

HEALTH EVIDENCE NETWORK SYNTHESIS REPORT 69

What is the evidence on policies, interventions and tools for establishing and/or strengthening national health research systems and their effectiveness?

Stephen Hanney | Lucy Kanya | Subhash Polkarel | Teresa Jones | Annette Boaz



**World Health
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Health Evidence Network synthesis report 69

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Abstract

High-quality research is important for improving population health and well-being and for achieving the health-related Sustainable Development Goals. The challenges facing individuals, organizations and countries in securing research funding and building research capacity, and then using these resources effectively, have led to renewed interest in adopting a systems approach to national health research systems strengthening. This report found that health research strategies play a key role in combining the diverse interventions to strengthen specific health research system functions into an overall system. Good practices in research systems strengthening were identified as health ministry involvement in and sustained political commitment to the comprehensive research strategy, and, where appropriate, integration of the health research system into the wider health system. Policy considerations include actions to ensure a contextual analysis to inform a comprehensive strategy; stakeholder engagement, including in priority-setting; monitoring and evaluation tools focused on system objectives; and partnerships.

Keywords

RESEARCH, HEALTH, BIOMEDICAL RESEARCH, TRANSLATIONAL MEDICAL RESEARCH, HEALTH SERVICES RESEARCH, CAPACITY-BUILDING, EVIDENCE-BASED PRACTICE

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ABBREVIATIONS

COHRED	Council on Health Research for Development
EU	European Union
EVIPNet	Evidence-informed Policy Network
EViR	Ensuring Value in Research
HEN	Health Evidence Network
HRB	Health Research Board (Ireland)
HTA	health technology assessment
Inserm	National Institute of Health and Medical Research (France)
LMIC	low- and middle-income countries
MRC	Medical Research Council (United Kingdom)
NHRS	national health research system
NHS	National Health Service (United Kingdom)
NIHR	National Institute for Health Research (England, United Kingdom)
PAHO	Pan American Health Organization
PCHRD	Philippine Council for Health Research and Development
SDG	Sustainable Development Goal
STEPs	Strengthening Engagement in Public Health Research (project)
TDR	Special Programme for Research and Training in Tropical Diseases
WAHO	West African Health Organization

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SUMMARY

The issue

Policies and interventions to improve population health and well-being and to achieve the Sustainable Development Goals (SDGs) should be informed by high-quality research evidence, including evidence derived from locally conducted research where available and appropriate. Major challenges persist in strengthening the generation and use of research evidence. These include securing sufficient research funding, building adequate capacity, avoiding poorly targeted, low-quality research production and underutilizing research findings. Developing or strengthening a national health research system (NHRS) has been proposed as a way of addressing those challenges in order to improve health. Many countries, including in the WHO European Region, do not have comprehensive national health research policies or strategies in place that would facilitate the introduction of a systems approach. Countries often struggle both to increase the production of relevant research that is used and to draw sufficiently on the global stock of evidence.

The synthesis question

The aim of this review is to address the question: “What is the evidence on policies, interventions and tools for establishing and/or strengthening national health research systems and their effectiveness?”

Types of evidence

Evidence was obtained by a scoping review of peer-reviewed and grey literature in English or with an English translation and with no restrictions on geographical region, publication date or document type. After duplicate removal, 1287 records were screened and 145 full-text articles were assessed for eligibility, giving a final set of 112 publications that included articles, reports, official documents and editorials. Three countries well represented in the literature were selected for case studies to illustrate comprehensive health research system development.

Results

The review applied a modified version of a WHO framework to identify policies, interventions and tools for establishing and strengthening health research systems. The review presents evidence related to the four functions of a NHRS (stewardship and governance, financing, capacity-building, and producing and using research) and their operational components.

The first section describes the two main overall approaches by which health research systems are strengthened. The first is developing and applying a comprehensive national strategy or policy that integrates the diverse approaches to strengthening each function into an overall system. Such strategies were identified in countries from all six WHO regions; they had often been built following an analysis of the current situation of health research in the country and discussions with relevant stakeholders. The second approach is building partnerships or regional initiatives/interventions through which countries analyse their situation and might collaborate with peers (as well as regional and international partners) to identify ways to strengthen the health research system of each country.

The stewardship and governance function includes defining a vision, ethical review, research priority-setting and appropriate monitoring and evaluation. Consultation with health system stakeholders should enhance the relevance of the research priorities to health care and evaluating the research's impact on policy and practice should help researchers to focus on achieving such impact.

Securing finance can involve obtaining funding from sources within the country and from external donors. Requests for funding can be more effective when linked to other parts of the overall strategy, including the identified priorities that need supporting and assessments of the benefits obtained from previous funding. Capacity-building involves building, strengthening and sustaining the human and physical capacity to conduct, absorb and utilize health research.

The last function of producing and using research has three mutually reinforcing components so that the systems can encourage the production of scientifically valid findings that are relevant for users and communicated in an effective, timely and targeted manner. Fostering the use of research requires specific knowledge translation and management approaches that draw on both locally produced and globally available evidence. Sources of such evidence include Cochrane and translation mechanisms such as the WHO Evidence-informed Policy Network (EVIPNet).

Building an effective health research system often takes over a decade, no matter how well developed the health research sector might have been at the start of the process. An example of a country where a comprehensive national strategy has been sustained, and has strengthened the health research system, is England (United Kingdom), where the Government health department successfully created a strategy with a range of policies aimed at integrating the research system into the health system. Important progress has also been made in other countries with

formal policy statements or strategies, including Ireland, the Philippines, Rwanda and South Africa. An initiative from the West African Health Organization (WAHO) as well as series of surveys and interventions from both the WHO Regional Office for Africa and the Pan American Health Organization (PAHO) provide examples where collaborative approaches have recorded some success in encouraging countries to strengthen their NHRSs.

Implementing changes to strengthen a NHRS can be challenging, but there is a range of helpful materials on which to draw covering the full range of functions and operational components.

Factors identified as strengthening health research systems included an initial assessment of the local context, sustained political commitment to a comprehensive strategy covering diverse functions, involvement of the health ministry (or a research council under its aegis) in managing and coordinating the system, engagement with stakeholders in the development and implementation of a strategy, appropriate monitoring and evaluation linked to the system's objectives and, particularly in low-income countries, the development of partnerships.

Policy considerations

The evidence derived from this analysis suggests that establishing an effective NHRS requires sustained commitment and funding, as well as the involvement of the health ministry. Based on the findings of the review, the main policy considerations to establish or strengthen a NHRS are to:

- undertake an analysis of the current state of health research in the country to inform the development of national health research policies and strategies – this can be a one-off activity in an individual country or part of a multicountry initiative with organizations such as WHO;
- develop, apply and sustain a comprehensive strategy (policy or legislation) for health research covering all four health research system functions (stewardship and governance, financing, capacity-building, and producing and using research) and aligned with the national vision and health priorities;
- embed stakeholder engagement into the development and routine implementation of the health research strategy to improve priority-setting, enhance the likelihood of research translation and increase the commitment of, and support from, key health research stakeholders;
- develop and apply monitoring and evaluation tools that focus on demonstrating the benefits of health research systems in improving health policies and

systems, and facilitate learning and knowledge exchange of good practices among key actors in the system, including helping to inform implementation research and processes; and

- invest in and advocate for intercountry (and in-country) health research partnerships and regional collaboration.



1. INTRODUCTION

1.1 Background

There is increasing recognition of the importance of health research and that health policies should be informed by the best available, high-quality research evidence (1). Local research evidence, combined with global research evidence, is critical for policy-makers to identify context-specific solutions (1). In 1990 a landmark report by the Commission on Health Research for Development highlighted the importance of health research in improving global health. It recommended an essential national health research approach in which all countries, no matter how poor, should identify and prioritize their own research requirements to improve the health of their citizens (2).

Since then, a series of WHO documents and initiatives have promoted the role of a NHRS in boosting the production and use of research and ensuring that it is aligned with health-care needs (3–11). Key recent documents include *The world health report 2013: research for universal health coverage*, which stated: “All nations should be producers of research as well as consumers” (3). The Thirteenth General Programme of Work, 2019–2023, which sets out WHO’s strategic direction, has three main targets (11): (i) achieving universal health coverage, for which *The world health report 2013* had already described the essential role for research (3); (ii) addressing health emergencies; and (iii) promoting healthier populations. These targets interlink and accelerate the achievement of the United Nation’s SDGs, particularly SDG 3 (ensure healthy lives and promoting well-being for all at all ages) (12). In the Thirteenth Programme of Work, WHO underlined its commitment to supporting countries in reaching the health-related SDG targets and emphasized the role of research and innovation in accelerating their attainment (11). Health research is defined by WHO as “the development of knowledge with the aim of understanding health challenges and mounting an improved response to them” and covers the following areas of activity: “measuring the problem; understanding its cause(s); elaborating solutions; translating the solutions or evidence into policy, practice and products; and evaluating the effectiveness of solutions” (4).

Similarly, WHO regional offices support research in their Member States. In the WHO European Region, the *Action Plan to Strengthen the Use of Evidence, Information and Research for Policy-making in the WHO European Region* (13) is being implemented under the auspices of the WHO European Health Information Initiative,

a multipartner network to coordinate health information activities in the Region (14). The Action Plan affirms the commitment to “consolidate, strengthen and promote the generation and use of multidisciplinary and intersectoral sources of evidence for health policy-making in line with the health-related United Nations Sustainable Development Goals and the Health 2020 policy framework” and underscores the importance of local, context-specific evidence for local decision-making (13).

1.1.1 Challenges facing health research

Securing sufficient funding for health research and supporting activities is often a major challenge globally (4,5,15–24). The evidence suggests that, while greater wealth provides nations with the potential to produce more research, other factors influence health research productivity (1,3), including the overall priority that governments give to population health (25). Even countries with the capacity to conduct research sometimes face difficulties in securing research funding (8,26).

