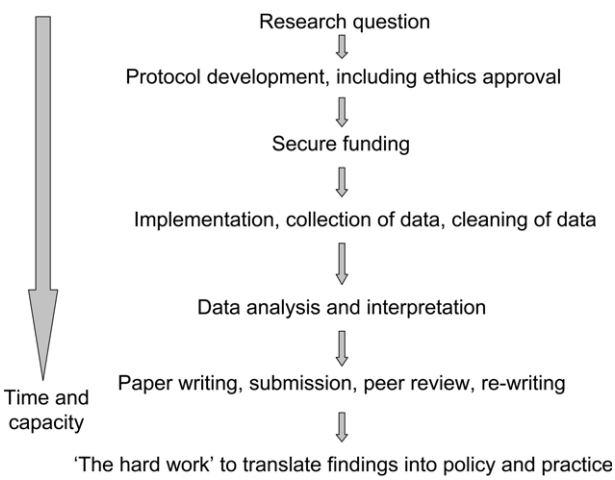

Figure 3 The steps from research question to scientific paper.

cooperation and ownership of the process. In another, similar initiative, after the presentation of a situational analysis of why HIV testing uptake was suboptimal among TB patients, participants at a Union-sponsored OR course in Uganda developed a research protocol to address the issue in five of the country's districts. After the course, a Union-sponsored consultant was mentored and tasked with refining the protocol, obtaining country and Union institutional board approval, developing the questionnaire, training staff, collecting and analysing data with country colleagues, submitting abstracts and writing papers. Two of these were accepted in peer-reviewed journals and helped to change country practice.

Second, The Union has received funding to engage OR fellows, appointed using strict selection criteria, who work within disease control programmes in their countries. They work full- or part-time for The Union and are given support and time from the programmes to carry out relevant OR. By June 2010, eight OR fellows had been placed in six countries (Viet Nam, India, Malawi, Zimbabwe, South Africa and Brazil). They receive training and mentorship from researchers at The Union in collaboration with their country colleagues, and are expected to initiate, complete and write up OR. One of the key milestones of these fellowships is the submission of two papers to peer-reviewed journals by the end of a 12-month period, failure to achieve this resulting in termination of the contract. Four of the fellows had completed their first 12-month contracts by the beginning of June 2010, and each had submitted two or more papers to earn a second 12-month contract.

Third, a new training course has been developed in partnership with MSF-Luxembourg that consists of three modules of 1 week each, spread over 9 months, with clearly defined outputs for each module.[10] The success or otherwise of this course is judged by a measurable product: completed projects that are submitted to and published in peer-reviewed journals, demonstrating that the participants can take a research question through to research protocol, research implementation, data analysis and writing up and publication of a scientific paper.

Fourth, the TREAT TB efforts focus on country-based OR training linked to programme priority research questions with both mentoring support and necessary financial resources to undertake research activities. The training includes the development of research protocols, along with the basic methodological skills necessary to carry out the research. The duration of the training has been limited to 5 days (Table 6) to ensure the most efficient use of programme staff time and resources. Once a workshop is completed, clear timelines and expectations for study implementation are created. Technical support is provided for activities ranging from ethics reviews, study implementation and statistical analysis to peer-reviewed publication. Finally, tracking the impact of the country research efforts in terms of national, regional and global policy change is an essential component of TREAT TB.

Table 6 Workshop agenda of the TREAT TB course run in India in 2009

Day 1	By the end of the day, the participants will have: • Identified and recorded the research question • Written a rationale for why this is important
09:30–10:15	Inaugural session: Introductions
10:45–11:45	Lecture: Introduction to protocol development
11:45–12:30	Lecture: The research question
12:30–13:15	Lecture: Justifying the need for research
14:00–16:00	Protocol: Setting the framework and defining the null hypothesis
16:15–17:30	Protocol: Preparing the rationale of the study
Day 2	By the end of the day, the participants will have: • Recorded the study design selected • Described the population to be studied
09:30–11:00	Lecture: Using epidemiology and designing the research
11:30–13:00	Lecture: Identifying the population for study
14:00–15:45	Protocol: Selecting the study design
16:15–17:30	Protocol: Describing the population
Day 3	By the end of the day, the participants will have: • Defined the variables to be measured • Outlined how information is going to be collected
09:30–11:00	Lecture: Variables and their definition
11:30–13:00	Lecture: Measuring and recording
14:00–15:30	Protocol: Defining the variables
16:00–17:30	Protocol: Methods and measurements
Day 4	By the end of the day, the participants will have: • Explained how information will be analysed • Indicated errors and how to avoid them • Defined the ethical issues to be addressed • Specified how the research will be conducted
09:30–11:00	Lecture: Comparing, analysing and defining error and bias
11:30–13:00	Lecture: Ethical and practical issues
14:00–15:30	Protocol: Comparing groups, avoiding error and bias
16:00–17:30	Protocol: Finalising workplan and budget
Day 5	By the end of the day, the participants will have: • Presented the protocol for critical review by peers
09:30–10:30	Lecture: Managing the research
11:00–13:30	Protocol: Presentation of research protocol
14:30–15:45	Protocol: Presentation of research protocol
16:00–17:30	Protocol: Presentation of research protocol
17:30–18:00	Concluding session

TB = tuberculosis.

MSF has three key approaches to OR training. First, there is 'on-the-job' training at project level. Senior-level researchers with doctorates hardly ever work with MSF, due to the rather modest conditions of service and employment settings. The emphasis has thus been to try and develop capacity in either expatriate or national field staff. Promising individuals are sponsored for courses on public health, medical statistics and data management. They are then taken through the practical process of defining research questions, writing protocols, managing and analysing

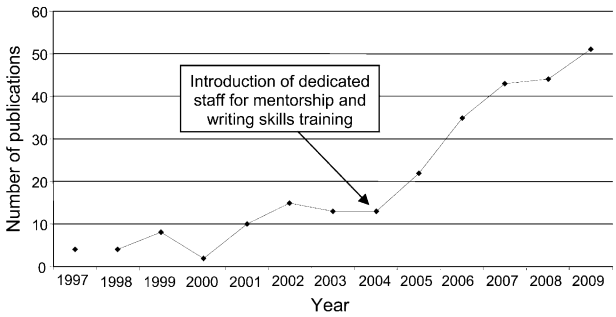

Figure 4 Trend in peer-reviewed scientific publications in Médecins Sans Frontières Operational Centre Brussels (1997–2009) and the impact of dedicated staff providing mentorship and writing skills training.

data and writing manuscripts for publication. The pillar of this approach is strong and sustained mentorship by the OR unit, which is staffed by experienced researchers, epidemiologists and medical editors. There has recently been increased emphasis on training national staff due to rapid turnover of expatriates. This model of training has been successfully conducted in five countries, namely Malawi, Kenya, Cambodia, Thailand and India.

Second, MSF invests in 'writing skills for publication' through workshops led by an experienced medical editor. Most individuals with Master of Public Health degrees or basic statistical training can collect, manage and analyse programme data. The real challenge lies in translating the findings into a manuscript that is accepted for publication. Specific writing skills workshops coupled with mentoring support have been instrumental at enhancing publication capacity both at headquarters and in the field. Figure 4 shows the trend over time in peer-reviewed scientific publications in the MSF Operational Centre, Brussels, and the impact of having a critical mass of headquarter staff providing mentorship support.

The third, rather novel, approach is the joint training course developed with The Union, described earlier. MSF also plans to introduce the concept of OR fellowships for its own staff, as this is likely to enhance retention and provide better career prospects. If partnered with a university, such a fellowship programme might lead to enhanced degree status and increase MSF's own research capacity.

ETHICS

Ethics has always been an important component of research promoted by both The Union and MSF. Both organisations have ethics review boards with terms of reference and policy and operational guidelines.[13,38] MSF has recently published its experience of research ethics reviews in humanitarian contexts.[39] Both ethics committees follow the principles set out in the Declaration of Helsinki, adopted by the World Medical Association (WMA) in 1964 and last revised at the 59th WMA General Assembly in October 2008.[40] In addition to ensuring ethical standards in research, the ethics committees foster discussion and reflection on ethical issues in all areas of work in which their respective organisations are involved. The Union's Ethics Advisory Group (EAG) has recently updated its own standard operating procedures on research protocol reviews and the promotion of ethical standards and issues in lung health services and international development (see http://www.theunion.org/ethics-advisory-group-eag.html).

Protocols developed by the OR Fellows and from the OR Course participants are subjected to review by The Union EAG, as are research protocols supported under the TREAT TB Initiative. Formal ethics review of OR proposals emphasises the need for informed consent to prevent risks to participants, data confidentiality, the need to submit for local ethics committee approval and the need to provide study results to local communities in accessible formats. Proposals for studies on existing data focus on the latter three items.

CONCLUSION

We strongly believe that OR should be an integral part of routine programme activities in low- and middle-income countries. If it is linked to routine programme monitoring and evaluation, OR can strengthen programme activities and lead to improved performance and better health prevention and care for patients. What is needed is further development of OR capacity, allocation of specific resources and collaboration between different actors such as international and national academic institutions, national programme managers and NGOs who should work together in promoting OR.[5]

There are encouraging signs of progress. The Global Fund to Fight AIDS, Tuberculosis and Malaria requests that countries include up to 10% of their funding for monitoring, evaluation and OR,[41] and this should be a major source of the funding needs for field activities. In July 2009, the Wellcome Trust announced the formation of seven new international consortia, each led by an African institution, as a step forward in strengthening research capacity on the African continent.[42] OR needs to be embedded in the research platforms that are being developed. In December 2009, the WHO organised a Stop TB Symposium at the 40th Union World Conference on Lung Health in Cancun, Mexico, a large portion of which was devoted to the role of OR in addressing TB and poverty. In late 2009 and early 2010, the United States government, through its new Global Health Initiative that will serve as the guiding framework for all of the government's health-related efforts, highlighted the role and importance of OR and the use of findings to

'identify critical problems and improvements'.[43] The WHO convened an international meeting in May 2010 of interested stakeholders and donors to discuss the priorities for OR in TB control and the steps needed to develop the necessary capacity to move the agenda forward. In all these efforts, The Union and MSF are committed to playing their full part in working together with stake holders, including the WHO, to turn the vision of better OR into reality on the ground.

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RÉSUMÉ

La recherche opérationnelle est devenue un sujet d'actualité dans les réunions nationales, les conférences internationales et les forums de donateurs. L'Union Internationale contre la Tuberculose et les Maladies Respiratoires (L'Union) ainsi que le Centre Opérationnel de Médecins Sans Frontières (MSF) à Bruxelles suscitent énergiquement et mettent en œuvre la recherche opérationnelle (OR) avec des collègues des pays à revenus faibles ou moyens. Dans cet article, nous décrivons comment les deux organisations définissent l'OR et nous expliquons les principes de guidance et la méthodologie qui étayent la stratégie du développement et de l'expansion des OR dans ces pays. Nous articulons les approches de L'Union et de MSF dans leur soutien à l'OR, en insistant sur les principales synergies et différences. Dès lors, en utilisant comme exemple le Programme National de lutte contre la Tuberculose du Malawi, nous montrons comment l'OR peut être intriquée avec les activités de lutte contre la tuberculose, entraînant des modifications de la politique et des pratiques au niveau national. Nous discutons du problème difficile et pourtant d'une importance vitale du développement des aptitudes et nous partageons nos visions sur le nouveau paradigme d'une formation liée au produit et de la solidarité dans une OR basée sur les performances comme deux moyens de développement des compétences nécessaires au niveau national pour garantir qu'une recherche soit effectivement pratiquée. Finalement, nous mettons en évidence la nécessité de considérer les composantes éthiques de l'OR et de les incorporer dans la pratique. Il s'agit d'un élément-clé à impliquer dans l'OR. Nous sommes confiants que lors du partenariat avec les responsables intéressés, y compris l'Organisation Mondiale de la Santé, nous pourrons stimuler la mise en œuvre d'une OR pertinente et de bonne qualité comme élément intégral de la fourniture de services de santé, qui à son tour contribuera à une amélioration de la santé des populations, particulièrement celles vivant dans les parties les plus pauvres du monde.

RESUMEN

La investigación operativa (OR) se ha convertido en un tema de mucha actualidad en las reuniones nacionales, las conferencias internacionales y los foros de donantes. La Unión Contra el Tuberculosis y Enfermedades Respiratorias (La Unión) y el centro operativo de Médecins Sans Frontières (MSF) en Bruselas fomentan en forma decidida y ponen en práctica l'OR con profesionales de países de medianos y bajos ingresos. En el presente artículo se describe la forma como ambas organizaciones definen la OR y se explican los principios conductores y los métodos que respaldan la estrategia de establecimiento y ampliación de este tipo de investigación en esos países. Se aclara el enfoque de respaldo a la OR de La Unión y de MSF y se ponen en evidencia los principales sinergismos y las diferencias. Luego, se toma como ejemplo el Programa Nacional contra la Tuberculosis en Malawi y se destaca el mecanismo de integración de la OR a las actividades de control de la tuberculosis, con el fin de alcanzar cambios en las políticas y las prácticas a escala nacional. Se analiza el aspecto delicado y al mismo tiempo primordial de la creación de capacidad de acción y se comunica un punto de vista sobre el nuevo paradigma de las becas de capacitación basada en los productos y la OR basada en el rendimiento, como mecanismos de desarrollo de las competencias nacionales necesarias, con el fin de verificar la ejecución real de la investigación en el terreno. Por último, se pone en relieve la importancia de considerar e incorporar en la práctica los componentes éticos de la OR. Este es un momento crucial para participar en la OR. Se espera que la vinculación de interesados directos como la Organización Mundial de la Salud logre fomentar la realización de una OR pertinente y de excelente calidad, como parte integrante de la prestación de servicios de salud. Esto redundará a su vez en una mejor salud para los pueblos, sobre todo en las regiones más pobres del mundo.