Often, however, low- and middle-income countries (LMIC) additionally lack the human and physical capacity to conduct the research needed to improve their health systems (16,20,27–30). Many LMIC also face the brain drain (i.e. the migration of trained scientists to other fields or careers, or to more wealthy countries) (5,23,31). Countries across the income spectrum increasingly focus on the challenge of how to build and retain the capacity of health-care staff to conduct research (32–34).

Even when finance and capacity are available, they are not always used effectively. A study in 2009 estimated that up to 85% of all biomedical research was wasted because it asked questions that were not relevant to clinicians and patients, was poorly designed or was either not published or poorly reported, with only about 50% of studies being published in full (35). Diverse challenges in the production, dissemination and use of health research evidence also include increasing policy-makers’ and practitioners’ access to, and use of, the global stock of knowledge, and narrowing the gaps between local knowledge producers and potential local users (3,6,8,13,36). It has been suggested that health research is too often fragmented among different isolated groups of researchers and lacks effective organization (5). Poor interaction has also been noted between the producers and users of research: policy-makers, health-care professionals, patients and the public (5).



1.1.2 Developing a systems approach to address the challenges of health research

Together with the Council on Health Research for Development (COHRED; an international nongovernmental organization), WHO pioneered work to promote a systems approach to health research in order to address some of the key challenges (5–8). A WHO analysis defined a system as “a group of elements operating together to achieve a common goal” and a health research system as “the people, institutions, and activities whose primary purpose in relation to research is to generate high-quality knowledge that can be used to promote, restore, and/or maintain the health status of populations; it should include the mechanisms adopted to encourage the utilization of research” (5).

The Bangkok Declaration on Health Research for Development in 2000 highlighted the importance of a systems approach, following consideration of how a NHRS could “be integrated with a nation’s health development plan” (36). The Declaration claimed that establishing and strengthening an effective health research system required coherent and coordinated health research strategies (36). Each national strategy should have a specific combination of the various components of a health research system, tailored to the country’s circumstances.

These issues were elaborated in the WHO Knowledge for Better Health initiative (5,6,37). The 2004 Ministerial Summit issued the Mexico Statement on Health Research, calling for nations to take actions to strengthen their NHRS, and this was endorsed by the Fifty-eighth World Health Assembly in resolution 58/22 in 2005, which committed its Member States to strengthening their NHRS as a pathway to improve their overall health system (7). *The WHO strategy on research for health*, published in 2012, reported that “active national health research systems speed up the achievement of health goals” (4). In *The world health report 2013*, WHO renewed its promotion of a systems approach to national health research (3):

Research for universal health coverage requires national and international backing. To make the best use of limited resources, systems are needed to develop research agendas, to raise funds, to strengthen research capacity, and to make appropriate and effective use of research findings.

To further guide the analysis and strengthening of health research systems, including development of a health research strategy, WHO developed a conceptual framework that can be used for the planning, implementation, monitoring and evaluation of health research systems (5). The framework outlined a range of constituent

components and how they can best be brought together into a coherent system. It identified four main functions for an effective system that are each defined by operational components (Table 1).

Table 1. The four functions and nine operational components of health research system

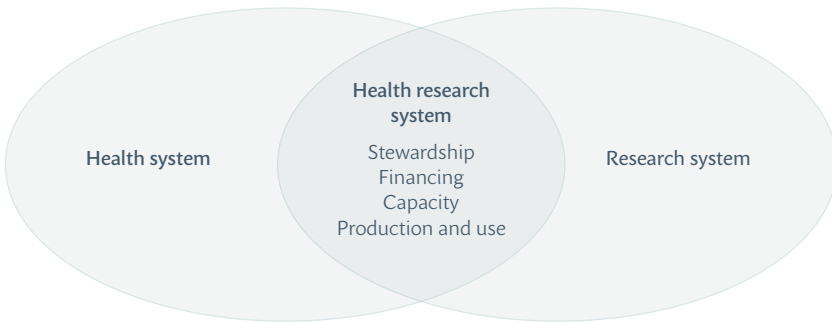
Function	Operational component
Stewardship	<ol style="list-style-type: none"> 1. Define and articulate vision for a health research system 2. Identify appropriate health research priorities and coordinate adherence to them 3. Set and monitor ethical standards for health research and research partnerships 4. Monitor and evaluate of the health research system
Financing	<ol style="list-style-type: none"> 5. Secure research funds and allocate them accountably
Creating and sustaining resources	<ol style="list-style-type: none"> 6. Build, strengthen and sustain the human and physical capacity to conduct, absorb and utilize health research
Producing and using research	<ol style="list-style-type: none"> 7. Produce scientifically valid research outputs 8. Translate and communicate research to inform health policy, strategies, practices and public opinion 9. Promote the use of research to develop new tools (drugs, vaccines, devices and other applications) to improve health

Source: adapted from Pang et al., 2003 (5).

The framework is not a precise blueprint, so some modifications are expected within each country (5). Various other approaches and frameworks have elaborated the stewardship function in particular, and have given specific attention to governance and management issues (28,38). Two key points relate to the framework: (i) the health research system, with its four key functions, exists at the intersection of the nation's health system and the wider research system (simplified in Fig. 1); and (ii) any strategy to strengthen a local health research system needs to address all four functions because "without effective stewardship, sufficient financing, and adequate human and physical resources, the challenge to produce and use scientifically valid research may be insurmountable" (5).



Fig. 1. The health research system: bridging the health and research systems



Source: adapted from Pang et al., 2003 (5).

1.1.3 Objectives of this report

Health research within a country can be organized in many different and complex ways. Crucial challenges to building a strong NHRS often arise from the health system having limited involvement in determining the priorities and organization of the nation's health research, which are both considered key factors in catalysing research uptake into policy and practice.

One reason the organization of health research may be highly complex is the involvement of many stakeholders (39–41). Despite some progress in developing NHRSs (24,32,33,42,43), some countries (including ones from the former Soviet Union and south-eastern Europe (1,44) and LMIC from across the WHO regions (22,24,27,45)) still face challenges relating to various operational NHRS components and in building a systems approach. Fragmentation has been identified as a continuing problem, for example in central Asia (44).

Even in high-income countries where considerable research is being conducted, it may not be fully organized at a systems level to generate the benefits that it potentially could (39,46,47). In 2011, the Strengthening Engagement in Public Health Research (STEPS) project, which was funded by the European Union (EU), concluded that only a few EU countries had strategies in place for health research, and these strategies were rarely drawn from the priorities of national health plans (39,46).

An important suggested reason was that the advisory councils of science ministries mainly drew on scientists from the life science and biomedical fields, with public health researchers seldom involved in the development of research programmes or in research prioritization (46).

Fig. 1 helps to explain the obstacles facing attempts to strengthen a nation's health research through using a systems approach. First, it highlights that all four functions need to be seen as part of the system; however, there can be a lack of awareness of this at the policy-making levels (48). Secondly, it helps to explain why a role for the health system in research might not be recognized, or readily accepted: as academics are used to being part of the research system, they may not consider themselves part of the NHRS (49). The nature of the tasks involved in conducting research may be an important factor here (50). Traditionally many researchers, and others, argue that the chances of high-quality research outputs are increased when scientists have the freedom to use their expertise to identify key research topics, rather than having research priorities imposed on them (51,52). They, therefore, claim that responsibility for funding and organizing health research should be left to bodies that are clearly part of the research system, such as a research council – perhaps loosely under the aegis of a science or education ministry (51). Many organizations operating within a traditional research system naturally tend to share this view (51).

In the light of these issues, the *Action Plan to Strengthen the Use of Evidence, Information and Research for Policy-making in the WHO European Region* also emphasized the importance of establishing and promoting NHRs to align research agendas with health priorities and foster the systematic and transparent use of research in local¹ health decision-making (13). To-date, an evidence synthesis bringing together the global evidence on national efforts to strengthen NHRs has been lacking. This scoping review systematically examines the evidence base to address the question: “What is the evidence on policies, interventions and tools for establishing and/or strengthening national health research systems and their effectiveness?”

1.2 Methodology

A search of available peer-reviewed and grey literature was conducted to identify relevant articles that addressed a systems approach to health research in English

¹ As in the Action Plan (13), the current evidence synthesis usually uses the term local to mean national, but sometimes to refer to a lower level depending on context.



or in any other language if an English translation was available, with no restrictions on geographical region, publication date or document type. The original search ran from the start of the Scopus database up to September 2017, with an updated search conducted in September 2019, and the scoping review included the combined body of literature. Full details of the methodology are included in Annex 1.

After duplicate removal, 1287 records were screened and 145 full-text articles were assessed for eligibility, giving a final set of 112 publications (articles, reports, official documents and editorials) (1,3,5-8,15-25,27-34,36,38-45,47-124). Only publications (national, international and generic) that adopted a systems approach were included; therefore, many identified papers that focused on just one function or component, or just one medical field or profession, were excluded.

Three countries with relevant publications from several periods and sources were selected for analysis in more detailed case studies to illustrate both the various stages of NHRS development and the different approaches to establishing and strengthening a health research system.

2. RESULTS

Of the 112 publications included in the analysis, 56 described health research system development in a given country (18,19,22,23,31–34,43,47,48,50–53,55,58,59,62–68,70,73,75–77,81,83,84,88–96,98–100,102,103,106,112,114,115,118,121–124), with 24 countries described at least once, including examples from all six WHO regions. In addition, 30 publications analysed developments in multiple countries (1,15,16,17,21,24,27–30,38–41,45,56,57,61,78,79,82,85–87,97,104,107,116,117,119), with over 140 countries included at least once. The remaining 26 publications were more generic, including proposed frameworks and reports from international organizations such as WHO and COHRED (3,5–8,20,25,36,42,44,49,54,60,69,71,72,74,80,101,105,108–111,113,120), but some included country case studies.

The results below present policies, interventions and tools relevant for NHRS strengthening, including each of the four functions of the WHO framework for health research (Table 1) (5). However, informed by later elaborations of the framework, the first function was renamed “stewardship and governance” and an additional component, “governance and management”, added to this function (28,38):

- stewardship and governance
- financing
- creating and sustaining resources (i.e. human and physical capacity-building)
- production and use of research.

Most evidence on NHRSs and their functions (sections 2.1 and 2.2) was drawn from relevant parts of publications describing developments at a systems level. In some cases, these sources were supplemented by papers cited in key systems-level reports and papers. Case studies describe approaches to establishing or strengthening health research at the overall systems level in three countries with differing local contexts, and one multicountry intervention. Section 2.3 analyses effectiveness, especially of the two main approaches to health research system strengthening: comprehensive national strategies and partnerships/collaborations.

2.1 Main approaches for NHRS strengthening: policies and partnerships

2.1.1 Comprehensive, coherent national policies and strategies

Creating a comprehensive and coherent national health research strategy or policy was one of the two major ways identified in the literature search for establishing and



strengthening a health research system. Strategy documents take various forms, but strategies and legislation are considered comprehensive when they describe how the system will undertake its various functions, such as those defined in the WHO framework (see Table 1) (5). Strategies are considered coherent when the various functions and components are analysed and presented in a coordinated way that shows how the vision of the NHRS and priorities of the health system can be achieved through concerted actions across the system. Various strategies also describe the detailed approaches and processes that had been successfully used in their construction to ensure their relevance to particular contexts. These processes include an initial analysis of the current situation and talking to stakeholders.

The review identified several types of comprehensive formal policy document for establishing or strengthening NHRSs, including strategies and legislation from countries in all six WHO regions (18,31,33,43,55,63,65,75,76,84,88,90,99), with examples across the income range and in differing contexts. In England, a comprehensive health research strategy was developed by the National Institute for Health Research (NIHR), which funds research linked to the health-care system and specifically focuses on its needs. A separate body, the Medical Research Council (MRC), continued to be loosely linked to the department responsible for science (Case study 1) (63). In Ireland, the Health Research Board (HRB; a research council linked to the health department) developed a strategy that has a substantial influence on the NHRS (Case study 2) (33).

Case study 1. The English NIHR: strengthening all four functions to create a comprehensive, coherent system

England is a high-income country that has strengthened the functions of governance, financing, capacity-building and research production/use to create a comprehensive and coherent health research system integrated into the health system (32). For most of the 20th century, the MRC, a body largely independent of any government department, was by far the most important public funder of health research: the government departments responsible for health played a much smaller role (51). There were growing concerns that the health research being funded did not sufficiently meet the needs of health policy-makers or clinicians in the health-care system, but initial attempts to reform the system had stalled by 1980 (51,50).

After decades of debate, reforms in 1991 created a research and development programme within the National Health Service (NHS) with increased funding for health research explicitly intended to meet the needs of policy-makers and


Case study 1 contd

clinicians (51,50,58). Investments in the first Cochrane Centre and the health technology assessment (HTA) programme, for example, were specifically aimed at synthesizing evidence from the global literature to inform decisions, improve health care and, in the case of the HTA programme, also produce relevant local evidence through conducting trials. Specific programmes within the new system, including the HTA programme, developed an approach of extensive stakeholder engagement in setting priorities. The overall programme commissioned, and started to apply, an evaluation approach that included a focus on the payback (i.e. impact) made by the funded research on health policy and practice (50,125).

Parts of this initial system, such as the HTA programme, were successful and began the process of moving from an ad hoc approach towards a fully functioning system (50,58), but a detailed analysis identified problems, including a sharp decline in the number of clinical academics (i.e. clinicians who also lecture and conduct research) (64). In response to this, Professor Sally Davies, Director-General of Research and Development at the Department of Health, received strong ministerial support and cabinet approval for plans to create the NIHR in 2006 (63). The Department conducted a comprehensive structured consultation with stakeholders from health-care organizations, professional bodies, leading research institutions and groups, medical research charities, patient organizations, industry, and the public (64).

Key elements of the NIHR strategy, *Best research for best health: a new national health research strategy*, included concerted steps to enhance the involvement of stakeholders, including the public and patients, in setting research priorities and in the research processes; support for priority areas such as public health; an enhanced status for leading medical academics, with funding that was separate from the NHS patient care budget; expansion of clinical research networks to provide a national infrastructure supporting the conduct of industry-funded and publicly funded clinical trials; and the creation of well-funded biomedical centres of research excellence at leading medical facilities in order to speed up the translation of research (50,32,71). Professor Davies highlighted the comprehensiveness of the strategy, which was confirmed in the consultation (63):

we want to emphasize that the strategy does not consist simply of one or two “big ideas” in isolation. We have to achieve a range of objectives which, although related, are individually quite distinct.



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The MRC continued to operate independently of the NIHR, with the research of the two organizations seen as complementary (3). In addition, an overarching body (the Office for Strategic Coordination of Health Research) was created to make a joint bid to the Treasury for public funding for health research and to encourage the public funders of research to work with the health-care industries and other stakeholders to develop a coordinated approach to translational research (50). Although the new NIHR was not intended to replace the MRC, it still took considerable drive and political support to develop a separate health research system with an explicit strategy of integration into the health system (51).

Case study 2. The Irish HRB: how to significantly strengthen a health research system

In building a NHRS over several decades with an increasingly comprehensive strategy, Ireland provides lessons in how to significantly strengthen a health research system in a small, high-income country (33). The Irish HRB was established in 1986 with a remit covering medical research, health and health services research, and epidemiological research. At that time, the HRB was the only significant funder of dedicated health research, and the health service “had no interest or involvement in setting a research strategy for health, leaving it predominantly to the researchers themselves to identify interesting research paths” (89). HRB funding was given to the best-quality research proposals (selected by academic peer review) rather than being directed towards strategic objectives, with most funding going to basic research.

In 1997 the Wellcome Trust agreed to provide pump-priming (i.e. seed) funding for biomedical and health-related research provided the Irish Government matched its contribution (89). This marked the beginning of a noticeable increase in funding. The first corporate strategy for the HRB was launched in 2002. The second, launched in 2007, identified six objectives towards achieving its mission to improve people’s health through research and information (89).

Other organizations also started producing health research documents, including the Irish Department of Health (89). In 2001 the Department strategy committed the Government to increase health science funding and, for the first time, “to establish and support a research and development function in the

Case study 2 contd

health system". The organogram for the Irish NHRS, which was published in the STEPS study, illustrated the range of bodies involved and a central role for the HRB (39). There was growing interest in health research from both general science funders, who supported biomedical science funding, and enterprise agencies, who aimed to encourage pharmaceutical and biotechnology industries. However, both groups recognized that use of biomedical research findings and attracting high-value industries required research infrastructure and capability in the health service (89). In the light of various challenges, the HRB commissioned a study based on the Payback Framework (125) to demonstrate the benefits of its research funding to interested stakeholders (89).

In 2015 the Department of Health contributed to an interdepartmental consultation on science and innovation. It confirmed the main aim of its research and innovation as improved health for Irish citizens and the HRB as "the statutory body under the aegis of the Department with responsibility for supporting and funding health research". It also described the economic potential of its research and EU funding (62).

Following a detailed stakeholder consultation, the HRB introduced its new corporate strategy for 2016 to 2020 (33), in which it claimed that it had achieved the objectives of its previous strategy and was responding to recommendations from a progress review by an international expert panel. The new strategy reflected the Department of Health's policies, strategies, plans and priorities, including its aims to use evidence to inform its work and ensure that research and innovation were fully used to improve the health system and support the Irish Government's agenda.

The comprehensive strategy included a commitment to strengthening the involvement of patients and the public in health research. Measures such as appointing a chief academic officer to the management team of hospital groups were aimed at ensuring that research remained a high priority of the health-care system. The strategy promised to support training and career development for researchers and emphasized the importance of linking to EU funding and expertise. It committed to maintaining the shift towards person-oriented and clinical research, population health sciences, and health services research (33).



The Rwandan health research strategy was similarly wide ranging and ambitious, with a starting point of producing local knowledge to meet the needs of the local health-care system and a vision to inform and improve health outcomes both in Rwanda and worldwide (31). The strategy covered components of the stewardship function, including coordination, ethics review, and monitoring and evaluation. It also covered securing finance and gave particular attention to capacity-building, including ways of addressing the brain drain. It included the production and use of scientifically valid research appropriate to the context of Rwanda. Similar to the English and Irish strategies, it recognized the importance of linking and integrating health information and health research evidence into health sector planning and policies.

Health research strategies identified in this review were sponsored by diverse organizations that may have played various leadership roles in the strategy development process. Sponsoring bodies included health ministries (31,63), health and medical research councils (33,75,90), a major national research institute (76), a science research council (84), a collaboration between a country's business and health ministries and health research council (43), and a subnational health research council (where the main health research council operated at federal level) (88).

In some countries, comprehensive legislation aimed to define and coordinate the various elements of the NHRS. In the Philippines, the 2013 Act Institutionalizing the Philippine National Health Research System (99) and subsequent administrative order detailed how different NHRS elements should be implemented by the Department of Science and Technology and the Department of Health (65). These documents described the membership, structure and/or role of key parts of the Philippine NHRS, including the governing council, coordinating body, steering committee, secretariat, NHRS network, agenda-setting arrangements, ethics board, research registry, and monitoring and evaluation mechanisms (65). Similar legislative processes on the NHRS establishment and functions have also been followed in Sri Lanka and Thailand (21).

Evidence from a range of countries (including England (United Kingdom), Ireland and New Zealand) indicates the importance of basing or constructing a systems approach on an analysis of the current situation in order to focus action and resources where they are most needed (33,43,63,64). Some of the identified articles analysed various stages of the development of comprehensive strategies (18,34,55). For example, the planning team from the Omani Ministry of Health, which in

2017 developed the Oman Vision 2050 for Health Research, conducted a situation analysis and then drew on developments from other countries (including Germany and Malaysia) when finalizing their draft strategy (55).