Appendix B

Sample Workshop Agenda

Research Protocol Development Workshop
AGENDA

Day 1	By the end of the day, participants will have: • Identified and recorded the research question • Written a rationale for why this is important • Recorded the study design selected • Described the population to be studied
08-30 - 09-00	Registration
09-00 – 09-30	Welcome and introductions
09-30 – 10-15	***Presentation*** 1. Justifying the need for Research
10-15 – 10-45	*Coffee Break*
11-15 – 12-00	***Presentation*** 2. Protocol Outline and research question
12-00 – 13-00	***Presentation 3***. Study design and population
13-00 – 14-00	*Lunch Break*
14-00 – 17-00 Coffee breaks in between	***Practical session protocol writing:*** Setting the framework, question and the null hypothesis Preparing rationale of the study
Evening	***Do a Literature Review on identified research question***
Day 2	By the end of the day, the participants will have: • Defined the variables to be measured • Outlined how information is going to be collected • Defined how comparisons will be made
08-30 – 10-00	***Feedback:*** Participants present feedback on progress with question, rationale and null hypothesis
10-00 – 11:00	***Presentation 4.*** Variables, definition and measurements
11-00 – 11:30	*Coffee Break*
11-30 – 12-30	***Presentation 5***. Error, bias and comparison
12-30 – 13-15	*Lunch Break*
13-15– 17-00 Coffee breaks in between	***Practical session protocol writing:*** Study design, population, summarise/interpret routine data to be used
Evening	***Work on Study design, population and data set***
Day 3	By the end of the day, the participants will have: • Described how data will be managed • Incorporated basic Impact Assessment and Policy Evaluation • Addressed collaborative and ethical issues in the protocol
09-00 – 10-00	***Presentation 6***. Data Management
10-00 – 11-00	***Presentation 7***. Impact Assessment and Policy Evaluation
11-00 – 11-30	*Coffee Break*
11-30 – 12-30	***Presentation 8.*** Ethical, practical and collaboration issues

Appendix B

Sample Workshop Agenda

12-30 – 13-15	*Lunch Break*
13-15 – 17-00 Coffee breaks in between	***Practical session protocol writing:*** Defining the variables Methods and measurements
Evening	***Work on study design, population, data set, variables etc.***
Day 4	By the end of the day, the participants will have: • Completed the protocol • Prepared for the presentation of the protocol
09-00 – 12-30 Coffee break between	***Practical session protocol writing*** *(Facilitators assist where needed):* Finalizing protocol, analysis plan, work plan and budget
12-30 – 13-15	*Lunch Break*
13-15 – 17-00 Coffee breaks in between	***Practical session protocol writing*** *(Facilitators assist where needed):* Finalizing protocol, analysis plan, work plan and budget
Day 5	By the end of the day, the participants will have: Presented the protocol for critical review by peers
09-00 – 10-30	***Presentation of research protocols***
10-30- 11-00	*Coffee Break*
11-00 - 13-00	***Presentation of research protocols***
13-00 – 13-45	*Lunch Break*
13-45 – 15-30	***Presentation of research protocols***
15-30– 16-00	*Coffee Break*
16-00 – 17-00	***Presentation of research protocols***
17-00 – 17-30	Concluding session

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STATE OF THE ART

Beyond accuracy: creating a comprehensive evidence base for tuberculosis diagnostic tools

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SUMMARY

The need for a strong and comprehensive evidence base to support decision making with regard to the implementation of new and improved diagnostic tools and approaches has been highlighted by a number of stakeholders; these include members of the New Diagnostics Working Group (NDWG) and the Subgroup for Introducing New Approaches and Tools of the Stop TB Partnership. To compile such evidence in a systematic manner, we have developed an impact assessment framework (IAF) which links evidence on inputs to outcomes.

The IAF comprises five interconnected layers: effectiveness analysis, equity analysis, health systems analysis, scale-up analysis and policy analysis. It can be used by new diagnostics developers and other interested research teams to collect as much policy-relevant data as possible prior to, during and after the demonstration phase of tool development. The evidence collated may be used by international and national policy makers to support adoption, implementation and scale-up decisions. The TREAT TB (Technology, Research, Education and Technical Assistance for TB) initiative uses the IAF in its operational research and field evaluations of new tools and approaches for TB diagnosis. It has also been incorporated into the NDWG's recent publication: 'Pathways to better diagnostics for tuberculosis: a blueprint for the development of TB diagnostics'. This article describes the IAF and the process of improving it and suggests next steps in overcoming the challenges in its implementation.

KEY WORDS: impact; evidence; tuberculosis; policy; diagnostics

Every TB patient must have access to an effective diagnosis, treatment and cure.
—The Global Plan to Stop TB 2006–2015[1]

THE ABOVE PRINCIPLE is key to attaining the vision of the Stop TB Partnership of seeing a tuberculosis (TB) free world by 2050.[1] Access to an 'effective diagnosis' has long been a concern. Smear microscopy is not sufficiently sensitive to detect tuberculosis disease in many cases, and particularly not in children and those who are co-infected with the human immunodeficiency virus. Multi- and extensively drug-resistant TB present new diagnostic and treatment challenges. Thankfully, new diagnostic approaches using existing tools have been recommended and new tools are in the pipeline.[2]

Any new approach or tool must be evaluated before being adopted by national tuberculosis programmes (NTPs); huge sums of money are already spent on TB diagnostics—estimated at more than $1 billion per year globally[3]—and resource-poor countries cannot afford to invest in interventions that are not more cost-effective than those already available. The World Health Organization (WHO) plays a key role in approving and developing guidelines for the use of new tools. The policy making process, described in a recent WHO statement,[4] comprises:

1 identifying the need for a policy change (e.g., the emergence of a new technology);
2 reviewing the evidence (e.g., through commissioning systematic reviews);
3 convening an expert panel to review evidence using the GRADE approach (Grading of Recommendations Assessment, Development and Evaluation, see BMJ 2008[5–9]);
4 assessing draft policies and guidelines (through the Strategic and Technical Advisory Group for TB, STAG-TB); and
5 formulating and disseminating new policies and guidelines.

Recent papers by Pai et al. have noted that systematic reviews, and hence the evidence reviewed in the above policy development process, have concentrated

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[A version in French of this article is available from the Editorial Office in Paris and from the Union website www.theunion.org]

mainly on test accuracy.[10,11] While such data are necessary, they are not sufficient to assess the contribution new diagnostics can make to the universal access requirements outlined in the Global Plan to Stop TB. A number of stakeholders, the Subgroup for Introducing New Approaches and Tools (INAT) and the New Diagnostics Working Group (NDWG) of the Stop TB Partnership, among others,[11–13] have called for a strong and comprehensive evidence base to support decision making with regard to implementation of new and improved diagnostic tools.

The NDWG has published 'Pathways to better diagnostics for tuberculosis: a blueprint for the development of TB diagnostics',[2] which outlines the required phases from needs assessment through test development to assessment of epidemiological impact, and all stages in between (Figure). The Stop TB Partnership's Retooling Taskforce, a precursor to INAT, stipulated the need for evidence that captures not only the benefits of new tools but also the risks and health systems implications associated with them.[14] This range of evidence is encapsulated in the Organisation for Economic Cooperation and Development definition of 'impact' subscribed to by multi- and bilateral donors who have signed the Paris Declaration on Aid Effectiveness (2005), which states that impact consists of:

> [The] positive and negative long-term effects on identifiable population groups produced by a development intervention, directly or indirectly, intended or unintended. These effects can be economic, socio-cultural, institutional, environmental, technological or of other types.[15]

Thus, measuring the impact of a diagnostic tool or approach involves assessing its positive and negative effects on different stakeholders (patients, health systems, laboratories, etc).

This entails summarising evidence not only about the test's accuracy, but also its effectiveness in field conditions in terms of diagnosing patients with various TB presentations, especially for the most infectious, and ensuring that they start appropriate treatment, its affordability, ease of implementation and potential for scale-up (for the health system) and accessibility (especially to poor and vulnerable TB suspects). Articulating and communicating this overall impact succinctly and with sufficient evidence is essential. It is required for national policy makers to make rational decisions about which new diagnostic tests and approaches to adopt, when and how to implement them, how to manage and finance them and how to ensure sustainable access and appropriate use.[14]

To compile such evidence in a systematic manner, we have developed an impact assessment framework (IAF) that links evidence on inputs to outcomes. This framework has been included in the NWDG's blueprint and has been adopted by the TREAT TB (Technology, Research, Education and Technical Assistance for TB) initiative for use in its operational research and field evaluations of new tools and approaches that are at late stages of development or have recently achieved international approval for use in TB diagnosis and treatment.

The present study describes the IAF, provides examples of how it can be used and suggests means of overcoming the remaining challenges in its implementation.

THE IMPACT ASSESSMENT FRAMEWORK

The IAF has been developed by a multidisciplinary team at the Liverpool School of Tropical Medicine and collaborators, including clinicians, laboratory specialists, health economists, social scientists and health systems analysts. It is based on a range of prior research activities in different countries that supported different elements of the evidence base.[16–25] These elements have been combined to provide an overarching

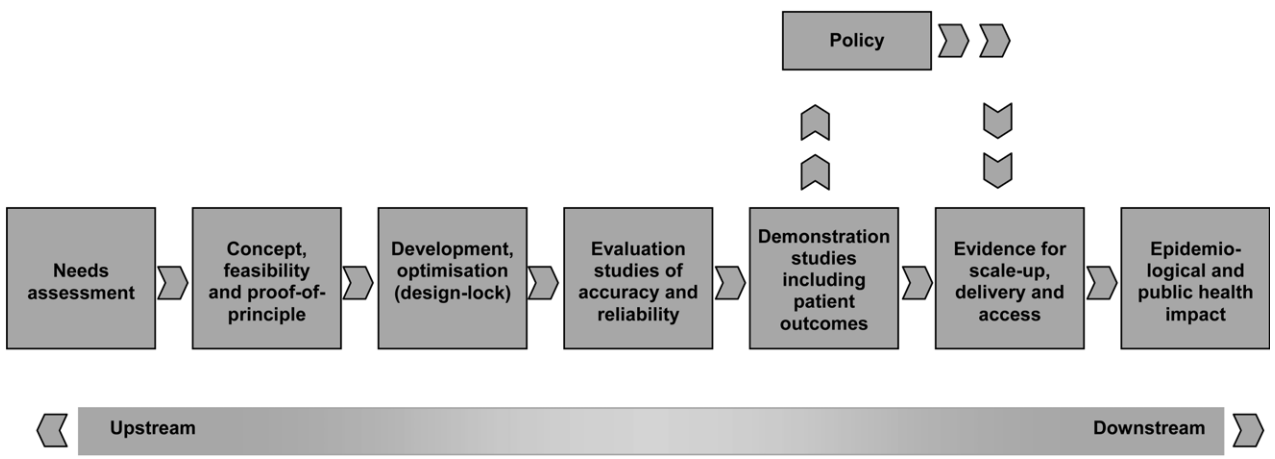

Figure Pathway for the development of tuberculosis diagnostics, from needs assessment to delivery [reproduced from reference 2 with permission from the World Health Organization].

framework (the IAF) to indicate how sufficient information for policy decisions could be collected in a systematic manner for all new diagnostic tools and approaches. The sufficiency of information has been considered in line with the international targets of the Global Plan to Stop TB and the Millennium Development Goals (MDGs).[26] The IAF, with references relating to different types of evidence, is shown in Table 1.

The IAF comprises five interconnected layers:

1 Layer 1: Effectiveness analysis
2 Layer 2: Equity analysis
3 Layer 3: Health systems analysis
4 Layer 4: Scale-up analysis
5 Layer 5: Policy analysis

Table 1 The impact assessment framework

Layer of assessment	Kinds of question(s) being addressed	References to studies addressing these questions
Layer 1 Effectiveness analysis	How well does the new tool work in terms of accuracy?	16
	How many additional cases will be identified who would otherwise not have been identified?	20
	How many additional cases will actually start (and complete) treatment as a result of using the new tool?	21
Layer 2 Equity analysis	Who benefits from the new tool (ambulant vs. hospitalised, poor/less poor, men/women, adults/children)?	27
	Why do these benefits accrue (level health system in which new diagnostic is deployed, change in time to issue of results, change in patient costs)?	22
Layer 3 Health system analysis	What are the human resource implications of introducing the new tool (training, number and cadre of staff)?	19
	What are the infrastructure implications (equipment, laboratory layout, safety installations)?	23
	What are the procurement implications (reagents, consumables, documentation)?	28
	What are the implications for quality assurance (internal and external)?	17
Layer 4 Scale-up analysis	What are the projected impacts of going to scale with the new tool? 1 Cost savings to patients in relation to income 2 Cost savings to health providers/ the health system 3 Effects on transmission of improved infection control as a result of the new tool	18
Layer 5 Policy analysis	What other similar technologies are available or likely to become available?	29
	How do similar existing or emerging technologies compare in their projected performance within each of the layers above?	25

Layer 1: Effectiveness analysis

This layer requires evidence about the accuracy (sensitivity and specificity) of new tools and approaches, but also flags the need to go further than this and build evidence on effectiveness. Data on sensitivity and specificity are universally provided by developers of new diagnostics, and their positive and negative predictive values have been suggested by GRADE as proxies for patient-important outcomes in the assessments of new tools. However, estimations of the number of patients who might start and complete appropriate treatment are typically calculated by extrapolating these parameters, rather than relying on evidence from field trials to provide estimates of actual numbers. All too often, diagnostic evaluations assess new tests solely in terms of their diagnostic potential (accuracy), which may not always translate into appropriate clinical or public health management decisions for patients within the context of health services (effectiveness).