Many countries included stakeholder engagement when developing their NHRS in order to increase the chances of meeting the needs of key groups and gaining their support. The names of stakeholders to be approached for comments, or of those who had already commented, were sometimes listed in strategy documents, for example in Malta (84) and New Zealand (43). Stakeholder engagement successfully contributed to NHRS development in South Africa (34) and Zambia (18).

Advice on conducting a situation analysis (also called system mapping) and the many stakeholders who might be involved in strategy development was found in COHRED's generic guide to developing and managing effective health research systems (54) and the first part of their more recent guide on priority-setting (108). Annex 2 contains the comprehensive list of tools to support NHRS development identified in this review.

2.1.2 Partnerships, regional initiatives and collaborative intervention programmes

The second main way identified for those responsible for health research in a country to establish or strengthen a NHRS was through partnerships and multicountry initiatives. These can generate benefits from combining resources and diverse perspectives. Various forms were found, including regional initiatives and analyses led by international organizations, collaborative intervention programmes and a wide range of partnerships, including ones solely between LMIC as well as those involving high-income countries (11).

The 2002 overview of NHRS development in nine countries in the WHO South-East Asia Region was an early example of a regional initiative to promote NHRSs (21). The countries participated in a collaborative review and exchange about their existing NHRS profile, its responsiveness and opportunities for strengthening. Crucially, in the context of the Bangkok International Conference on Health Research for Development (36) and of promoting the NHRS as the "brain of the health system", the results encouraged the countries to take further actions for NHRS reinforcement. The overview stressed the role of the WHO Regional Office for South-East Asia in facilitating an enabling environment at the regional and international levels (21).



The longest-running activity (from 2003 onwards) was conducted by the WHO Regional Office for Africa, which carried out a series of regional surveys that encouraged action by monitoring each country's progress in NHRS development (16,24,82,87). Based on these data, it called for the development of a NHRS barometer of performance to guide policy-makers to locate sources of poor performance and to design interventions to address them (28). The results of the 2014 survey were analysed in 2016 using the barometer (28). Since then, the barometer has been used to assess progress in 39 of the 47 countries, especially towards universal health coverage. The results of the fourth regional survey conducted in 2018 (and published in 2019) showed that many of the 39 NHRSs have been significantly strengthened, often reaching or exceeding the targets set for 2025 (24).

COHRED has developed a number of approaches to support other multicountry initiatives (49,54,80). It worked with various groups of LMIC, sometimes in collaboration with WHO, to conduct a situation analysis in each country in order to map and profile national health research stakeholders, structures and mechanisms for commissioning, producing and using research (54). Examples include exercises in central Asia (15), the Pacific island States (97), the Pan American Health Authority (PAHO/WHO) (56,57), the WHO Eastern Mediterranean Region (29,79) and the WHO Western Pacific Region (107). In some cases, the WHO regional office, especially that for PAHO/WHO, continued working with countries in their region to promote NHRSs and assess progress (45,116,117). In 2017 COHRED supported an initiative by the WHO Regional Office for Europe to strengthen health research systems and establish the European Health Research Network (44).

A clear example of what can be achieved in a collaborative intervention programme came from WAHO (with its partners the Canadian International Development Research Centre, COHRED, the Special Programme for Research and Training in Tropical Diseases (TDR) and the Wellcome Trust). This brought together health ministries from the 15 members of the Economic Community of West African States (17,38,104). Two multicountry interventions by WAHO were based on data collected by situation analyses and NHRS mapping workshops, along with a survey in 14 of the 15 member countries (17,38,85,104). The exercises were partly informed by modified versions of the WHO NHRS framework (5,17,38,104). Key activities and achievements of the WAHO initiatives are described in Case study 3. The specific action taken in Guinea-Bissau, one of the poorest West African countries, is described in Case study 4.


Case study 3. WAHO interventions: building NHRs through collaborative multicountry partnerships

The health ministers in WAHO recognized the importance of developing NHRs in the region to provide evidence to improve the health systems and address common health problems. They established an intervention to address a series of challenges facing the NHRs, including a lack of adequate funding, research capacity, and policies and strategies for health research. In the first five-year initiative from 2009 to 2013, WAHO and its partners provided technical and financial support to all member countries to develop their NHRs (17), with activities planned following a situation analysis and workshops and surveys of ministries of health (17,104). In eight countries, the intervention included support to develop their policies and priorities and to improve their research governance (17). Training in research methodology, resource mobilization, ethical oversight and the use of the Health Research Web (a resource information management platform developed by COHRED (126)) was also provided (17). Additionally, a regional network of institutions was launched to improve collaboration between researchers in the region – its activities included organizing regional scientific congresses and launching a peer-reviewed, multilingual journal to promote the work of regional researchers (17).

From 2011 to 2015, a second, more detailed, project was implemented by WAHO with COHRED's technical assistance, focusing on four post-conflict countries with the greatest need for NHR development: Guinea-Bissau, Liberia, Mali and Sierra Leone (85,38). Informed by the situation analyses, the combined national and international teams identified specific priorities and activities for each country. Activities within the intervention depended on national priorities and, in some cases, overlapped with those of the first intervention. They included building structures such as a national ethics committee and a research monitoring system and advocacy (by the WAHO and COHRED teams) aimed at encouraging improved access to funding at the health ministry (38).

Case study 4. Guinea-Bissau: building a NHR from a very low base

One of Africa's smallest and poorest countries, Guinea-Bissau, was included in both WAHO initiatives (Case study 3), having been identified as one of the countries in particular need of post-conflict support (85). Nevertheless,



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and despite the challenges, the considerable interest within Guinea-Bissau itself in building a NHRS from the ground up predated the WAHO initiative (53,38).

Following independence in 1974, health research publications in Guinea-Bissau were mostly led by expatriate researchers (53). While the publications may have been of high quality, it was claimed that they were often based on the priorities of donors. In 2005 the Ministry of Public Health approached COHRED to facilitate the process of developing a NHRS. They began the process by undertaking a situation analysis of the existing NHRS, developing a policy for health research, engaging stakeholders and initiating research priority-setting (53).

Subsequently, the legal framework that institutionalized health research was provided by cabinet approval for the National Institute of Public Health, created as an independent body within the health ministry. Health research was integrated into the national health plan. After December 2009, all research protocols were submitted to the newly established National Ethics Committee, which was independent of but situated in the National Institute (85).

At the meeting to launch the second WAHO initiative in 2011 (Case study 3), the team from Guinea-Bissau presented a workplan setting goals and activities, including mapping the NHRS and setting the basis for good governance, priority-setting and further developing the National Ethics Committee. Areas suggested for capacity-building included financial management and accountability, communication, networking and monitoring the use of research results. The workplan also proposed advocacy for sustainable funds (38). In analysing the role of health ministries in developing research capacity, *The world health report 2013* observed that the commitment of the Ministry of Public Health to invest in research was central to the success of Guinea-Bissau, but that limited capacity and dependence on foreign assistance were its main challenges (3).

Research partnerships include those between public, charitable and private funders and bilateral partnerships between countries. Research partnerships are becoming more important and sometimes more formalized, with increasing evidence of their role described in NHRS strategies (33,43,63,76,84,88). COHRED's Research Fairness Initiative encourages governments, business, funders and organizations to describe "how they take measures to create trusting, lasting, transparent, and effective partnerships in research and innovation" (see Annex 2) (127).

2.2 Strengthening specific functions of a NHRS

This section describes the evidence for strengthening the four functions of a NHRS (5), as elaborated in later analyses (28,38): stewardship and governance, financing, capacity-building, and producing and using research. Each function consists of one or more operational components (listed in Table 1).

2.2.1 Stewardship and governance

The stewardship and governance function is concerned with strengthening effective oversight and management of a system's planning, implementation and accountability, as well as upholding standards and regulations around health research in both public and private sectors. It includes the following components: vision statements, governance and management, priority-setting processes, ethics review structures, and arrangements for monitoring and evaluation (5,28,38,65).

2.2.1.1 Defining a vision

Defining and articulating a vision for the NHRS is important in providing an overall direction and purpose for the activities involved in establishing and strengthening the system.

All of the comprehensive strategy documents identified that contained a vision statement referred to improved health (31,33,43,63,84,88,90). While they partly reflected priorities emphasized in the wider political context of each country (or state), they also had a variety of perspectives, including health equity (Nepal (90)), innovation (Malta (84)), economic benefits to the nation (England (63)) and high-quality knowledge production (British Columbia (Canada) (88), Ireland (33) and New Zealand (43)).

In several countries, visions for the health research system were explicitly set in the context of a vision for the whole society, or for the health system as a whole. For the Rwandan health research strategy, the context was the country's Vision 2020 to become a middle-income country, with health research seen as key to realizing the objectives for an improved health sector (31). In the Philippines, a 22-year vision for the nation (to be achieved by 2040) provided a framework within which to develop a long-term vision for the country's health research (118). The Oman Vision 2050 for Health Research was developed in the context of the country's Health Vision 2050 (55).



2.2.1.2 Governance and management

Organization, governance and management of health research activities varied greatly, as reported for the WHO European Region (1,39,40,41,46) and in multicounty initiatives (section 2.1.2). Many countries still lack a well-defined NHRS. Some countries with the most-developed systems have included the clearest statements about which bodies are responsible for the different functions. These countries are also among the leaders in developing additional ways to sustain and improve the governance and management of their systems.

The EU-funded STEPS project collated the findings from its examination of the organization of publicly funded health research in each EU country (39). Despite the continuously evolving situation in each country (40,41,44), STEPS was able to use a common basic framework to produce a detailed organogram for each system. The only national organogram example fully presented in a key STEPS publication (39) described the Irish NHRS in 2011 (outlined in Case study 2). Although governance patterns vary greatly, some generalizations can be made. In 2011 STEPS identified just six countries with what it described as a national health research strategy, but this definition was quite broad; for example, even the one from Germany was a detailed health research priorities document rather than a comprehensive strategy (68). Health ministries were rarely involved in the research strategies (46). Nevertheless, STEPS demonstrated the often-complex governance and management arrangements for health research within countries and helped to identify which organizations mainly provided funding, just conducted the research or did a mixture of both (39).

The diverse organizational patterns across countries involve combinations of different ministries and/or research councils. There are also increasingly detailed levels of policies, legislation and plans, plus management forums and research networks. New Zealand's strategy is a good example of a comprehensive health research strategy that includes statements about the respective responsibilities of the health and business ministries and the health research council (43). Nevertheless, even where there are comprehensive strategies there is often a need for more detailed policies; for example, the legislation in the Philippines (65,99) was supplemented by further policy documents (124). Similarly, in England, despite the creation of the comprehensive NIHR, there was also a role for an additional body, the Health Research Authority, with the core purpose of protecting the interests of the public and patients across the health research sector (122).

A series of articles from the WHO African Region and PAHO/WHO identified some of the major organizational features of health research systems in different countries and showed how countries have been increasingly developing them as part of attempts to strengthen their health research systems (16,24,45,56,57,82,87,117). In the WHO African Region, a growing proportion of countries have a law regulating research for health, a national strategic health research plan and a health research management forum (Table 2) (16). In general, these trends were further identified and promoted by applying the African NHRS barometer of performance to the information gathered in the 2014 and 2018 surveys (24,28).

Table 2. Findings of repeated health research surveys in the WHO African Region

NHRS feature	Number of countries with each feature		
	2003 (n = 10)	2009 (n = 44)	2014 (n = 47)
Official health research policy	3/10	13/42	23/47
Law regulating research for health	1/10	7/44	19/47
Functional NHRS	3/10	16/40	24/47
National strategic health research plan	2/10	8/39	22/47
Health research programme at the health ministry	2/10	11/44	24/47
Health research management forum	2/10	9/37	24/47

Source: adapted from Kirigia et al., 2015 (16).

PAHO/WHO's investigations into the condition of health research in Member States revealed that it was organized in diverse ways, with many gaps in the various policies and governance structures (56). Consequently, PAHO/WHO worked with Member States to develop a policy on research for health to be implemented both within its own structures and in individual countries. The policy aimed to strengthen structures "that administer and supervise how research is managed and financed, how research participants are protected, and how accountability is ensured", but recent assessments have suggested somewhat limited use of this so far (45,117). Elsewhere, there was also support for building networks within systems, especially as a way of boosting research in particular fields (114).

COHRED's advice on creating an effective governance and management framework identified the need for various organizations, such as a national research committee, and for a legislative and policy framework that, in turn, might consist of various policies (54).



Even where health research systems are well developed, such as in England and the Netherlands, there is strong recognition by those managing the systems of the need to address remaining challenges in avoiding waste (35). Research funding bodies are increasingly seeking to make progress in this area by working together in the Ensuring Value in Research (EViR) Funders' Collaboration and Development Forum, which has issued a consensus statement (described as a tool in Annex 2) (113). The Forum is convened by the English NIHR, the Netherlands Organization for Health Research and Development and the Patient-Centered Outcomes Research Institute (United States of America) and its membership includes research funding organizations from Australia, Ireland, Italy, Sweden and Wales (United Kingdom), as well as the TDR's ESSENCE on Health Research Initiative (128). These organizations have recognized that they have a responsibility beyond simply advancing knowledge; advancing the practices of health-related research and research funding is also required. They have claimed that their efforts will contribute to improvements in people's health and lives (113).

2.2.1.3 Setting and adhering to research priorities

Priority-setting involves a committee or organization identifying the topics on which the funding of health research should focus and the degree to which it should do so (within the whole system or parts of it). Historically, the development of priority-setting might be seen as the first step towards adopting more of a systems approach to health research within a nation. The 1990 Commission on Health Research for Development recommended that the priorities should focus on the needs of the national health system. This section considers who should set the priorities and how, the significance of priority-setting to the whole concept of a NHRS, and the particular role of priorities in LMIC in receipt of donor funds.

Soon after the 1990 Commission on Health Research for Development, some countries, such as South Africa, quickly strengthened their NHRSs by embracing an essential national health research philosophy and identifying national research needs (94). Subsequently, calls for greater focus on setting and implementing priorities to address the needs of a country's health system emphasized the importance of prioritizing research questions relevant to the needs of clinicians or patients to avoid wasting resources (35).

Selecting which local stakeholders should be involved in priority-setting is debated in both high- and low-income countries. Policy-makers, health-care practitioners, the public, patients, researchers and industry are all sometimes involved in setting agendas that researchers might then be encouraged to follow. Strategy documents

illustrated the growing importance of stakeholder engagement in setting the priorities for health research, and in ensuring that those priorities were informed by the priorities and needs of the health system (31,33,43,63,65,76,88). By 2018 there was a growing literature around governance issues for public engagement in health research systems (120) and, while many publications discussed the desirability of involving the public in priority-setting, fewer related to the issue in terms of contributing towards achieving health equity or coordinating adherence to research priorities. Nevertheless, specific priority has increasingly been given to identifying the research priorities and approaches of indigenous populations, including the Māori and Aboriginal populations in New Zealand and Australia, respectively (43,106). Stakeholder participation formed part of one step-by-step guide to developing priorities (129), as highlighted in *The world health report 2013* (3).

Priority-setting can be a key feature of wider attempts to strengthen existing NHRSS. In Brazil, 15 000 people from the health, education and science sectors participated in local conferences that informed decisions about research priorities, including indigenous health (70). In Malawi, the Health Research Capacity Strengthening initiative led to development of a national health research agenda (19). Key activities of this initiative included:

- establishing a national task force that identified thematic priority research areas using a Delphi method (i.e. a systematic, interactive way of gaining opinions through at least two rounds of questions);
- carrying out a gap analysis based on literature reviews, key informant interviews and focus group discussions; and
- creating a research agenda draft, which was revised by advisers and members of a national stakeholders' consultative meeting prior to finalization.

The WAHO interventions assisted countries in defining their national research priorities, including through discussion at subregional workshops and the mapping and involvement of national stakeholders (17,38). For example, NHRS development in Guinea-Bissau involved challenging the power that donors have traditionally exercised over research priorities in many LMIC and, instead, gave greater emphasis to research relevant to the needs of the local health system (see Case study 4).

2.2.1.4 Setting and monitoring ethical standards

Ethical review of research is vital to ensure (i) the safety and human rights of research participants and (ii) that the research is being conducted for legitimate purposes with transparency as to who is funding the research and who might benefit



from it. The many issues surrounding ethical review include the responsibility for establishing ethics review committees, the composition and training of its members, and the transparency and accountability of its procedures (4).

Strategy documents can emphasize the importance of functional ethics committees through promoting capacity-building and policies that suggest how these committees could be operationalized and institutionalized. For example, the 2013 Act Institutionalizing the Philippine National Health Research System included a section describing how existing ethics regulations would operate within the system (99). In 2016 the Philippine Health Research Ethics Board accredited 48 research ethics committees and signed a memorandum of understanding with the National Commission on Indigenous Peoples to protect the rights of indigenous people in health research (77).

The WAHO interventions provide an example of regional provision of training on ethical oversight (17,38). *The world health report 2013* presented an abbreviated version of WHO's own comprehensive guidance for research ethics committees, which covers 10 key areas (Annex 2) (3,130).

2.2.1.5 Monitoring and evaluation

Monitoring and evaluation involves regularly checking that the NHRS is running appropriately, including adherence to the priorities set, and evaluating both the system as a whole and the research outputs and outcomes (5). National health research strategy documents were found to increasingly stress the importance of having a monitoring and evaluation framework or plan anchored to the aims and priorities of the country's NHRS (31,33,43,55,63,84). In particular, there is a growing focus in these documents and elsewhere on assessing the wider societal impacts or outcomes of research, in addition to the traditional academic outputs (3,5,50).

Various monitoring approaches have been proposed (55,67). The Iranian evaluation system was praised for innovation in being linked to some functions of the WHO framework for health research systems, but it was criticized for still having too narrow a focus (95,103). In addressing this, a peer-review model that included impact assessment was recently piloted in the Islamic Republic of Iran (23). Careful development of the monitoring and evaluation plan is often required: in the Philippines, too, this involved piloting prior to national implementation (77).

The New Zealand health research strategy proposed evaluating diverse aspects of the whole NHRS, such as the amount and types of health research undertaken,

including in priority areas; partnerships between researchers and health professionals, community organizations and industry; levels of consumer and community involvement in research funding decisions and processes; ethics procedures; bibliometric measures; the amount of research undertaken to reduce inequities and improve health outcomes for Māori and Pacific island people and disabled people; the time taken to translate findings into policies and practices; and the value of production and exports by the medical technology sector (43). PAHO/WHO developed an even more detailed scorecard to assess progress of the 2009 Policy for Health Research that it had agreed with Member States (116). Tools for monitoring and evaluation at the level of the whole NHRS include COHRED's strategic monitoring and evaluation approach (described further in Annex 2) (105).

It is noticeable that in the Islamic Republic of Iran, New Zealand and the Philippines, the proportion of funded projects that were based on local priorities was an important issue. The 2016 Annual Report of the Philippine Council for Health Research and Development (PCHRD), the main body responsible for operationalizing and monitoring NHRS performance, reported that 45 of the 56 priority topics in the National Health Research Agenda had been addressed (77). A more detailed analysis of the topics covered by the outputs of PCHRD-funded research confirmed this picture; however, it went on to claim that, even though the research was aligned to the agenda, it did not necessarily address the health needs of the Philippines (123).