Layer 2: Equity analysis

This layer examines who benefits from the new intervention. The Global Plan to Stop TB highlights the need to 'prioritise the needs of the poor and vulnerable', recognising that the greatest burden of TB is found among poor people, who also face the greatest barriers in access to care.[22] Typically, however, the systematic measurement of equity in health and health interventions is either absent or sporadic. Although the first MDG is expressed in terms of an equitable outcome, the health and other goals that are intended to contribute to this make no specific reference to equity or distributional issues.[30]

Layer 3: Health systems analysis

This layer examines the health systems requirements of a new intervention, for example human resources, infrastructure, operating procedures, quality assurance, procurement and maintenance.

These data are sometimes collected during the demonstration studies (Figure)—studies in optimised operational settings—of new diagnostics, but not in all cases. Even where they are collected, the improvement to operations necessarily provided through the demonstration study may mask issues that become apparent in implementation ('real world') studies. This layer provides crucial data for assessing the feasibility of implementation and for identifying where key constraints, or bottlenecks, in the system may occur.

Layer 4: Scale-up analysis

This layer projects and models the full economic costs as well as the clinical and epidemiological effects of going from demonstration or implementation studies to full scale (national or regional) with a new intervention. Health system, patient and societal

perspectives are all important here. Modelling techniques can provide information concerning the epidemiological benefits of scaling up and, when combined with patient costs from Layer 2, total additional costs or savings for patients. At the same time mathematical systems analysis techniques can outline the potential constraints to and resources required for scale-up. When combined with cost analyses from Layer 3, these can give an indication of total resources required as well as identify and quantify likely resource gaps.

Layer 5: Policy analysis

This layer critically appraises the new intervention studied in Layers 1–4 against other interventions that are available or may become available for uptake in the short to medium term. An important part of this layer is a scoping of the risk that a given new diagnostic test may be supplanted by newer technology within a short period of time. It requires a rapid assessment of data on other pipeline diagnostics from the previous four layers and a review of whether changes made for one diagnostic may provide a better platform for the next technology or, alternatively, whether the new technology is 'disruptive',[31] or 'market transformational',[32] both terms used to describe a technology that could radically alter the way in which TB diagnosis is achieved.

USING THE IAF

The IAF can be used by diagnostics research teams during the 'demonstration' and 'evidence for scale-up, delivery and access' phases of development shown in the Figure. The latter may take the form of field evaluation, or implementation, studies in non-optimised settings, or of other operational research activities. The framework can also be used by international policy makers during the policy development process to systematically assess a broader range of evidence, and by national policy makers to support adoption, implementation and scale-up decisions.

The IAF has already been used for the development of protocols for a multi-country research programme to study the implementation of line-probe assays (LPAs), which were recommended by WHO STAG-TB in 2008.[33] Representatives from three countries (Russia, Brazil and South Africa), all clinicians or laboratory specialists, with other members of the TREAT TB core group, discussed the priority research questions they would like to answer with regard to the use of LPAs, and mapped these questions to each layer of the IAF. All the questions raised mapped to one layer of the framework, and all layers were addressed; the resulting framework is shown in Table 2. Each of these teams now has a different protocol for collecting the evidence, due to the stage at which their NTPs are with regard to rolling out LPA. Nevertheless, each will provide data against the same set of outcome indicators, facilitating comparisons across different epidemiological settings.

Table 2 Use of the IAF for designing LPA field studies

Layer of assessment	Kinds of questions being addressed: questions and issues raised by multi-country research teams
Layer 1 Effectiveness analysis	How many additional cases will be identified who would otherwise not have been identified? How many additional cases will actually start treatment/achieve cure/avoid death as a result of using LPAs? What will be the effect on tuberculosis transmission? How will LPA affect the timeliness in results influencing a clinical or treatment decision?
Layer 2 Equity analysis	Who is benefiting from LPA implementation and why? Is the test sufficiently accurate for all patients? What are the risks to patients/others? What costs will patients face? How acceptable is the test to patients? Are there inequalities in access to LPA?
Layer 3 Health system analysis	What is the effectiveness and/or efficiency from a health system perspective? What effect will LPA have on how cases are managed in the health system? What quality assurance mechanisms need to be in place? What information systems need to be in place? What are the human resource requirements in the health system? What are the laboratory issues (including infrastructure, e.g., utilities, space; personnel, e.g., numbers and skills; monitoring system for laboratory)? How will the challenge of mixed infections be addressed? What are the safety issues? How will the results be interpreted and standardised?
Layer 4 Scale-up analysis	What are the obstacles to the rollout? What are the human resource and training requirements for full national scale-up?
Layer 5 Policy analysis	How does LPA compare with conventional 'old' methods vs. other new methods that may be available in the short to medium term? How does LPA interface with other existing and new diagnostics that will be recommended and implemented in the future (e.g., GeneXpert)?[34] Should routine drug susceptibility testing be completely dropped and replaced by LPA?

IAF = impact assessment framework; LPA = line-probe assay.

The central methodology that we advocate to feed robust evidence into Layers 1–3 is the prospective randomised controlled trial (RCT). This design permits comparison between the existing technology and approach (control) and the new (intervention), as follows:

For Layer 1, a comparison of effects on 1) numbers of patients achieving important outcomes (including diagnosis, start of treatment and treatment completion), and 2) time to achieving these outcomes.

For Layer 2, a comparison of effects on different patient sub-groups (e.g., poor vs. less poor, adults vs. children). Equity may be assessed based on outcome indicators among different groups, in terms of morbidity or mortality measures, or process indicators such

as health service use.[30] Analysis of socio-economic status may use asset-based measures to define different socio-economic groups.[35] Demographic and health surveys and more recent TB prevalence surveys are increasingly using these methods.[36,37]

For Layer 3, a comparison of the health system inputs is required. Data for this may be gained through economic analyses of standard vs. new diagnostic interventions, focusing on the health system and not just the tool, and through interviews with health systems personnel.

Data for these comparisons can be obtained across all study participants in both intervention and control arms, or through nested sub-studies on more limited numbers. For example, in-depth qualitative and quantitative research on patient costs incurred during a diagnostic process (either control or intervention) is time consuming, and data are thus only collected for a subgroup of study participants. Data from Layers 1–3 can then be fed into the modelling and other methodologies required in Layers 4 and 5.

We recognise that the type of randomised trial employed will depend on the stage of diagnostic development to which the IAF is being applied. During demonstration studies (which may be conducted prior to STAG-TB approval), an explanatory RCT with well-controlled study conditions and data collection instruments is appropriate. During subsequent implementation or operational research, a pragmatic RCT (PRCT) approach using existing health system data will be more suitable (for a fuller description of the difference between explanatory and pragmatic RCTs see Zwarenstein et al.[38]) There are concerns that RCT designs deny some patients (those in the control arm) the assumed benefits of a new technology —especially in the implementation research of STAG-approved technologies. Such ethical concerns need to be addressed, for example by ensuring that the PRCT includes a scale-up plan, such as through a step wedged approach in which all sites access the technology, but in a phased manner, to allow for comparisons between those with and those without the technology.

NEXT STEPS AND OVERCOMING CHALLENGES TO USING THE IMPACT ASSESSMENT FRAMEWORK

The framework will continue to be revised as experience in using it for research design and implementation continues. It will have value for other diagnostics tools and also for drugs and vaccines. The research methodologies for addressing each of the different layers are under constant development. As the multidisciplinary research teams needed to implement these methodologies are currently uncommon in many countries, capacity building involving training, mentoring and partnership between service delivery programmes, academic organisations and patient organisations will be required. The increased focus on patient-centred outcomes in particular will provide opportunities for patient representatives and organisations to become more engaged in the research process. If patient groups are empowered to collect and analyse relevant data—particularly in Layer 2—it will give them a greater voice in policy decision-making at the national and international levels.

When it was originally developed, the IAF was envisaged as being applicable to single new tests. However, as we move further into implementation research it is clear that it will also need to be applied to packages of tests, or combinations of existing and novel tests, along with all the additional inputs required to introduce such packages and combinations in different algorithms; this challenge is currently being addressed under the TREAT TB initiative.

The questions in the different layers of the IAF do not all necessarily carry equal weight in any given circumstance. For example, a new test for detecting drug resistance that is best suited for deployment in a central reference laboratory may be more important in monitoring drug resistance patterns than in directly improving patient access. The questions about which patient group or type of patient benefits (Layer 2) may then assume lesser importance, whereas these may be key research questions in a diagnostic approach or test that is aimed at 'point of care'.

We also recognise that while the IAF provides a body of evidence for policy makers, evidence alone is often not the only driver of policy change; process, context and sometimes subjective factors, for example expert or political opinion, can also play a substantial role. These factors need clearer and more systematic documentation and analysis in the process of implementation research. This is the subject of a forthcoming study by Bissell et al.

There are concerns that accumulating a comprehensive evidence base such as the one we advocate here will take too long and be too costly; rather than promoting the rational uptake of new technologies, it will instead impede the introduction of much needed innovations. Such concerns are valid, but they must be balanced against the dangers of the premature introduction of tools into unprepared and under-resourced health systems, often as a result of lobbying or forceful marketing. To counter both sides of this argument, research and implementation partners need to come together and collaborate on an unprecedented scale, and with a renewed sense of urgency. By directly addressing the concerns of policy makers through the research process, the adoption and implementation of new tools should be achieved more rapidly, sustainably and with beneficial effects for affected populations.

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RÉSUMÉ

La nécessité d'une base de preuves solide et complète pour servir à la prise de décisions en ce qui concerne la mise en œuvre d'outils de diagnostic et d'approches nouvelles et améliorées a été soulignée par un certain nombre de responsables ; parmi ceux-ci, des membres du groupe de travail sur les nouveaux outils diagnostiques New Diagnostics Working Group (NDWG) et du sous-groupe pour l'introduction d'approches et d'outils nouveaux (Subgroup for Introducing New Approaches and Tools) du Partenariat Stop TB. Afin de rassembler ces évidences de manière systématique, nous avons élaboré un réseau d'évaluation d'impacts (IAF) qui fait le lien entre apports et résultats finaux.

L'IAF comporte cinq couches interconnectées : analyse d'efficience, analyse d'équité, analyse des systèmes de santé, analyse de l'extension et analyse de la politique. Il peut être utilisé par ceux qui élaborent de nouvelles techniques de diagnostic et par d'autres équipes de recherche intéressées à rassembler autant de données possibles en rapport avec la politique à suivre avant, pendant et après la phase de démonstration de l'élaboration de l'outil. Les évidences rassemblées peuvent être utilisées par les décideurs politiques internationaux et nationaux pour soutenir des décisions d'adoption, de mise en œuvre et d'extension. L'initiative TREAT TB (Technologie, Recherche, Education et Assistance Technique) utilise l'IAF dans sa recherche opérationnelle et dans ses évaluations sur terrain des nouveaux outils et des nouvelles approches du diagnostic de la tuberculose ; l'IAF a été incorporé dans la publication récente du NDWG : « Pathways to better diagnostics for tuberculosis: a blueprint for the development of TB diagnostics ». Cet article décrit l'IAF et les processus employés pour son amélioration et suggère les étapes ultérieures pour surmonter les défis que comporte sa mise en œuvre.

RESUMEN

Varios interesados directos, entre ellos el Grupo de Trabajo sobre Nuevos Diagnósticos (NDWG) y el subgrupo de introducción de nuevos enfoques e instrumentos de la Alianza Alto a la Tuberculosis, han destacado la necesidad de contar con una base de datos científicos sólida y exhaustiva, a fin de respaldar la toma de decisiones relacionadas con la introducción de nuevos enfoques e instrumentos perfeccionados de diagnóstico. Con el objeto de recoger estos datos de manera sistemática, se ha diseñado un marco de evaluación del impacto (IAF), que vincula los datos aportados con los resultados obtenidos.

El marco de evaluación del impacto comporta cinco estratos interconectados: el análisis de eficacia, el análisis de equidad, el análisis de los sistemas de salud, el análisis de la ampliación de escala y el análisis de las políticas. Este marco pueden usarlo los creadores de nuevos métodos diagnósticos y otros grupos científicos interesados, durante el desarrollo de un nuevo instrumento con el fin de recoger la máxima cantidad de datos pertinentes a las políticas, antes de la fase de demostración, durante la misma o después de ella. Los datos científicos recogidos pueden ser útiles a los encargados de definir las políticas a escala nacional o internacional, a fin de respaldar las decisiones de adopción, ejecución o ampliación de escala. En la iniciativa TREAT TB (Tecnología, Investigación, Educación y Asistencia Técnica para la Tuberculosis) se aplica el IAF en las evaluaciones de la investigación operativa y de terreno de los nuevos instrumentos y estrategias utilizados en el diagnóstico de la tuberculosis. También se ha incorporado en la publicación reciente del NDWG: 'Pathways to better diagnostics for tuberculosis: a blueprint for the development of TB diagnostics' (Estrategias encaminadas a mejorar los métodos diagnósticos de la tuberculosis: un plan de acción para el desarrollo de medios diagnósticos). En el presente artículo se describe el IAF y los mecanismos que permiten mejorarlo y se sugieren nuevos pasos que contribuyan a superar las dificultades que plantea su ejecución.