To ensure the implementation of the activities key for the success of a NHRS, monitoring and evaluation of research outputs should look beyond traditional academic factors (50) and consider the wider impact on policy and practice (3,31,32). Attempts to introduce policy-relevant research into the portfolio of a health research system can be undermined if the assessment criteria do not consider the intended application of the research (50).

In England and Ireland (see Case studies 1 and 2), leaders in the health research systems have been keen to promote assessment of the wider impacts of health research outputs and then to use the findings to support the case for further funding (3,50,62,89). This is clearly illustrated in the account of the NIHR's achievements in its first 10 years by the former Director-General, Professor Dame Sally Davies. She highlighted the importance of evaluating both the academic outputs and the wider societal outcomes/impacts (32). In this context, she claimed that "Treasury has been convinced enough of NIHR's value to continue to fund it" (32).

This statement was partly based on an evaluation referred to in *The world health report 2013*, which described the high rate of return from investment in health



research in Australia, the United Kingdom and the United States calculated in terms of the monetary value of the health gains resulting from research translation (3). The report highlighted that appropriate monitoring and evaluation is crucial if NHRSS are to focus on improving health systems (3):

To encourage a shared responsibility among researchers for reaching universal coverage, performance measures could be adjusted within academic and research institutions. Incentives should make reference, not only to publications in high-impact scientific and medical journals, but also to measures of influence on policy and practice.

The world health report 2013 cited the usefulness of approaches such as the Payback Framework (125) that go beyond traditional assessments to include payback categories to assess the impact of research on health policies, on improving health and health equity, and on the economy. The report cited as an example the application of the Payback Framework to assess the impact of the Irish HRB's research (89). It described the health gains and reduced costs resulting from research that had contributed to the development of early intervention services for psychosis (3,89). This payback assessment tool also facilitates learning and knowledge exchange of good practices (125).

The importance of assessing impact was also recognized in LMIC. For example, the strategy document from the Rwandan Ministry of Health suggested that, at the highest level, improvements in research would be reflected in improved evidence use in developing policies and laws that improve health outcomes (31). In addition to monitoring and evaluation approaches developed for specific countries, the NHRS barometer exemplifies a comprehensive approach covering the full range of NHRS functions and components aggregated at regional level (see Annex 2 for more information) (28).

2.2.2 Financing

The financing function has only one operational component: to secure funds and allocate them accountably to support the function and performance of a NHRS.

Research funds can be secured from national sources, donors and other external sources (5). The 1990 Commission on Health Research for Development suggested that at least 2% of national health expenditure should be invested in research and research capacity-building (2). This figure was repeated in international ministerial statements such as the Mexico Statement on Health Research (7), the Bamako Call to Action on Research for Health (69) and *The world health report 2013* (3), with the


last stating that the 2% should be spent on essential national research. The NHRS barometer of performance developed for the WHO African Region incorporated this as one of its indicators for the finance function (28). The target was also incorporated into the PAHO/WHO scorecard (116). Creation of the 2% target and its inclusion as a barometer indicator or scorecard item were intended to encourage and support policy-makers to take action to achieve adequate funding for health research. The Rwandan strategy illustrated how the target could be promoted in a local NHRS strategy to strengthen the case for funding by stating (31):

The WHO recommends that ministries of health allot two per cent (2%) of their annual budget for funding health research. With that in mind, the Ministry of Health will advocate within the government to reach and maintain this level of financial contribution.

The importance of securing a dedicated national budget for health research was illustrated by the work of WAHO, which provided training in resource mobilization for officials from countries with particularly acute resource problems (38). The WHO African Region's NHRS barometer of performance included this as another of its indicators for the finance function (28), and the updated results based on the survey in 2018 showed that the percentage of countries with a budget line for health research had increased from 51% to 62% (11). However, the number of countries achieving the target of 2% of the health budget to be spent on research remained very low.

Adopting a comprehensive systems approach can help with securing NHRS financing and disbursing it appropriately. Just as countries such as Rwanda have developed strategies that include the 2% target, so EU countries developing a health research strategy can use it to highlight the funding opportunities presented by EU research programmes (33,76,84). Furthermore, having a politically supported health research strategy could be important in reducing problems that might arise when a health ministry's budget for research comes under pressure from other parts of the health system. For example, in England prior to the creation of the NIHR in 2006, some funds had been removed from the health system's research and development programme on several occasions to pay for the direct provision of health care (51).

In addition, the more that LMIC develop priority-setting mechanisms, the better positioned they should be to encourage donors to direct funds to local priorities. COHRED proposed that financial stability for health research was boosted both by aligning funding to local and national research priorities (110) and by harmonization among funders to jointly support a local or national agenda (86). This topic is further



discussed in Case study 4 on Guinea-Bissau. In some other African countries, despite some progress in local research priority-setting, there were fears that greater local control over donor funds for health in general was resulting in a reduction in the donor funding being used for health research (26,66). Given the commitment of the Tanzanian Government to support health research, there was a call for greater coordination between donors, and with local agencies, to ensure more focus on the national research agenda and “to deliver a more comprehensive support that builds on research systems rather than on research projects” (66). Further discussion of how the lack of local health research plans and priorities might hinder the ability to attract donor funding was made in relation to the analysis of NHRs in the Pacific island States (27).

Health research priorities can also help to inform the funding of partnerships. For example, the 2020 strategic plan of Inserm (the French National Institute of Health and Medical Research) included an objective to “launch a proactive policy to encourage and accompany consistent international collaborations” (76). The many activities listed included structuring collaborations with Brazil on neurosciences, with China on infectious diseases and with India on chronic metabolic diseases. Other examples of this approach were identified in the Philippines, where the PCHRD collaborated on priorities with the United States National Institutes of Health to create a platform for a coordinated approach to tuberculosis research, and with the United Kingdom’s MRC in a partnership involving infectious disease projects in institutions in both countries (77).

Finally, a systems approach proved useful in demonstrating the benefits of research (e.g. in improving health outcomes) and in showing how the research findings were meeting the needs of the local health-care system (and valuing them in monetary terms); this provided strong evidence to argue for increased funding for health research in countries of all income levels (3,21,62,89,125). *The world health report 2013* emphasized this further by noting that the growing body of evidence showing high returns on investment from health research was adding to the impetus to do more research (3).

Ensuring accountability for fund allocation is also important, and aspects of this were included in the monitoring and evaluation sections of various NHRs strategies (33,43). The relevant section of the Maltese draft strategy (84) was informed by WHO’s Health Research Systems Analysis framework (74,101). The strategy listed the headings that could be used for capturing data about the allocation of funding to various categories of research, including health services research and

research capacity-building (84). Assessing the benefits of research is also a major way of increasing accountability to those who have provided the research funding through taxation or donations to medical research charities (125).

2.2.3 Creating and sustaining resources

This function has only one operational component: to build, strengthen and sustain the human and physical capacity to conduct, absorb and utilize health research. This is achieved through developing adequate capacity of individuals, organizations and systems to conduct, absorb and utilize health research. Health research strategies that comprehensively cover capacity-building are those that develop human capacity at all stages of the research career and include both the human and physical resources required for different fields of research and the skills required to conduct a range of NHRS tasks.

Mapping of health research capacity in 17 countries of the former Soviet Union and south-eastern Europe identified generally low levels of research production and recommendations were made for building capacity across the subregion (1). The main recommendation was for sustained investment in training and career development of researchers that went beyond the simple provision of scholarships for training abroad; instead there should be:

- a comprehensive strategy to ensure that there is a clear career structure, with transition through masters, doctoral and postdoctoral training leading to an adequately remunerated career pathway in organizations that encourage and support high-quality research.

Various NHRS strategies also highlighted the importance of clear career structures (33,34,63,76). A common theme was the importance of providing opportunities for health-care professionals to develop their capacity to conduct research. Following their respective situation analyses, the English and South African strategies addressed priority gaps in the health research workforce. These analyses identified concerns about the need to ensure that research roles remained attractive options for clinicians, as well as to train more health professionals to be researchers (63). In South Africa, the National Health Scholars Programme (an initiative by the national Health Research Committee) aimed to build human resources for health research (34).

Strategies identified in the review emphasized the importance of both human and infrastructural capacity-building efforts in fields ranging from basic research to primary care and public health research (41,63,76). In France, Inserm developed a



health research strategy for 2016–2020 that included proposals to establish a public health research plan that would recognize the importance of capacity in human, economic and social sciences (76). The strategy also supported the compilation of large national and European databases for public health research and described how infrastructure would be boosted across Inserm’s range of activities.

Donors can also play an important part in building the expertise of stakeholders within the NHRS. The Rwandan health research strategy promoted the idea that international researchers could help to strengthen in-service training on research by working with local investigators to design studies (31). Partnerships with either specific institutions (98,100) or a development agency from a wealthier country may provide opportunities for LMIC to build capacity; for example, the Swiss Agency for Development and Cooperation provided support in Tajikistan to strengthen its capacity to evaluate health interventions (61,102). TDR contributed its expertise in capacity-building to a workshop organized by the WHO Regional Office for Europe to assist countries in building their NHRS (44). As reported at the workshop, TDR’s strategy emphasized the importance of supporting regional training centres in LMIC to build capacity for medical research, including in areas such as implementation research, project management and ethics (131). Other approaches identified by TDR included piloting innovative tools such as the Massive Open Online Course and social media platforms to support learning and research (131).

Many countries were found to be making considerable efforts to build their capacity more widely, including to absorb and utilize knowledge. For example, the Maltese strategy included establishing an online portal to support dissemination of information and research evidence (84). The regional partnership between WAHO and other organizations provided capacity-building training on topics including research methodology and ethics (17). In Malawi, a consortium of funders including the Canadian International Development Research Centre, the United Kingdom’s Department for International Development and the Wellcome Trust supported a wide-reaching capacity-building project (Health Research Capacity Strengthening initiative, described in section 2.2.1.3) that included training in how to conduct research, on priority-setting and how to disseminate research findings (19).