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Making innovations accessible to the poor through implementation research

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SUMMARY

Within countries, poorer populations have greater health needs and less access to good medical care than better-off populations. This is particularly true for tuberculosis (TB), the archetypal disease of poverty. Innovations also tend to become available to better-off populations well before they become available to those who need them the most. In a new era of innovations for TB diagnosis and treatment, it is increasingly important not only to be sure that these innovations *can* work in terms of accuracy and efficacy, but also that they *will* work, especially for the poor. We argue that after an innovation or a group of innovations has been endorsed, based on demonstrated accuracy and/or efficacy, introduction into routine practice should proceed through implementation by research. Cluster-randomised pragmatic trials are suited to this approach, and permit the prospective collection of evidence needed for full impact assessment according to a previously published framework. The novel approach of linking transmission modelling with operational modelling provides a methodology for expanding and enhancing the range of evidence, and can be used alongside evidence from pragmatic implementation trials. This evidence from routine practice should then be used to ensure that innovations in TB control are used for positive action for all, and particularly the poor.

KEY WORDS: poverty; tuberculosis; innovation; research; access

DESPITE RECOGNITION of the importance of social determinants as drivers of the tuberculosis (TB) pandemic,[1] the core medical approach to TB control remains as it has been for 30 years. It still rests on the identification of TB cases and then reducing their morbidity, mortality and infectiousness to others by treatment with combination chemotherapy. This approach is now entering a new era, with well-validated new tools for identifying and treating patients. These new tools are either new technologies or drugs, or new approaches. If the latter, these may use novel combinations of existing technologies or drugs, modifications of existing tools, or combinations of all of these. These innovations are extremely welcome, but individual countries and clinics now have to make decisions about which innovations to take forward, when and where to implement them, and how to fund and sustain them. The World Health Organization (WHO) plays an important role in guiding this decision-making process by endorsing innovations that reach

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Table 1 Factors used in the GRADE statements for evidence-based recommendations

	A Factors that are consistently synthesised and reported in systematic reviews and meta-analyses (mostly based on explanatory studies)	B Factors that are rarely synthesised and reported in systematic reviews and meta-analyses (can be collected from pragmatic implementation by research)
Quality of evidence (may be categorised as 'high', 'moderate', 'low' or 'very low' as a result of consideration of these factors)	Study design Methodological quality Inconsistency Imprecision Publication bias	Directness of evidence (patient-important outcomes and generalisability)
Strength of recommendation (may be categorised as 'strong' or 'conditional' as a result of consideration of these factors)	Quality of evidence	Balance between desirable and undesirable effects Values and preferences Costs

GRADE = grading of recommendations assessment, development and evaluation.

certain standards through the recommendations from the Strategic and Technical Advisory Group for Tuberculosis (STAG-TB)[2] based on the reports of carefully constituted expert advisory groups. Examples of innovations that have recently been supported by STAG-TB include same-day diagnosis (front-loading*), light-emitting diode fluorescence microscopy in 2009,[3] and the Xpert® MTB/RIF assay, performed using the GeneXpert® System (Cepheid, Sunnyvale, CA, USA) in 2010.[4] STAG-TB can also give negative recommendations, as it did in 2010 in the case of commercial TB serodiagnostic tests, making it clear that they should not be used in individuals with suspected active pulmonary or extra-pulmonary TB, irrespective of human immunodeficiency virus (HIV) status.[4]

In 2009, the WHO adopted the GRADE (grading of recommendations assessment, development and evaluation) approach[5] for the synthesis of evidence to inform the formulation of guidelines and recommendations. GRADE provides a summary statement about the quality of the evidence and a separate statement about the strength of the recommendation based on a series of criteria (Table 1). To date, the bulk of the evidence considered by STAG-TB has been presented in the form of systematic reviews of accuracy or efficacy data. These summarise the factors in column A of Table 1 and relate to the quality of evidence about whether innovations *can* work. Expert groups also consider data from implementation studies in column B (including cost and cost-effectiveness), but as yet the methodologies for systematically collecting, synthesising and presenting this evidence are not well developed. An impact assessment framework (IAF) for collating and synthesising evidence of what is required to make innovations work in routine practice has been published previously.[6] The IAF addresses the question 'Will it work?', and by answering that question, it provides an inclusive means of answering two important implementation questions that have been posed before, namely 'Does it work?' and 'Is it worth it'.[7] Evidence collated through the IAF should feed directly into the whole GRADE process, including provision of evidence for the factors in column B of Table 1, which are used in formulating the strength of a recommendation.

The best means of obtaining and using evidence about whether innovations *will* work has been the subject of debate in many fora.[8] The need for work in this area has been particularly highlighted by the Introducing New Approaches and Tools Subgroup[9] (and its predecessor, the Re-Tooling Task Force), as well as the New Diagnostics Working Group[10] of the Stop TB Partnership. The Bill & Melinda Gates Foundation hosted a meeting on this topic, termed 'Evidence for scale-up', in December 2010, with specific reference to molecular TB diagnostics, from which a viewpoint publication is in preparation. We propose the concept of 'implementation by research' as an approach for filling the gap in the evidence base for scale-up. We argue that such an approach is essential to ensure that innovations in TB control are used for practical and positive action for all, and especially the poor.

THE PROBLEM OF REACHING POORER POPULATIONS WITH INNOVATIONS IN TB CARE AND CONTROL: THE 'INVERSE CARE LAW'

A key problem for any health service provision or intervention is a universal phenomenon known as the 'inverse care law', which was originally described in 1971 and states that 'the availability of good medical care tends to vary inversely with the need for the population served'.[11] Innovations are important components of good medical care, and we argue that they are subject to the same law. Need, in this discourse, is closely related to and determined by poverty: poorer populations within any country have greater health

*'Front-loading', or 'same-day diagnosis', refers to consecutive sputum specimens from the same patient being examined, and results provided to the health facility, on the same day.

needs and less access to good medical care than better-off populations. This is particularly true for TB, the archetypal disease of poverty. First, TB transmission is facilitated in overcrowded, poorly ventilated living conditions, the very conditions associated with poverty.[12] Although it is intuitive, therefore, that TB prevalence is higher in poorer populations, and that most TB patients are poor, hard evidence to prove this association has mainly come from industrialised countries.[13] The recent conduct of wide-scale TB prevalence surveys in developing countries has begun to produce additional evidence that even within poorer countries, TB can be more than twice as prevalent in households within the lowest quintile of household expenditure compared with households in the highest quintile.[14] Even in less developed countries, the poor face barriers that affect them more than others[15] as they proceed along the pathway to TB care.[16] For these reasons, it is imperative to ensure not only that innovations will work in general populations, but also that they will work for the poor.

LIMITATIONS OF CURRENT EVIDENCE FOR UPTAKE AND IMPLEMENTATION OF INNOVATIONS

There has been progress in recent decades in reaching consensus that normative guidelines for health care interventions should be 'evidence-based'. Systematic reviews and evidence synthesis are required before innovations—be they new drug regimens,[17] diagnostic approaches[18] or diagnostic tools[19]—are endorsed internationally for TB control. The GRADE system is now used by the WHO in formulating guidelines and recommendations.[5] This brings welcome transparency and rigour to the decision-making process. The evidence that is assessed for these guidelines and endorsements generally comes from efficacy or demonstration studies (i.e., evidence that a given innovation *can* work) and would usefully be completed with systematically synthesised empirical evidence of effectiveness demonstrating that a given innovation *will* work.

The WHO endorsement is clearly not always required for innovations to be taken up and implemented at country level, but the consequences of implementing innovations that have not been independently scrutinised for accuracy or efficacy can be serious. A good example of this is the commercial serodiagnostic tests for TB. At least 10 different products have been widely marketed and used in South-East Asia for the past decade or more, without WHO endorsement. They do not meet international standards of accuracy,[20] so at best patients or health systems will have been paying for them, but with neither benefit nor harm. At worst, patients who have falsely been diagnosed with TB will have been exposed to the risks of TB treatment without benefit, while those given false-negative results may have been delayed in starting lifesaving TB treatment, or even denied it completely. This has now been recognised by STAG-TB in the 2010 negative endorsement of commercial serodiagnostics for TB.[4]

Once WHO endorsement has been achieved, it is not clear how adoption or implementation should proceed at country level, nor what further evidence, if any, should be collected during implementation. In some instances, implementation will be at the mercy of market forces, health system constraints, lobby groups and strong expert opinions. An example of this is liquid culture for *Mycobacterium tuberculosis*. In 2007, STAG-TB recommended that the WHO assist countries such that liquid culture and drug susceptibility testing could be implemented in National Reference Laboratories. Cost, human resource constraints and other factors have meant that many poorer countries have failed to establish and sustain liquid culture facilities that are accessible to the poorer sections of their societies.[21] In the best instances, a public health system may make a considered decision to phase in a new innovation, but even in these cases, the tendency is to implement it first in facilities where success is more likely. For example, if an innovation is dependent on an uninterrupted electricity supply in a country where mains power is unreliable, then the innovation will usually first be deployed in facilities that have the resources to install, maintain and fuel a back-up generator. In turn, such facilities tend to be situated in urban areas and may serve better-off populations. Implementation tends, therefore, to start in urban areas or larger, better-resourced facilities. The lessons learned from this implementation are not relevant for implementation in less accessible locations, be they rural areas or difficult slum areas in large cities. The result is that the hoped-for extension of implementation for the benefit of poorer populations tends not to extend as planned.

There is an additional issue to consider with the 'phasing in' of innovations in public health systems. 'Phasing in' can be accompanied by lesson learning, which helps in making decisions about discrete process issues associated with implementation, such as numbers of staff required or changes to procurement and distribution procedures. Evidence from such lesson learning is clearly helpful; it should not, however, be misconstrued as hard evidence of programmatic effectiveness.

IMPLEMENTATION BY RESEARCH AS A POTENTIAL SOLUTION—CONCEPTS AND DESIGNS

Documentation of programmatic effectiveness during implementation of an innovation requires a comparator. The usual course of action is to compare baseline with post-innovation data in a 'before-and-after' analysis. Such analyses provide weak evidence

even when a formal, clustered design is chosen (see below). Most 'before-and-after' comparisons in implementation proceed without consideration of clusters or effect size, and use monitoring and evaluation to draw conclusions about effectiveness. An additional problem with such an approach is that it will tend to produce positive results; initial implementation is deliberately selected to take place in optimal sites. Once initial 'phasing-in' has taken place, further scaling up then proceeds as a matter of course, and the option of halting an inappropriate scale-up may not be considered.

A more rational approach is to make an a priori decision to implement by programmatic research employing a very pragmatic trial approach.[22] Instead of implementing by selecting sites for early implementation according to likelihood of success, sites can be chosen by a formally randomised process in a prospective cluster-randomised design.[23] If an explicit goal is to ensure access to the innovation by poorer populations, then the sites for randomisation could be selected because they already serve these populations. For example, only sites serving the rural poor could be included in the randomisation, some receiving the innovation and others acting as comparators (see below). Using this approach, outcome measures can be chosen prospectively, formal sample size calculations can be undertaken based on expected size of effect and robust, unbiased evidence on whether an innovation actually will work under routine conditions can be generated. Sites continuing to deliver services using existing approaches and technologies can provide the comparator information, or an alternative innovation could be implemented in the comparator sites to facilitate decisions on which of two (or more) potentially suitable options should be taken to scale.

The concept of pragmatic, randomised controlled trials (RCTs) has been developed in detail in recent years. They differ from explanatory RCTs in that they focus on effectiveness (does the intervention work when used in the real world, i.e., under routine normal practice?) rather than on efficacy (does the intervention work in ideal and fully controlled conditions?). Pragmatic RCTs are more suited to operational research and provide an opportunity to answer a broader range of questions than explanatory trials. It must be recognised that there is a spectrum of trial type, with pure pragmatic trials at one end of the spectrum and pure explanatory trials at the other. Quality criteria are well developed and documented for the conduct and reporting of randomised controlled trials in the CONSORT (Consolidated Standards of Reporting Trials) statement.[24,25] An addendum to the CONSORT statement to improve the quality of pragmatic RCT has also been published.[26] This includes a table describing the key differences between explanatory and pragmatic trials (summarised in Table 2).

Table 2 Key differences between explanatory and pragmatic trials

	Explanatory	Pragmatic
Question	Efficacy: does the intervention work?	Effectiveness: does the intervention work when used in normal practice?
Setting	Well-resourced, rigorously controlled conditions	Normal clinical or public health practice
Participants	Selected. Participants who are poorly adherent are either considered as having a negative outcome or are not assessed	Little or no selection
Intervention	Strictly enforced and adherence is closely monitored	Applied flexibly within the requirements of normal practice
Outcomes	Often short-term surrogates or process measures	Directly relevant to participants, funders, communities and health care practitioners
Relevance to practice	Indirect: little effort made to match trial to decision-making needs of those in the usual setting in which the intervention will be applied	Direct: designed to meet the needs of those making decisions about intervention options in the setting in which the intervention will be implemented

Options for units of randomisation in pragmatic RCTs

Randomisation is arguably the most important element of a pragmatic RCT. Conventionally, individuals are allocated to study groups through a random process to prevent bias in the selection of group members. However, it may not be possible or even desirable to randomise individuals (e.g., if the intervention is to be delivered to entire communities), in which case groups (clusters) of individuals are randomised. A cluster can be defined in various ways to suit the design of the particular study in question. Examples include:

1 Administrative districts: one cluster = all patients attending health services within a given health district
2 Enumeration area: one cluster = all individuals in a census enumeration area
3 Health units: one cluster = all patients attending a given health unit, be it a health centre or a hospital —as defined by the study needs
4 Households: one cluster = all individuals in a household
5 Time-defined: one cluster = all patients attending during a defined time period, e.g., 1 week, 2 weeks, 1 month or several months—this is usually used when an intervention is applied to all health unit attendees for a given time period, and then swapped back to the comparator intervention (so-called 'week-on, week-off' or 'month-on, month-off').

Cluster-randomised designs permit the capture of health system effects (both direct and indirect), and often make use of routinely collected data.

Options for comparator (control) arm allocation in clustered designs

The comparative clustered designs are illustrated in the Figure, and are described below.

A Before-and-after design: This design does not include a comparator group separate from the innovation group. For all participants in this design, data on the outcome measures are collected over a baseline (pre-innovation) time period, the innovation is then introduced, and finally, data on the outcome measures are collected over a follow-up (post-innovation) time period.

In the absence of any other option, this design can provide important information about the possible effectiveness of an innovation. However, the absence of a contemporary comparator group means that any difference found between the pre- and post-innovation study periods could be due to factors other than the innovation; the interpretation of the results from this design is therefore often problematic. Ideally, the baseline data should be collected prospectively, so that the data collection methods (and hence data quality) are the same in the pre- and post-innovation study periods. Most commonly, however, historical control data (data that have already been collected for other purposes) are used as the baseline, and only the post-innovation data are collected prospectively. This further weakens the validity of the final comparison.

This is the weakest of the interventional designs, but the most commonly used in operational or implementation research, usually without any formal consideration of clusters. The following designs all include contemporary comparator arms and are amenable to randomisation, so the innovation effects detected are more robust.

B Parallel groups design: Clusters are randomly allocated to the innovation and comparator groups concurrently, and data collection on the outcome measures occurs in both groups concurrently.

This gives a direct comparison of the innovation and comparator groups. Clusters can be matched in pairs for important characteristics (e.g., sex distribution, population size, average distance of residents from a health facility) and randomised within these pairs.

C Cross-over design: Clusters are initially randomly allocated to the innovation and comparator groups concurrently, and data collection on the outcome measures occurs in both groups concurrently over an initial study period. At the end of this period, all participants cross over to the other arm, and data collection on the outcome measures continues in both groups concurrently over a second study period of equal time interval.

In such designs, within-cluster evaluation allows a more precise evaluation of the effect of the innovation, and this design therefore usually requires fewer participants (and fewer clusters) than a parallel groups design; however, a longer time duration is needed to complete the study. There may also be important considerations for a wash-out time at the cross-over point, so that any effects that occur in the first study period do not carry over into (contaminate) the second study period. In addition to the wash-out consideration, knowledge on how the innovation works is necessary; if the time intervals of switching the intervention are short, then the intervention may either not have adequate time to take effect or it may result in an inaccurate estimate of the effect. This design is better suited to innovations with a short-term effect.

D Stepped-wedge design:[27] Also known as a dynamic wait-listed, delayed or phased intervention, this is an important and ingenious modification of the cross-over design, and is particularly useful in situations where the only other alternative is the before-and-after study design. This pragmatic RCT design makes use of an implementation plan where an innovation is introduced to some areas or health facilities before others over time. The sequence by which these areas or facilities implement the

A

Cluster	Pre-innovation study period →	Post-innovation study period →
1	Control	Innovation
2	Control	Innovation

B

Cluster	Study period →
1	Innovation
2	Innovation
3	Control
4	Control

C

Cluster	Study period →	Study period →
1	Innovation	Control
2	Innovation	Control
3	Control	Innovation
4	Control	Innovation

D

Cluster	Study period →				
	1	2	3	4	5
1	Control	Innovation	Innovation	Innovation	Innovation
2	Control	Control	Innovation	Innovation	Innovation
3	Control	Control	Control	Innovation	Innovation
4	Control	Control	Control	Control	Innovation

Figure Illustration of different cluster-randomised trial designs with concurrent innovation and comparator arms: **A**) before and after; **B**) parallel groups; **C**) cross-over; **D**) stepped-wedge.

innovation is randomised. Comparisons are then made over time between those areas or facilities receiving the innovation and those not yet receiving it.

As this is essentially a cross-over design where clusters act as their own comparator, the stepped-wedge design also generally requires fewer clusters than a parallel groups design, but requires more time to complete. The unidirectional switch from comparator to innovation may not permit the full within-cluster comparisons that can be employed in standard cross-over designs. It has the advantage of phasing-in an innovation over time, as would happen with uncontrolled or non-randomised implementation, so no study areas are deprived of a new innovation if this proves to have an added value. This can remove ethical concerns about withholding the innovation from some clusters, as can be the case with parallel designs. On the other hand, it is difficult to interrupt or stop a step-wedge design in the event of evidence accumulating that the innovation is either not useful or is actually harmful. Such evidence may be available at an interim analysis and may be difficult to communicate to the clusters that have not yet received the innovation, but are expecting to do so.

EXAMPLES OF IMPLEMENTATION BY RESEARCH

Several examples of health system innovations have been tested under programmatic conditions using cluster-randomised pragmatic RCTs, including prospective assessments of the effectiveness of different strategies to promote adherence to TB treatment,[28–30] assessment of the effect of educational outreach to nurses on TB case finding and primary care of respiratory illness[31] and active case finding.[32] A recent systematic review of operational research, concerning WHO-endorsed interventions, concluded that prospective comparative study designs have been underused to date, and calls for increased use of such designs in the manner proposed here (F Cobelens and C Lienhardt, WHO Stop TB Department, personal communication).

THE USE OF IMPLEMENTATION BY RESEARCH TO PROMOTE MORE EVIDENCE-BASED UPTAKE OF INNOVATIONS

If implementation of innovations by research proceeds through pragmatic RCTs as a matter of course in several countries in different settings, then it will be possible to add more evidence about true effectiveness in routine settings to existing evidence on efficacy. Such evidence about whether innovations will work, along with more precise evidence about what resources are required for them to work, will be invaluable for future policy decisions about uptake and implementation. Evidence is needed from different settings that innovations will work under routine circumstances. For example, an innovation for multidrug-resistant TB (MDR-TB) that is costly or complex to implement may be suited to settings where MDR-TB is the dominant TB epidemiology, such as the Eastern Baltic states, but it may not be at all suited to the resource-constrained settings of many countries in sub-Saharan Africa, where TB-HIV, and not MDR-TB, is the dominant TB epidemiology.

INCREASING THE POLICY AND PRACTICE RELEVANCE OF INFORMATION FROM IMPLEMENTATION BY RESEARCH—THE ROLE OF THE IMPACT ASSESSMENT FRAMEWORK

As indicated in the introduction, providing evidence that an innovation will work is necessary, but not sufficient, for TB control. It is necessary to demonstrate that it will work for poorer populations who would otherwise be disadvantaged by the workings of the inverse care law. This requires more than the primary analyses of pragmatic effectiveness made possible by the implementation by research designs outlined above. The kinds of additional questions that need answering are outlined in Layer 2 (equity analysis) and Layer 3 (health system analysis) of the recently published IAF (Table 3).[6]

Placing patient experiences of innovations in provision of TB care at the heart of implementation research using equity analysis (Layer 2) is currently the exception rather than the rule. These experiences can be usefully expressed in terms of the costs incurred in care seeking relative to ability to pay (i.e., relative to wealth quintiles, income measures or assets). Data for these analyses may be collected on a randomly selected subset of patients within pragmatic,

Table 3 Layers of the impact assessment framework requiring primary research

Layer of assessment	Kinds of questions being addressed for the innovation
Layer 1: Effectiveness analysis	How many additional cases will actually start treatment/achieve cure/avoid death as a result of the innovation? What will be the impact on the time to starting treatment/achieving cure?
Layer 2: Equity analysis	How effective is the innovation for poorer populations? What costs will patients face in accessing the innovation?
Layer 3: Health system analysis	What is the effectiveness and/or efficiency from a health system perspective? What quality assurance mechanisms need to be in place? What information systems need to be in place? What are the human resource requirements in the health system? What are the infrastructure (utilities, space) implications?

cluster-randomised implementation trials, using a validated patient costing tool.[33] Additional means of capturing and expressing these experiences, perhaps through qualitative research, are urgently needed.

In Layer 3, health economic analyses can be added to pragmatic, cluster-randomised implementation trials;[34] greater accuracy is possible where the units of randomisation correspond to budgetary or cost centres and where costs of implementation are collected prospectively.[35] Integral cost centres usually correspond to administrative units such as health districts or whole hospitals, and these constitute large clusters. In cluster-randomised trials, large numbers of small clusters give greater statistical power to detect effect sizes in parallel group designs[36] and stepped wedge designs,[37] so randomising by large units such as districts brings two challenges. First, randomising large units usually results in having fewer units available for comparison, leading to low study power.[38] Second, implementation of innovation activities in a large cluster will usually require greater cost and time than implementation of the same innovation in a small cluster. If adequate numbers of large units are to be included, then the overall scale and cost of conducting this kind of implementation research can be high. There are, however, pay-offs to consider. More purist, cluster-randomised implementation studies that demonstrate effectiveness (see Layer 1 of the IAF, Table 3) using large numbers of small clusters may provide little information on the true economic costs or real-life implementation challenges of the innovation. More pragmatic, cluster-randomised implementation studies based on smaller numbers of larger clusters may only detect large effect sizes, but may provide valuable cost and cost-effectiveness data for health policy makers.

Adding health system and equity analyses to cluster-randomised trials of effectiveness not only requires relatively larger cluster sizes, it also makes cluster randomisation by multiple short blocks of time less feasible. While this may be a useful approach for primary effectiveness analysis (Layer 1), it makes health system and equity analysis much more complex. Assigning costs associated with implementing an innovation to different blocks of time is difficult. Furthermore, patient pathways through diagnosis and treatment need time to become established with the introduction of an innovative change, and costs incurred by patients along these pathways cannot be representative of actual pathways if the diagnostic and treatment algorithms are continually switching between types of provision.

SYNTHESISING A BROADER EVIDENCE BASE FOR INNOVATIONS—THE ROLE OF OPERATIONAL MODELLING

Primary implementation research is essential for the promotion of evidence-based innovations, but cannot always be carried out in every country and for every innovation to inform local policy on uptake and scale-up. Furthermore, as new, well validated diagnostic and therapeutic tools for TB become available, a bewildering array of possible placements of these tools within different health system algorithms becomes possible. Not all of these placements can be individually tested by implementation research.

Linking operational modelling with transmission modelling provides a mechanism whereby a range of implementation research data (e.g., across all three Layers 1–3 of the IAF) can be brought together to inform policy and practice decisions.[39] Furthermore, it provides a rapid and efficient means of virtual testing of different combinations of innovations to project their potential impact, reducing the need for costly, large-scale primary research. Ideal characteristics of modelling for health systems are outlined in Table 4.

Operational modelling can be used at various stages of the decision-making process. For example, with data from efficacy studies and initial field trials, modelling can be used to assist in defining the pragmatic RCTs and combinations of innovations that should be tested in a given context and in providing initial estimates of their expected impact. Data from pragmatic RCTs can then be used to model the impact of scale-up, including health system and patient costs, as well as patient and population outcomes. At a detailed level, modelling can assist in understanding the effects of additional resources (e.g., technicians)

Table 4 Important qualities for a high-utility modelling approach for health systems

Quality	Description
Stochastic	Ability to model uncertainty based on user-defined and statistical probability distributions, e.g., patient arrivals, power outages and default probabilities
Comprehensive	Covers all key aspects of the health system being modelled so patient, health system and population effects can be reported
Accurate	Driven by data collected from the specific locations being modelled and validated against current performance
Links key factors	Models the potentially complex interactions between and within the operational and population factors that are specific to particular contexts and can affect outcomes in a significant way
Easy to change	Easily and quickly reconfigurable for different diagnostic tools and algorithms. Adjustable to model different contexts with different patient demands and treatment pathways. 'What if' scenarios quickly and interactively testable
Understandable	Presents a realistic schematic image of the health system being modelled that aids understanding and provides policy makers with confidence in the model accuracy, its outputs and validity
Powerful	Sufficient processing power to run the models over a 3–4 year outcome period

or equipment (e.g., microscopes or GeneXpert modules), and also enables the complex interactions at district and central level within a health system to be explored and understood prior to investment. One further use may be as an adjunct to pragmatic RCTs that of necessity have to work with large numbers of small clusters. As described above, such RCTs may result in accurate estimates of overall effect size but limited estimates of patient or health system costs. Operational modelling could be used to project health system and patient costs if the innovation were to be fully implemented within larger administrative districts or within full scale-up.

Feasibility of implementation by research

At first sight, the approach we advocate appears to require more time and cost than rolling out innovations without collating evidence in an organised fashion. However, this is not necessarily the case; initial roll-out often proceeds in phases along a similar time scale to the one required in a step-wedge pragmatic RCT. Nonetheless, it may be unrealistic to expect all countries to use prospective implementation by research with RCT designs before proceeding with implementation. It is usually quicker and cheaper to add more circumscribed operational research questions to implementation. In such instances, we suggest the use of the IAF to frame these questions, and we recommend explicit recognition of the limitations of the results that emerge when the comparator data have not been obtained through a prospective, concurrent, randomised process. Prospective, comparative, cluster-randomised pragmatic RCTs (implementation by research) of innovations should proceed in some countries in each of the major regions that are characterised by different, dominant TB epidemiologies (HIV, MDR-TB, extensively drug-resistant TB, high-burden, low-burden). Evidence from such countries can then be synthesised along with evidence from more circumscribed, descriptive operational research from other countries. This should then facilitate evidence-based implementation decisions in countries where implementation by research has not been possible. Modelling can help in this respect.

Our approach should, in the long term, save the time and cost that can be wasted on unplanned implementation that lacks evidence on effectiveness.

CONCLUSIONS

Implementation by research using pragmatic RCTs, which collect a broad range of evidence, should become the norm for innovations whose efficacy and/or accuracy has been validated. Linking operational with transmission modelling should be used alongside these trials to provide evidence that can usefully guide large scale-up decisions on innovations, ensuring that they work under field conditions, especially for the poor.