Several approaches have been suggested to address the brain drain. For example, national programmes could encourage researchers who trained abroad to return, share their expertise and, where possible, maintain links to the institutions where they were trained. In 2011 a scheme to entice top scientists to return to the country was initiated in the Russian Federation (1). In an approach that could be adopted by LMIC in general, the Rwandan strategy recommended making the country

an appealing place to conduct health research in terms of job requirements and providing opportunities for career advancement (31).

In terms of possible guides for capacity-building, Objective 7 of the comprehensive Inserm strategy set out a range of measures to promote professional careers, and the overall strategy could serve as a guide to many issues relevant to other health research systems, especially in high-income countries (76). One operational guide for measuring sustainable capacity-building efforts was developed based on results from four African case studies (132) and has been cited for its effectiveness in both *The world health report 2013* (3) and a review of the Malawian initiative (19).

2.2.4 Producing and using research

Considerable overlap was found between the three components of this function. Scientifically validated health research aligned to the needs of health policy and practice can be produced in a way that is likely to increase the chance of translating and communicating the research findings to inform policy and practices and of promoting their use to inform the development of tools (e.g. drugs or devices) to improve health.

2.2.4.1 Producing scientifically valid research outputs

Key aspects of the approaches to priority-setting, ethics management, securing finance and capacity-building (sections 2.2.1–2.2.3) will all help to boost the production of scientifically valid research.

It is important to avoid waste by ensuring that research is not only relevant but also well designed and properly reported (35). The EViR consensus statement committed research-funding member organizations to require robust research design, conduct and analysis (113).

The way in which health research evidence is produced can increase the chance that it will be used in the health system. This has several elements. First, research centres can act to drive progress in innovation and translational research. A national health research strategy in England considered that leading medical centres that had substantial funding to conduct translational research could act as “leaders in scientific translation and early adopters of new insights in technologies, techniques and treatments for improving health” (63). Examples of such centres included the Dutch university medical centres, the Massachusetts General Hospital and Mayo Clinic (United States) and the Swedish Karolinska Institute (64).



Secondly, and more generally, funding research production widely within a country was found to improve the ability of clinicians and health-care organizations throughout the system to absorb and appropriately use research findings and thus improved their performance (5,50,72,125). A review of *The world health report 2013* cited an evidence synthesis that found that clinicians and health-care organizations that took part in research seemed more likely to apply the findings of both their own studies (which they knew and trusted) and those from the global literature, of which they were more likely to be aware because of their own active involvement in research (3,72,133). The evidence synthesis also suggested that the active collaboration of policy-makers and the health system in conducting and producing research might increase the use of research in policy and management decisions about health-care systems, with a range of examples from studies in Canada, the United Kingdom and the United States (133).

In England, the strategy of the NIHR includes a dual approach reflecting both mechanisms. The NIHR funds biomedical research centres in which leading researchers work in well-resourced NHS/university partnerships “to drive progress on innovation and translational research in biomedicine into NHS practice” (32). Additionally, it funds wide-ranging research networks that support the integration of health research and patient care through encouraging health-care professionals from all parts of the country to participate in research (64).

The production of research outputs varies greatly between countries, but attempts to increase the publication rate were identified in many systems. Analysis of publications between 2008 and 2013 from 17 countries of the former Soviet Union and south-eastern Europe found a generally low (though increasing) number of papers per head of population, except in Lithuania, which had a higher publication rate (1). Features of the Lithuanian system were reported to include having a detailed programmes of health research (one of only two countries out of the 17), a long record of participation in international collaborative studies and a health ministry with mechanisms to support public engagement with the research findings (1). Specific initiatives in LMIC to boost the production of research outputs included the first WAHO intervention, which created a regional peer-reviewed, multilingual journal (17). In the Philippines, PCHRD partnered with national and Asian Pacific associations of journal editors to provide training in writing journal articles to a total of 71 young researchers in two regions of the country in 2016 (77). A large expansion of medical research centres in the Islamic Republic of Iran led to a considerable increase in the number of Iranian research articles (115). As a final example, the Rwandan health research strategy highlighted the need to increase

the number of publications in international peer-reviewed journals by Rwandan researchers (31).

2.2.4.2 Translating and communicating research

Research strategies can describe coproduction approaches so that research translation (or knowledge mobilization) processes start well before the formal reporting stage. Comprehensive national strategies for health research give considerable attention to evidence syntheses and to implementing research findings within the health system through both knowledge management and knowledge translation. The Irish HRB facilitated evidence-informed decisions by promoting access to the Cochrane Library and supporting training for individuals and groups to conduct high-quality Cochrane reviews (33). The English NIHR strategy proposed a unified knowledge management system to meet the needs of stakeholders, including patients and their carers. Key pillars of the strategy included supporting Cochrane, and the NHS Centre for Reviews and Dissemination (63). The Rwandan health research strategy stated that “[t]he Government of Rwanda is committed to using research findings to make evidence-based decisions that will improve health in Rwanda”, and oriented its various functions, including agenda setting, capacity-building and monitoring and evaluation, to facilitate this (31). Other examples of actions identified from NHRs in LMIC include the role of a Department of Health programme in the Philippines in producing health policy notes (or policy briefs) (77) and the key role of the South African Cochrane Centre in conducting evidence syntheses and the importance attached to utilizing research findings in South Africa (34,86).

A published review identified the types of research programme that have produced research utilized by local clinicians and policy-makers (134), as did a Dutch primary study (135). Both were included in a wide-ranging collation of papers on the functions of health research systems (42). The review analysed the findings of separate impact assessments for 36 specific health research programmes and identified those programmes in which an above-average proportion of projects claimed to have made an impact on health policy (134). These programmes often had features such as conducting research to meet the needs of the health-care system and collaboration with potential users, and sometimes also had structures encouraging research use. Those high-impact programmes with at least one of these features included primary care and health promotion research in Australia; HTA research in Austria, Canada and the United Kingdom; and health services research in Belgium (134). This evidence might suggest that incorporating such features more widely into health research systems would boost research use. However, a study of working at the nexus of public health policy, practice and



research in the Netherlands illustrated some of the complexities that have to be addressed. Consequently, there are several challenges: identifying ways of engaging busy practitioners and policy-makers with research evidence; ensuring that researchers become better acquainted with the problems practitioners and policy-makers face; and facilitating collaborations and exchange of information between these groups (135).

Evidence showed that WHO regional offices particularly focus on knowledge translation and the use of health research in their activities to strengthen NHRSS. For example, the WHO Regional Office for Europe's workshop to promote a systems approach to health research recorded that participants supported WHO's efforts to assist Member States "to develop a comprehensive health research strategy that provides a systematic approach to managing health research and leads to evidence-informed policy-making" (44). The PAHO/WHO scorecard to assess the progress of its policy for health research included items about work in cooperation with its specialist centres (e.g. the Latin American and Caribbean Center on Health Sciences Information) to index and organize research evidence, as well as work with the media to improve public understanding and the scientific literacy of policy-makers and health providers (116).

WHO reports on health research highlighted a range of key initiatives aimed at assisting the utilization of evidence. The *World report on knowledge for better health* described the establishment of the Health Evidence Network (HEN) by the WHO Regional Office for Europe as a method to provide policy-makers with the evidence they need to make key decisions on health (6). *The world health report 2013* described the important role of several Internet-based platforms for sharing knowledge (3), including Health Systems Evidence, a continuously updated repository of evidence about health systems developed by the McMaster Health Forum in Canada, and PDQ-Evidence, which is maintained by the Pontifical Catholic University of Chile to provide evidence about public health and health systems and services.

EVIPNet is an initiative to promote the use of research in policy (136). It aims to strengthen health systems by linking the results of scientific research to the development of health policy through synthesizing research findings, producing evidence briefs and organizing policy dialogues that bring together policy-makers, citizen groups and researchers (3,136). EVIPNet's mandate is to strengthen country capacity in planning, implementing, monitoring and evaluating research-to-policy activities and in establishing institutionalized knowledge translation mechanisms to catalyse system changes. EVIPNet has had widespread support across all WHO regions, including in the WHO European Region, where EVIPNet Europe

supports 21 Member States in systematically and transparently using national and global health research evidence in policy (16,13,56,78,86,136). The SUPPORT tools were derived from the Supporting Policy relevant Reviews and Trials project and are a further initiative to support evidence-informed health policy-making (137). The SUPPORT tools are a series of guides that give the steps required for using scientific evidence to inform health policy (137). EVIPNet promotes these tools at country level.

2.2.4.3 Promoting the use of research to develop new tools to improve health

National health research strategies were found to increasingly focus on innovation and commercial opportunities and, hence, also on the desirability of promoting links and networks between publicly funded research and private sector companies that might use research findings to develop new tools such as drugs and devices to improve health (33,43,63,76,84,88). In England, the vision of the health research strategy included improving “the health and wealth of the nation” (63); an important aspect of the approach towards industry has been “to attract its involvement and its expertise in translating knowledge into better health care interventions” (32).

The Inserm strategy described how a planned increase in public health research capacity in France would be accompanied by initiatives to reinforce the continuum between research and technical expertise by strengthening interactions between researchers and policy-makers (76). The Organisation for Economic Co-operation and Development provides advice about research and innovation to high-income countries. Its 2017 report on Norway noted that the high level of publicly funded health research was not fully matched by the level of innovation in the health system (47). Its recommendations to address this included engaging a wide range of stakeholders and supporting proposals for greater coordination across the system.

In LMIC the increased focus on innovation was reflected in one of the key recommendations from the 2015 meeting in Manila of the Global Forum on Research and Innovation for Health (60), which emphasized the need for new strategies for translating evidence into viable and sustainable interventions. PCHRD in the Philippines reported in 2016 that it continued to support the discovery and development of drugs from natural products, particularly those endemic to the country (77). In South Africa there has also been an increasing focus on the need to organize the health research system in ways that encourage commercialization (96). Finally, the PAHO/WHO scorecard includes an item on facilitating communication between the public health and industrial sectors to encourage the development of new products and procedures (116).