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RÉSUMÉ

Au sein des pays, les populations plus pauvres rencontrent des besoins de santé plus importants et ont moins d'accès à des soins médicaux de qualité que les populations plus favorisées. Ceci est particulièrement vrai pour la tuberculose (TB), une maladie archétypale de la pauvreté. Parallèlement, les innovations tendent à devenir accessibles aux populations plus favorisées bien avant de l'être à celles qui en ont le plus besoin. Dans une nouvelle ère d'innovations en matière de diagnostic et de traitement de la TB, il est de plus en plus important non seulement d'être sûr que ces innovations sont capables d'être performantes en termes de précision et d'efficacité, mais aussi qu'elles pourront être utilisées, particulièrement par les pauvres. Nous argumentons qu'après qu'une innovation ou un groupe d'innovations ait été approuvé sur base de la démonstration de sa précision et/ou de son efficacité, son introduction dans la pratique de routine devrait se faire via une mise en œuvre par la recherche. Pour cette approche, des essais pragmatiques à randomisation par grappes sont adéquats et permettent la collecte prospective des évidences nécessaires à l'évaluation complète de l'impact en se tenant à un canevas publié antérieurement. La nouvelle approche de liaison de la modélisation de la transmission avec la modélisation opérationnelle constitue une méthodologie qui permet d'étendre et de renforcer la marge de preuves et peut être utilisée en même temps que les preuves concernant les essais pragmatiques de mise en œuvre. Cette évidence en provenance de la pratique de routine devrait être utilisée pour s'assurer que les innovations en matière de lutte contre la TB sont utilisées avec un effet favorable pour tous, et particulièrement pour les pauvres.

RESUMEN

En todos los países, las poblaciones más pobres tienen grandes necesidades de salud y cuentan con menos acceso a la atención médica de buena calidad que las poblaciones en mejor situación económica. Esta afirmación se confirma particularmente con relación a la tuberculosis (TB), que es la enfermedad prototipo de la pobreza. De igual manera, las innovaciones tienden a llegar a las poblaciones solventes mucho antes de estar al alcance de quienes más las necesitan. En una nueva era de progresos en el diagnóstico y el tratamiento de la TB, cada vez cobra mayor importancia, no solo procurar que estos avances se puedan aplicar dada su precisión y eficacia, sino que además serán aplicables especialmente a las poblaciones pobres. Se propone que después de haber aprobado una innovación o un grupo de innovaciones con base en la demostración de su precisión y eficacia, su introducción en la práctica corriente debe estar respaldada por la investigación operativa. Los estudios de eficacia real (pragmáticos) en conglomerados y aleatorizados se adaptan bien a este enfoque y facilitan el acopio prospectivo de los datos que contribuirán a la evaluación del impacto global de las medidas, según un marco publicado previamente. El nuevo enfoque que consiste en vincular la modelización de la transmisión con la modelización operativa ofrece un método para acrecentar y fortalecer la amplitud de las pruebas y se puede usar al mismo tiempo que los datos obtenidos con los estudios pragmáticos de implantación. Estos datos provenientes de la práctica corriente se deben usar luego con el fin de procurar que las innovaciones en el control de la TB se apliquen en acciones positivas dirigidas a toda la población, sobre todo a los pobres.

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Analysing policy transfer: perspectives for operational research

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SUMMARY

Policy transfer occurs regularly. In essence, a strategy developed elsewhere is taken up and applied in another policy context. Yet what precisely is policy transfer and, more importantly, under what conditions does it occur? This paper describes policy transfer and addresses three main questions, exploring what perspectives of policy transfer might contribute to operational research (OR) efforts. First, what facilitates the transfer of OR results into policy and practice? Second, what facilitates effective lesson-drawing about OR results and processes between and within countries? And third, what would increase the amount of OR being carried out by low- and middle-income countries and used to inform policy and practice at local and global levels?

Mexico's adoption and adaptation of the DOTS strategy is used here as an example of policy transfer. Policy transfer is relevant to all countries, levels and arenas of people, institutions and organisations involved in health. With a more systematic analysis of learning and policy processes, OR policy and practice outcomes could be improved at all levels, from local to global.

Policy transfer offers theory and concepts for analysing OR from a new perspective. The present paper proposes a model of the policy transfer process for qualitative research use. Comprehensive policy transfer research, given its length, complexity and need for qualitative researchers, should not be envisaged for all OR projects. All OR projects could, however, incorporate some concepts and practical tools inspired from this model. This should help to plan, evaluate and improve OR processes and the resulting changes in policy and practice.

KEY WORDS: policy transfer; learning; lesson drawing; operational research; qualitative

WHEN MEXICO adopted the DOTS strategy in 1995,[1] it took time for the strategy to be accepted by the diverse health care institutions and professions across the country. Many specialist doctors and academics were sceptical, even resistant. Some people saw no need for change, while others preferred to look to the United States, rather than international organisations, for new health policies. A major impetus for the eventual adoption of the DOTS strategy was a joint programme review by the World Health Organization (WHO), the World Bank, Mexico's Ministry of Health (MoH) and its other health institutions. Blunt reporting of weaknesses in the existing programme was not well received by the MoH, but it did serve to catalyse an inter-institutional plan for piloting and implementing DOTS.

This introduces an example of policy transfer.[1] In essence, a strategy developed elsewhere is taken up and applied in another policy context. Policy transfer occurs regularly, and most readers will relate to some elements in Mexico's story. Yet what precisely is policy transfer and, more importantly, under what

Previous articles in this series **Editorial:** Enarson D A. Operational research, a State of the Art series in the *Journal.* Int J Tuberc Lung Dis 2011; 15(1): 3. **No 1:** Lienhardt C, Cobelens F G J. Operational research for improved tuberculosis control: the scope, the needs and the way forward. Int J Tuberc Lung Dis 2011; 15(1): 6–13. **No 2:** Harries A D, Rusen I D, Reid T, et al. The Union and Médecins Sans Frontières approach to operational research. Int J Tuberc Lung Dis 2011; 15(2): 144–154. **No 3:** Rieder H L, Lauritsen J M. Quality assurance of data: ensuring that numbers reflect operational definitions and contain real measurements. Int J Tuberc Lung Dis 2011; 15(3): 296–304. **No 4**: Bratton D J, Nunn A J. Alternative approaches to tuberculosis treatment evaluation: the role of pragmatic trials. Int J Tuberc Lung Dis 2011; 15(4): 440–446. **No 5**: Menzies D. Systematic reviews and meta-analyses. Int J Tuberc Lung Dis 2011; 15(5): 582–593. **No 6**: Mann G H, Thomson R, Jin C, et al. The role of health economics research in implementation research for health systems strengthening. Int J Tuberc Lung Dis 2011; 15(6): 715–721. **No 7**: Squire S B, Ramsay A R C, van den Hof S, et al. Making innovations accessible to the poor through implementation research. Int J Tuberc Lung Dis 2011; 15(7): 862–870. **No 8**: Lin H-H, Langley I, Mwenda R, et al. A modelling framework to support the selection and implementation of new tuberculosis diagnostic tools. Int J Tuberc Lung Dis 2011; 15(8): 996–1004.

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conditions does it occur? The present paper briefly summarises the example of Mexico and DOTS, then describes policy transfer and addresses three questions, exploring what perspectives on policy transfer might contribute to operational research (OR) efforts. First, what facilitates the transfer of OR results into policy and practice? Second, what facilitates effective lesson-drawing about OR results and processes between and within countries? And third, what would increase the amount of OR being carried out by low- and middle-income countries and used to inform policy and practice at local and global levels? The paper then presents a model for analysing policy transfer and discusses its potential practical and research applications.

AN EXAMPLE OF POLICY TRANSFER

The story of DOTS strategy transfer and Mexico assembles insights and lessons that may otherwise go unnoticed.[1] The Mexican National Tuberculosis Programme (NTP) and inter-institutional coordinating group (ICG) re-branded DOTS as TAES (Tratamiento Acortado Estrictamente Supervisado, strictly supervised short-course treatment). They made it into a Mexican strategy and marketed it as an innovation, deliberately focusing on the treatment component to distinguish it from existing guidelines and practices. In practice, DOTS had to be adopted and expanded by each health institution in parallel. Institutional differences were challenging: different organisational cultures, populations served, levels of resources, administrative and financing procedures, information systems and indicators for success, objectives and corporate visions, approach to community outreach. It became clear that achieving a degree of inter-institutional coordination at each level in the country would be fundamental for the expansion of DOTS. The federal model of an ICG began to appear in states and municipalities.

Expansion throughout the country was acknowledged as a challenge, especially as the federal level cannot impose policy on states and municipalities. In addition, the NTP did not have a tradition of countrywide supervision, as tuberculosis (TB) control had been run by specialised services rather than being entrusted to peripheral levels.

Several institutional changes gave DOTS more visibility, credibility and sustainability: DOTS was included in the Basic Package of Health Services; two key Ministry directorates—Epidemiology and Preventive Medicine—were merged; and the Mexico City laboratory was redesigned as a national reference laboratory and included in NTP decision-making. However, despite this progress, and despite significant financial aid from the United States, Mexico was listed by the WHO in 1997 and 1998 as one of the countries that were stalling global progress towards DOTS targets.

Mexico launched a DOTS expansion phase in 1999, backed by a significant increase in political commitment. Under the direct and participative supervision of a Vice-Minister, the MoH's new leadership concentrated on communication, negotiation and reorientation of its strategies to better adapt to a decentralising health system. DOTS components were accompanied by social mobilisation and integrated into a broader vision: 'Tuberculosis-free Mexico'. DOTS was also made part of a new health sector-wide initiative, 'Marching towards Excellence', which reportedly helped secure greater accountability from states and institutions by formalising regular analysis and comparison of data and strategies. Strengthening state-level political commitment and programme performance became a priority. The NTP reinforced the network of state-level TB coordinators, re-naming them 'leaders', increasing training and facilitating joint programme supervision. Mexico's NTP also learnt from and contributed to regional DOTS expansion activities, led by the Pan American Health Organization (PAHO).

POLICY TRANSFER DEFINED

In the literature, 'policy transfer' is about how policies (or programmes, ideas) move from one time and space to another time and space.[2–4] In practice, it incorporates many commonly used concepts: generation and uptake of innovations and new knowledge, research-policy-practice, learning lessons from other countries, policy adoption and adaptation, expansion and scale-up. Policy transfer is about how and why transfer occurs, who learns what from where and from whom, what gets taken up, how things get adapted, how they 'fit' or not when transplanted elsewhere and what influences the different parts of this whole process. A common approach is to analyse what facilitates transfer and what constrains it.

The definition of 'policy' is broad. It does not have to mean a whole new policy; it can be an individual item in a policy, or a programme, plan, strategy, tool, institutional or administrative arrangement, way of working, procedure, norm or principle. We consider all of these to be related to policy, as they are part of how a government, institution or other organisation is choosing to improve their action and reach their goals.

To qualify as 'transfer', first, there needs to be a significant movement of something related to policy from one place to another—it is not about the general diffusion of knowledge among humankind or within organisations. Second, the movement has to have a spatial dimension, not only a temporal dimension, i.e., across space, not just time. Third, it has to be about intentional or action-oriented policy change.[5–8]

Transfer can range from being 'forced' to 'voluntary', with many nuances in between.[9] Forced transfer may result in the application of a policy blueprint

that ultimately fails because it is inappropriate to its new setting. Voluntary uptake is often referred to as learning or lesson drawing.[10] It may help to think of lesson drawing as two phases of learning: learning *about* a policy (what makes it work where it is) and then learning *from* it (what can we take from it and what do we need to do to make it work in our setting).[11] How governments, organisations, people and networks learn is central to policy transfer,[12–21] and the concepts of knowledge creation, transfer and utilisation in policy making are closely related to it.[22–29] Although much of the literature has been about how governments are involved in policy transfer, it is now generally acknowledged that policy transfer can include state and non-state entities and multiple levels in a country, and that global and transnational transfer networks often play a large role in transfer.[5,30–33]

HOW RELEVANT IS POLICY TRANSFER TO OPERATIONAL RESEARCH?

In the health field, OR has been defined as 'research into strategies, interventions, tools or knowledge that can enhance the quality, coverage, effectiveness or performance of the health system or programmes in which the research is being conducted'.[34,35] It aims for changes in policy and practice.[34–36] In policy transfer terms, OR researches an identified problem or area for improvement and produces the type of results that allow people to see whether and/or how a policy or practice should be changed. Its responsibility reaches further than obtaining results or publishing papers; it actively facilitates the process of changing policy and practice. OR might provide evidence for change at national or subnational levels in a country, or inform global guidelines. OR may also be about testing a locally proposed innovation or a strategy recommended by the WHO, or a strategy used in another country or organisation, to see whether and/or how it might work in a new setting. OR may take lessons from TB care, for example, and adapt them for other communicable as well as non-communicable diseases.[37]

OR is thus closely related to policy transfer. Policy transfer analysis could in fact help to enhance OR by answering three important questions. First, what facilitates the transfer of OR results into policy and practice? We need to know how to document, analyse and strengthen this fundamental role of OR. This will be key to evaluating whether increased OR is leading to improved health systems, programmes and services. Researchers can use policy transfer analysis to identify what facilitates and hinders OR results getting into policy and practice. However, we should probably also be integrating some basic tools and concepts from policy transfer into the OR and other routine activities of programmes and organisations, so that a focus on changes in policy and practice becomes an integral part of evaluation and planning.

Second, what facilitates effective lesson drawing about OR results and processes between and within countries? Sharing and comparing OR results can provide evidence of what works in practice and help us avoid re-inventing the wheel or repeating others' mistakes. Mechanisms for international exchanges about OR have existed for decades, for example, through the network constituted by the International Union Against Tuberculosis and Lung Disease from its beginnings.[38] Today, advances in communications technology and strategies, such as online journals, open-access journals, e-newsletters, as well as enhanced understanding and broader participation in OR, have provided countries with better access to publications and other documents about OR happening elsewhere. In theory, this enlarges the pool of examples and lessons for countries to draw on. In practice, we need to know whether current OR methodologies, networks, training and publications are actually maximising the benefits of this comparative learning. We also need to look more at how OR is being carried out—and do more sharing and evaluating of methodologies, ethical challenges, research principles and new types of research partnerships, for example.

Third, what would increase the amount of OR being carried out by low- and middle-income countries and used to inform policy at local and global level? A policy transfer perspective requires us to examine who does OR, where, with whom, what interests and motivations are involved, what conditions facilitate country-level priority setting, training, leadership development and support for OR, what role OR is being given in programmes and policy at the country and global levels, questions that are usually not systematically addressed. Knowledge about how policy transfer occurs in these countries and how they participate (or not) in international policy development is limited.[6] In the policy transfer literature, there are very few analyses[39–42] of health policy transfer in low-income settings. In the literature on TB, OR has been published for decades, but the focus tends to be on quantitative methods and results rather than on policy processes and learning.

If attention is not given to these three questions, OR will not be used to its full potential to improve global and local policy. In addition, we risk creating suboptimal research partnerships[43,44] and more uninformed, incomplete or inappropriate policy transfer,[45] which is likely to waste precious resources, confuse practitioners and fail populations. How might we address these questions? Policy transfer provides potentially useful concepts and tools. The next section presents a model for analysing policy transfer and discusses potential practical and research applications.

A MODEL FOR ANALYSING POLICY TRANSFER

The Figure conceptualises health policy transfer as a process across time and space, involving interaction

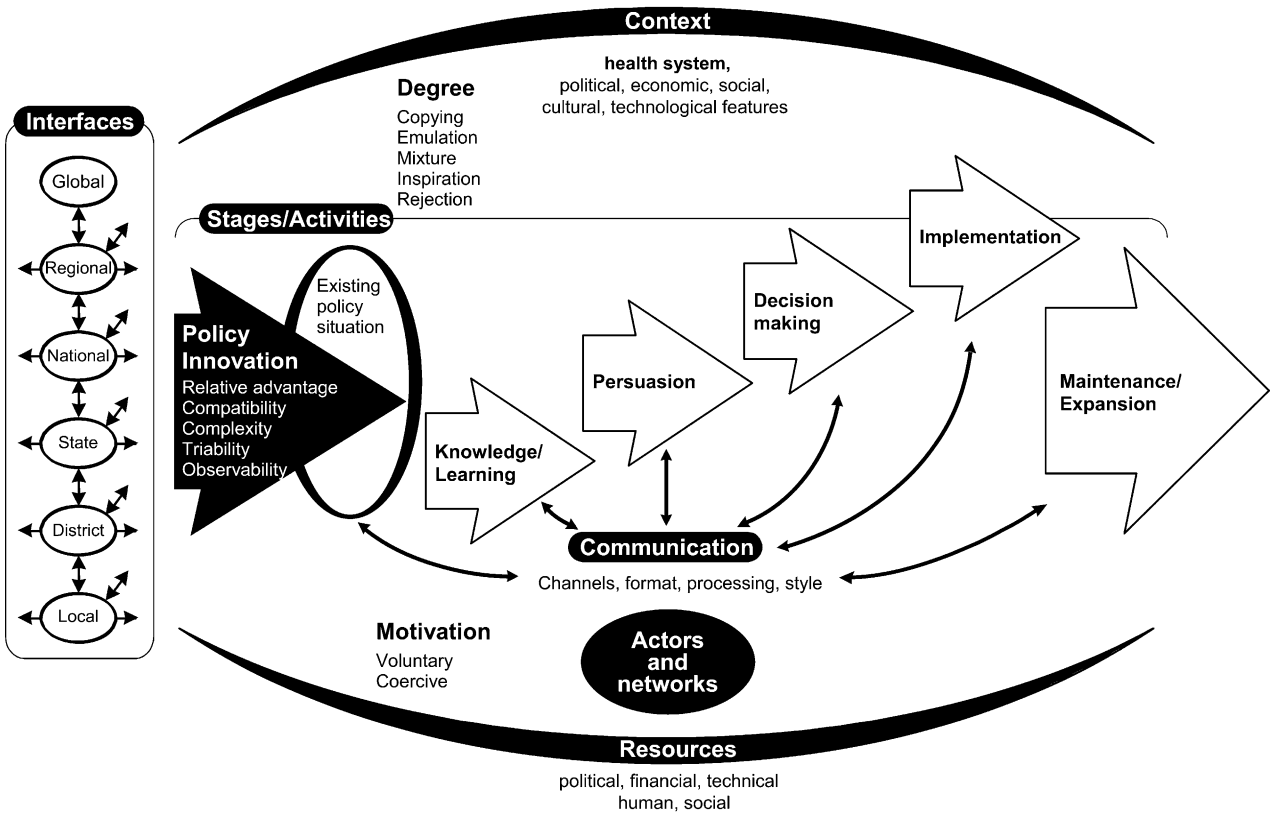

Figure Model for analysis of health policy transfer.[1]

among a variety of elements that can potentially facilitate or hinder this process. This approach is a fusion and adaptation of a key framework[3,45] from the policy transfer literature, and a model from the literature on the diffusion of innovations.[46] The purpose of this model is to discover what facilitates or hinders the process of policy transfer, and to use this understanding to suggest how efforts to generate new knowledge and apply it to policy and practice might be improved. The model does not show cause and effect; rather, it guides us to ask the right questions so that we can describe what is happening in a more systematic way. This, in turn, can be used to better understand how to improve this process.

The elements are summarised as questions (Table 1) and explained below. The centrepiece of the model is a process (represented by wide arrows in the Figure) of stages/activities that prompts us to ask questions about how people and organisations

- come into contact with a new policy or innovation;
- learn and manage knowledge;
- are persuaded by evidence and changes, and then persuade others;
- make decisions about the policy;
- implement the policy; and
- maintain and expand the policy.

We use the arrows as a way to organise our understanding of what happens (or does not happen) and when, during the process of a policy or innovation coming onto the scene, being assessed, adopted, implemented or rejected. This is adapted from Rogers' explanatory model of how individuals and organisations make decisions about whether or not to adopt an innovation.[46] By distinguishing types of activities over time, we can see, for example, if certain activities continue throughout, who is involved when and how in the process, and which contextual and resource factors are relevant and when.

The model does not claim that progressive stages exist or that transfer is a linear process. Activities do not necessarily constitute stages or follow any particular order. In other words, one activity does not automatically flow into another. Activities may continue

Table 1 Main questions from the model

Element	As a question
Stages/activities	What activity has taken place and when in the process?
Policy innovation	What is transferred?
Interfaces, actors and networks	Between which levels and/or arenas is it transferred? Who is involved?
Communication	How do actors communicate during transfer?
Degree	What is the degree of transfer?
Motivation	Why has transfer occurred?
Context and resources	What contextual or resource factors have facilitated or hindered transfer?
Facilitators/constraints	Overall, what factors have most facilitated or hindered transfer?

throughout the process alongside subsequent activities. The whole process may come to a halt or slow down at any point, and activities may be repeated later or missed out.

Nevertheless, even if activities occur in a non-linear fashion, it is useful to describe the process as comprising stages/activities: policy/innovation enters the existing policy situation: a new policy or innovation or research idea arrives on the scene. What happens here may be influenced by past policies, related or competing policies, the culture of research and policy making, and so on. Knowledge/learning: this activity includes decisions about what knowledge and types of learning are needed, how knowledge is acquired, validated, shared, whether learning continues throughout the process. Persuasion: this is about how people or organisations persuade others or are persuaded themselves to adopt a policy and/or to provide a facilitating environment for its transfer. This includes, for example, implementers' motivation, getting topics on political and social agendas and advocacy. Decision making: this identifies the major decisions about adopting or rejecting a policy or innovation, and, for example, how the policy change is formulated and how implementation is planned. Implementation: this includes all activity related to putting a new policy into practice. The focus is not on technical detail, but on understanding the processes of implementing and adapting, which can also be thought of as appropriating, re-inventing[47] or translation.[48] Maintenance/expansion: this is the activity of continuing a policy once implemented, and how it is expanded.

The policy/innovation element is about what is transferred (or not). This may be all or part of a policy (its goal, content or instruments), programme, plan, strategy, tool, institution, way of working, norm, principle, ideology, innovation, idea, negative lesson. The model uses certain characteristics to help think about what might influence uptake. These characteristics (relative advantage, compatibility, level of complexity, triability and observability of results) have been demonstrated to influence the likelihood of adoption of a technological innovation[46] and are proposed as relevant for policy.[1] They help to explore how people perceive a policy and how certain characteristics of the policy itself and the way in which transfer occurs might facilitate uptake.

It is also important to think of policy transfer in health as a process that can include multiple levels and arenas. These are represented in the model's interfaces—political and administrative levels (local to global), and the arenas (at each level), in which actors are grouped around issues of health policy making and implementation. These are linked by double-ended arrows which acknowledge the possibility of transfer occurring vertically, 'top-down' or 'bottom-up'; horizontally between arenas at the same level, e.g., national to national; and diagonally from one level to another level outside the conventional verticality, e.g., from a district in one country to the national level in another. The interfaces illustrate that, in theory, new knowledge and lessons can come from anywhere and then move anywhere to influence policy. Interfaces remind us of the different levels and arenas that a policy may need to suit when it is expanded. They also prompt us to question where and how a policy actually moves. Has a national policy got 'stuck' somewhere, needing to be better adapted, explained or resourced at district level? Has it bypassed some levels, for example, the national level interacting directly with a district level, and distancing its subnational state level? Which levels are involved in the different activities? For example, has the global arena dominated all the piloting and learning about a technological innovation, leaving national and subnational levels feeling uninvolved and unconvinced, and leading to insufficient knowledge about the impact and implementation of the innovation?

The actors and networks are the individuals, organisations, institutions and any formal or informal group or network that are involved in the process, or should be involved. These are likely to have different resources, power and interests. They may have different ways of learning, assessing knowledge and evidence, persuading others, adapting a policy, and so on. We thus explore how they engage in policy-related communication. They might be producers, senders, facilitators or recipients of information.[49] Arrows indicate the need to analyse whether or not communication occurs during different activities, and whether it is two-way. How information is packaged, processed and perceived is likely to be key,[46,50,51] so the model looks at channels, format, processing and style of communication. It might be written or verbal: through key documents such as guidelines, events such as conferences, meetings, training, social mobilisation, and other channels such as media, among others.

When thinking of the degree of transfer, it may be useful to consider five potential scenarios: a policy might be directly copied from the original, it might have taken the ideas behind it but not the details, it might be a mixture of various policies, or it might be a policy change inspired by the original policy without closely resembling it, or the original policy might be rejected (in whole or in part). Was the outcome what was intended? If not, what may have led to it? This is closely linked to the motivation for transfer, which can be considered as being somewhere along a spectrum that ranges from 'forced' to 'voluntary'.

Finally, the policy transfer process is shaped by context and resources. Aspects of the context, such as the health system, and political, economic, social, cultural or technological factors, may influence the process. Resources to be considered are human, financial, political, technical and social. Any of these factors may facilitate or hinder the process over time either consistently or varyingly. They may be

perceived and prioritised differently by different people or groups. Once identified, some factors can be acted upon by policy makers, practitioners or communities, for example, addressing obstacles, improving adaptation, utilising opportunities more efficiently or appropriately.

APPLYING THE POLICY TRANSFER MODEL TO IMPROVE OPERATIONAL RESEARCH

The above model can help track the generation of innovations and new knowledge, and uptake (or not) into policy and practice. It helps to identify factors that lead to effective uptake of a policy or innovation, as well as obstacles. This understanding should help with improving processes and techniques, such as learning, persuasion, decision making and adapting OR results into policy recommendations. Its focus on the interaction between a range of actors, networks, levels and arenas reflects the importance of representing multiple perspectives, perceptions and needs. Analysing learning and policy processes between and across levels helps explore how people access lessons from other policies, people and places; how lessons can be packaged to help others judge how they might work in their own setting; and what mechanisms and events facilitate this particular type of learning (i.e., comparing and drawing lessons).

PRACTICAL APPLICATIONS

Policy transfer concepts, as described in the model above, may be useful for programmes and organisations in their routine work and at all levels. The process arrows in the model are based on activities that are easily recognisable (communicating, learning, persuading, making decisions, implementing, expanding) for all levels and arenas in a country and internationally, for policy makers, managers, implementers, community participants, non-governmental organisations (NGOs), donors and technical agencies. Policy transfer may offer tools that help to plan and evaluate efforts to see research into policy and practice.

Importantly, uptake into policy and practice should be planned for at the beginning of an OR project, and not as the last step. The model can serve as a visual prompt to guide discussion, generating important process- and policy-related questions. For example, it can inspire policy-process-oriented questions for the initial planning of an OR project (Table 2). 'Finding the right research question' should involve rigorous quantitative thinking, but also strategic thinking about whom to involve and how to obtain and communicate the type of evidence that will facilitate policy decisions and uptake into practice. Once the OR is underway, further questions may be useful (Table 3). Questions can help identify non-technical obstacles to getting OR completed and into policy and practice.

Table 2 Some policy transfer related considerations when preparing an OR project

Questions for researchers	How the question helps to prepare OR for successful policy transfer
How is your OR project going to help improve health systems, services and the life of patients, especially the poor and the vulnerable?	Check your research is looking for results that will lead to public health action
Which policy and practices might need to be changed, depending on your results?	Check that it is clear how your research is relevant to these policies and practices Identify who should be involved in and/or informed about it
Whose support will you need to get the research done and published?	Inform and/or involve sources of official and informal support at the beginning
Who is likely to resist the research and the potential policy change?	Anticipate and, where appropriate and feasible, address any resistance to the research and to evidence-based decision making
Who will need to make a decision about any policy changes you propose?	Identify decision makers and other stakeholders Think about what type of evidence they will require and/or be convinced by, and what type of recommendations they will be able to act upon
Who would need to implement and benefit from these policy changes?	Identify relevant representatives (e.g., programmes, institutions, health care workers, patients, communities) Consult and/or involve them: — to ensure research will propose feasible and appropriate changes in policy — to increase ownership and chances of successful adaptation into practice and to different contexts
How would people check whether the policy changes make it into practice?	Ensure you are aiming for actionable, observable changes Determine how decision makers, implementers and other stakeholders could observe changes Plan monitoring and evaluation early on

OR = operational research.

Findings can be written up as lessons learned, with recommendations for future OR and policy activity.

The model can also be used retrospectively to examine the past, perhaps to understand why a policy has not been adopted as expected, as failed uptake can also provide valuable lessons. Correspondingly, it can be used prospectively to plan and accompany a new policy as it is being decided and expanded.

Moreover, it may provide an innovative complement to conventional programme monitoring and evaluation checklists that tend to contain predominantly technical and health systems indicators. Programmes may decide to assess their progress in improving communication channels between levels in the programme, for example, or their success in achieving policy change. They may wish to explore uptake of

Table 3 Some policy transfer related considerations once OR is underway

Element in model	Examples of questions to consider
Policy/innovation	Where did our research idea come from? Depending on our results, what might we be recommending as a change in policy? What will need to be transferred along with it for it to be a success?
Existing policy situation	What policies or guidelines or sets of procedures is this going to affect? What changes might it imply for our programme, health system, community?
Interfaces, actors, networks	Who is involved in and affected by the topic we are researching? Which levels and/or networks in the country or world are involved? How are we all linked, or not? Who is likely to support or resist our research and any proposed policy changes? Are there issues of power and interests to address?
Communication	How will we communicate about our research topic and findings on the way through, when we have results and when a policy change is made? What formal and informal channels exist for this communication? Is there shared understanding on this topic or misunderstandings?
Degree	Have we copied something from elsewhere? How can we assess whether we have appropriately adapted it to our situation? Are we expecting others to copy or adapt it? Are we able to reject it if it turns out to be unsuccessful or inappropriate?
Motivation	Why are we doing this OR? What might influence the way people and organisations react to the research process, results and recommendations?
Knowledge and learning	What opportunities are we providing for people to learn during this research process? What works best for different people to learn? Who has access to knowledge and who should have access? Is evidence from quantitative research enough or do we also need ways to learn about our processes and use lessons learned to improve our programme activities?
Persuasion	Who would need to feel convinced or be convinced about any proposed policy changes? How would they assess things?
Decision making	What major decisions will need to be made when our research findings are available? When will policy decisions be made? What will they be based upon—our research only? Who will be involved in this decision making? Who should be included?
Implementation	Is our research going to show sufficiently how a policy change would need to be implemented? What else might need to be worked out? What might need to be adapted once the policy change is made and people are taking it up into practice? How could this process be facilitated?
Maintenance and expansion	When would decisions be made about whether to continue and expand the change? What would enable people to assess whether it is working in practice?
Context	What are the most significant contextual factors that are likely to affect the success of our research, and getting results into policy and practice (e.g., health system, political, economic, social, cultural, technological)? How can we address these? How will our research recommendations deal with these?
Resources	What are the most significant resource issues that are likely to affect the success of our research, and getting results into policy and practice (e.g., political, financial, technical, human, social)? How can we address these? How will our research recommendations deal with these?

OR = operational research.

certain ways of working, such as partnership, or new institutional arrangements, such as joint activities between TB and human immunodeficiency virus programmes. The model provides a framework for reflecting on these elements. Programmes can then devise their own ways to monitor them or seek advice from technical agencies, qualitative researchers and experts in fields such as health systems, policy, promotion, management and communications.

The five characteristics likely to influence policy transfer (Table 4) may be useful. If OR projects can be designed to produce results that address these characteristics, evidence suggests that people are more likely to engage with the results.[46,52] Likewise,

Table 4 Characteristics of policy or innovation that are likely to influence transfer*

Characteristic	Questions asked by decision makers, stakeholders, implementers	Transfer is likely to be facilitated by . . .
1 Relative advantage	Why would we change and use this instead?	Clarity about advantages of this policy or innovation as opposed to others
2 Compatability	Does it suit our setting? Can we make it into something that does?	Clarity about how it could be adapted to the constraints and facilitating factors of the particular setting
3 Complexity	Can we understand it?	Clarity of concepts and their operationalisation
4 Triability	Can we try this out first and see if we are convinced by it?	Being able to try something out and be convinced before adopting/implementing it
5 Observability	Can we see results from this?	Clarity about results. Being able to observe the results

*Described in Bissell.[1] Adapted from Rogers.[46]

when expanding the new policy, addressing these characteristics should enhance uptake. Obviously, this requires knowledge of the context. Showing the 'relative advantage' offered by a new policy is only possible if one knows the current situation well and can explain the differences in terms that will be understood by the audience(s). Similarly, 'observability' of results requires an understanding of who is persuaded by what type of results: at the global level, it might be randomised controlled trials; at the health clinic level, implementers may be more convinced by seeing patients in their register achieving cure. The five characteristics may help to diagnose why uptake is slow or reluctant. For example, if a policy is perceived as rigid, 'compatibility' may be the problem. A solution may be to explain how the policy can be adapted, and encourage adaptation.

The characteristics fit well with OR principles, reinforcing that people need to understand why things are being changed and what will be improved (relative advantage) and that it is important to adapt to contexts (compatibility), keep things simple (level of complexity), pilot before implementing (triability) and be result-oriented (observability of results). These five characteristics should be considered during all phases of OR and policy change: for example, project design, report writing, briefing documents for decision makers, guidelines, training materials, communications materials, advocacy.

RESEARCH APPLICATIONS

Qualitative policy transfer research can be a component of OR projects. Social scientists would usually apply methods such as the case study approach, document analysis, semi-structured qualitative interviews with key informants, focus groups and process evaluation. The policy process is mapped, relevant variables are identified and organised, and relationships between them are explored. It is complex to analyse each element of the proposed model in detail. Researchers would often choose to concentrate on some elements more than others. To interpret results, they refer to the theoretical works behind the model, their own background of political and social theory, and any political and social (including indigenous) systems relevant to the context. Findings are often written up as case studies. They may also contribute to guidelines on getting research into policy and practice.

Policy transfer analysis can be applied alongside 'impact assessment'. One such project is examining the impact and uptake of a new diagnostic for multidrug-resistant TB. The impact assessment analyses multiple types of impact: effectiveness, equity, health system, scale-up implications and comparison with other current or upcoming diagnostic options.[53] The accompanying policy transfer analysis examines the process of testing, introducing and expanding the new diagnostic. It looks at the roles and perceptions of various actors, how decisions are made, how learning and communication occurs, and how context and resource issues are addressed. Together, these approaches provide evidence and lessons learned for decision making about whether to retain the new diagnostic, but also how to comprehensively assess the impact of future diagnostics and how to improve policy and learning processes related to piloting, implementation and expansion of new tools.

Comprehensive policy transfer research is recommended prior to launching new strategies, tools and programmes, as well as at key strategic moments, such as prior to a phase of expansion. It is also recommended when there are major lessons to be drawn from one field to another, and for capturing process-related lessons from programmes, research projects or initiatives. Such research is time-consuming, complex and requires experienced health policy qualitative researchers. Such researchers are often scarce, but capacity and interest should grow if there is an increase in collaborative OR between programmes, technical agencies, implementing NGOs and universities. Those interested in policy transfer research can seek partnerships with groups that have such expertise.[36]

CONCLUSIONS

Policy transfer is an important phenomenon and is relevant to all countries, levels and arenas of people, institutions and organisations involved in health. With a more systematic analysis of learning and policy processes, it is likely that the policy and practice outcomes of OR could be improved at all levels, from local to global.

Policy transfer offers theory and concepts for analysing OR from a new perspective. This paper proposes a model of the policy transfer process for qualitative research use. Comprehensive policy transfer research, given its length, complexity and requirement of qualitative researchers, should not be envisaged for all OR projects. It is, however, proposed that all OR projects could usefully incorporate some policy transfer concepts and practical tools inspired from this model. This should help to plan, evaluate and improve OR processes and the resulting changes in policy and practice.

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RÉSUMÉ

Des transferts de politique surviennent régulièrement. Essentiellement, une stratégie élaborée ailleurs est reprise et appliquée dans un autre contexte de politique. En fait, qu'est-ce exactement qu'un transfert de politique et élément important, dans quelles conditions se produit-il? Cet article décrit le transfert de politique et répond à trois questions principales, en explorant ce que les perspectives de transfert de politique pourraient apporter comme contribution aux efforts de recherche opérationnelle (OR). Premièrement, qu'est-ce qui facilite le transfert des résultats de la OR en politique et en pratique? Deuxièmement, qu'est-ce qui facilite la possibilité de tirer des leçons effectivement au sujet des résultats et des processus de OR entre les pays et au sein des pays? Et troisièmement, qu'est ce qui pourrait augmenter le volume d'OR réalisé dans des pays à revenus faibles ou moyens et être utilisé pour donner des informations à la politique et à la pratique au niveau local et mondial?

L'adoption et l'adaptation de la stratégie DOTS au Mexique sont utilisées comme un exemple de transfert de politique. Le transfert de politique est significatif pour tous les pays, tous les niveaux et tous les groupes de population, institutions et organisations impliquées dans la santé. Grâce à une analyse plus systématique des processus d'apprentissage et de politique, la politique d'OR et les résultats dans la pratique pourraient être améliorés à tous les niveaux depuis le niveau local jusqu'au niveau mondial.

Le transfert de politique fournit une théorie et des concepts pour l'analyse des RO dans une nouvelle perspective. Cet article propose un modèle de processus de transfert de politique à utiliser dans la recherche qualitative. Des recherches complètes sur le transfert de politique, vu leur longueur, leur complexité et l'exigence de chercheurs qualitatifs ne devraient pas être envisagées pour l'ensemble des projets de OR. Tous les projets d'OR pourraient toutefois incorporer certains concepts et outils pratiques inspirés de ce modèle. Ceci devrait aider à suivre, à évaluer et à améliorer les processus d'OR ainsi que les modifications qui en résultent dans la politique et la pratique.

RESUMEN

La transferencia de políticas tiene lugar regularmente. Esencialmente, una estrategia elaborada en otro lugar se adopta y se aplica en un contexto político diferente. Sin embargo, ¿que significa exactamente? y aun más importante, ¿en qué condiciones tiene lugar la transferencia de políticas? En el presente artículo se describe esta estrategia y se analizan tres preguntas principales, sobre las perspectivas de la transferencia de políticas que podrían contribuir al trabajo de la investigación operativa. En primer lugar, ¿qué factores facilitan la transferencia de los resultados de la investigación operativa (OR) a las políticas y las prácticas corrientes? En segundo lugar, ¿cómo se puede promover eficazmente la extracción de enseñanzas a partir de los resultados y los procedimientos de la OR entre los países y dentro del mismo país? Y en tercer lugar, ¿cómo se podría aumentar el número de OR realizadas por los países con bajos y medianos recursos y facilitar su utilización en la documentación de las políticas y las prácticas a escala local y mundial?

La adopción y la adaptación de la estrategia DOTS en México se presenta siempre como un ejemplo de transferencia de políticas. La transferencia de políticas es un fenómeno que interesa a todos los países, en todos los niveles y todos los entornos de personas, instituciones y organizaciones que se ocupan de la salud. Con un análisis más sistemático de los procesos del aprendizaje y las políticas se podrían mejorar los resultados políticos y prácticos de la OR en todos los niveles, desde la escala local hasta la escala mundial.

La transferencia de políticas aporta bases teóricas y conceptos al análisis de la OR desde una nueva perspectiva. En el presente artículo, se propone un modelo del proceso de transferencia de políticas que se puede usar en la investigación cualitativa. Una investigación exhaustiva de transferencia de políticas lleva mucho tiempo, es compleja y exige el concurso de científicos especializados en investigación cualitativa, por lo cual no es posible considerarla en todos los proyectos de OR. Sin embargo, todos los proyectos podrían incorporar algunos conceptos e instrumentos prácticos inspirados en este modelo, con lo cual se facilitaría la supervisión, la evaluación y el mejoramiento de los procesos de OR y de sus repercusiones en las políticas y las prácticas.

Appendix F

Additional References

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Founded in 1920, the International Union Against Tuberculosis and Lung Disease (The Union) is dedicated to bringing innovation, expertise, solutions, and support to address health challenges in low- and middle-income populations. With nearly 10,000 members and subscribers from over 150 countries, The Union has its headquarters in Paris and offices serving the Africa, Asia Pacific, Europe, Latin America, Middle East, North America, and South-East Asia regions. Its scientific departments focus on tuberculosis, HIV, lung health, and non-communicable diseases, tobacco control and research. Each department engages in research, provides technical assistance and offers training and other capacity-building activities leading to health solutions for the poor.

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