2.3 Effectiveness of approaches to strengthen NHRs

This section collates evidence from sections 2.1 and 2.2 to inform an assessment of the possible effectiveness of the key policies and interventions for establishing and strengthening NHRs. The evidence is structured around two approaches: (i) actions taken in a single country to develop strategies and policies, and (ii) multicountry initiatives. There are some inevitable overlaps.

2.3.1 Effectiveness of comprehensive strategies and policies in single countries

This section starts by considering the effectiveness of the policy of having a comprehensive, coherent health research strategy covering a range of health research system functions in the European countries described in Case studies 1 and 2. It then considers the effectiveness of attempts by four non-European countries (the Islamic Republic of Iran, the Philippines, Rwanda and South Africa) to strengthen their NHRs by adopting comprehensive approaches and policies.

2.3.1.1 The English NIHR

Given the ambitious reforms introduced with the creation of the NIHR in England, some aspects proved difficult to implement (59). The NIHR also appeared to suffer from at least some of the waste problems previously identified as a global problem (35). It responded to these challenges in a systematic way through the internal Adding Value project (which was independently judged to have made good progress (71)) and by co-coordinating the EViR Funders' Collaboration and Development Forum (113,128). Furthermore, the NIHR developed the Push the Pace project to improve health research management by identifying bottlenecks and barriers within the system and reducing the time taken for various research processes (71,121).

Various performance analyses conducted to mark the NIHR's 10th anniversary identified a range of successes (71). One hundred examples of positive change were identified and brought together under the heading "NIHR at 10: 100 examples, 10 themes, 1 transformation" (138). The 10 themes of positive change included the involvement of patients in decisions about the research priorities and processes, which increases the likelihood of research meeting the needs of the health system. A recent review highlighted England and Alberta (Canada) as having health research systems that had made important progress in this field (119).

The examples described in the review of NIHR successes illustrated that interactions and synergies between research infrastructure and culture, between projects and the system, and between patients and researchers supported system-level change in health research. The analysis found evidence of considerable NIHR impact in terms of “patient benefits, the delivery of health and social care, public policy, economic growth and the generation of knowledge” (138).

It is highly significant that the 10 themes were described as one transformation because this emphasizes that success of the NIHR depended on a range of components (71). In her review, Davies noted: “What we envisaged was integrating a health research system into the health care delivery system so that the two would become interdependent and synergistic” (32). The success of the NIHR was identified in commissioned independent assessments of the value or payback of the funded research, which helped to secure continued funding (32).

2.3.1.2 The Irish HRB

A 2014 report on behalf of the Irish Medical Research Charities Group described the opinions of Irish researchers on the nation’s health research, including but not limited to the HRB, and identified the coexistence of many enabling features that contribute to excellent health research but also some barriers (73). A recurrent theme was that “health research funders are selectively funding particular areas of research” and “[r]esearch that is likely to deliver commercial outcomes or that is directly relevant to health services is ... most likely to achieve funding”. Although these latter comments may have been intended as criticisms, they also indicate that HRB funding, at least, was consistent with stated objectives.

The HRB strategy developed subsequent to the 2014 report consulted a wide range of stakeholders, and overall a key effectiveness factor has been the use of a systems approach to build up the HRB in a comprehensive way to serve the health system. The seed funding with matched government support helped to start the process of generating a better funded, more organized system (89). The HRB’s strengths include clear leadership for health research and its consultation and close links with the Department of Health: it used the Department’s policies and strategies as an important source for its own strategy (33). Furthermore, an external study to identify progress in meeting the objectives of the previous strategy was used to inform the new strategy (33). HRB’s systematic approach was later further strengthened by its membership of the EViR Funders’ Collaboration and Development Forum and its commitment to develop and share new approaches to increasing the value of health-related research, made through its endorsement of the Forum’s consensus statement (113,128).



2.3.1.3 Four non-European countries

Evidence on the effectiveness of strategies and policies in four non-European countries illustrates a range of points.

The Philippines. Legislation was used as the policy approach in the Philippines to create a comprehensive NHRS strategy (65,99). The 2016 Annual Report of PCHRD described progress in the Philippines on many NHRS functions and components, including priority-setting, ethics, monitoring and evaluation, financing and the production and use of research (see sections 2.2.1, 2.2.2 and 2.2.4) (77). As with the English and Irish strategies (section 2.1), a key factor was the comprehensiveness and coherence of the approach, which prompted concerted action among NHRS functions. However, several analyses indicated that, despite progress in many areas, improvements are still needed, for example in securing adequate funding to boost the number of research publications and in the use of research in the health system (118,123).

South Africa. An early adoption of the essential national health research approach (2,94) may partly explain the findings of a local evaluation that identified stewardship arrangements as one of the strengths of the South African NHRS (34,94). Another strength was identified as the synthesis and utilization of research findings, and specifically the role of the South African Cochrane Centre (34). A weakness was underfunding, which limited the number of training programmes and clinical research centres (34). In developing a comprehensive, coherent strategy for the NHRS, detailed stakeholder engagement was deployed so that policies were developed to address the identified weaknesses (34). More recently, the South African Government has increased its funding for health research, sometimes meeting the target of 2% of its national health budget, but further work is claimed to be required to bring more coherence into resource expenditure and to emphasize commercialization (96). When the findings of the 2014 and 2018 surveys on NHRS performance conducted by WHO's Regional Office for Africa were subsequently analysed using the NHRS performance barometer (24,28), South Africa was found to have the second-best and best performance, respectively.

Rwanda. An analysis of the potential to expand health research in countries with a limited NHRS, which included Rwanda, focused on two factors: the health research capacity and the political commitment to health research in the country (25). It identified Rwanda as one of the countries that was making progress in fields such as health and higher education and might benefit from additional targeted investment in research capacity-building (25). In 2012 Rwanda's political commitment to health research was demonstrated by

the Ministry of Health's publication of their comprehensive strategy (31). That document itself identified the large challenges facing Rwandan health research but predicted that "[a] tremendous amount of high level political commitment for promotion of health research ... will help move health research in Rwanda forward". Comprehensive plans related to various NHRS functions have been described in sections 2.1 and 2.2, and it is claimed that the increased use of evidence in policy-making has boosted health gains (139). In the 2014 survey of NHRS performance, Rwanda's score of 81% was the highest of any African country (28). In the 2018 survey, Rwanda's performance had improved but South Africa's improvement was even greater (24).

The Islamic Republic of Iran. A recent review the many NHRS policy developments identified substantial progress in some components such as ethics review, monitoring mechanisms and capacity-building, but suggested improvements were needed in securing and allocating finance and in the use of evidence (23). Analysis of the 1985 policy of integrating the country's medical and health education into the Ministry of Health suggested that the policy successfully improved the health system through boosting the numbers admitted to medical schools (78,83). However, the policy's impact on linking research to action was more mixed. In group discussions, some stakeholders thought that additional opportunities for research had been created in peripheral regions of the country, interaction between researchers and decision-makers had improved and knowledge required for decision-making was being produced (83). However, criticisms included perceptions that university independence had been weakened and that the policy might have resulted in resources (i.e. the time of clinical academics, especially in large universities) being diverted from research to the direct provision of health care.

2.3.2 Effectiveness of partnerships and multicountry interventions

This section discusses the effectiveness of some of the identified partnerships and multicountry interventions described in section 2.1.2. These were mostly bilateral or within regions/subregions, but there is growing recognition that the WHO Global Observatory on Health Research and Development (10,71) has the potential to guide efforts to strengthen health research governance among Member States (45).

The long-term activities of the WHO's Regional Office for Africa in encouraging action to strengthen NHRSs in the Region (including repeated health research surveys) has contributed towards a general trend of improvement in national systems. A study that compared the results of applying the NHRS barometer to the



findings from the 2014 and 2018 surveys found improvement over time in both the average score for many items and the overall score for most countries (24). Similarly, a comparison of relevant findings of the first three surveys in 2003, 2009 and 2014 found that numbers of countries with official health research policies, strategic plans and a functional NHRS had increased over time (Table 2) (16). However, of the 22 African countries that had reported having a national strategic health research plan in the 2014 survey, only eight were implementing it. Furthermore, a study of the NHRS in three African countries claimed that implementation of policies and strategies was generally rated as poor because of “lack of policy coherence, lack of enforcement and accountability mechanisms, and a lack of financing for implementing the policies” (30).

Thorough evaluations of the comprehensive interventions included in the first WAHO initiative suggested that the participating countries had made most progress in governance and management, but that sustained efforts would be required to achieve fully functioning NHRSs (Case study 3) (17,38). Progress in this initiative was variable across the 15 countries and sometimes limited by difficult political and conflict situations. Challenges included high staff turnover, weak institutional capacities and ineffective collaboration (17). However, political will and understanding within the Economic Community of West African States helped WAHO to achieve some successes (17). There was support for the comprehensive approaches undertaken within the resources available to address the problems identified in the situation analyses (17,38).

In the second WAHO intervention, all four countries developed at least one policy, plan or research agenda, and all four adopted a research information management system (38). There was some capacity-building, but limited progress was made on creating a budget line within the health ministry to finance research and on developing dissemination mechanisms. In the overall assessment, WAHO’s supporting role was considered as both necessary and appreciated by the countries in a 2017 evaluation, and some progress was seen from its systematic, participatory approach, even in post-conflict countries. Nevertheless, the evaluation concluded:

capacity building for an entire national research system is a significant task requiring long-term commitment. The project helped improve the national environment in four countries, but did not address all the local challenges that impact the overall strength of a NHRS.

By the end of the WAHO intervention in 2015, the before-and-after analysis for Guinea-Bissau recorded progress in several areas related to governance and

management (Case study 4) (38). The country had successfully created a list of stakeholders in health research; a research policy, plan and agenda; and a health research monitoring and indicators system. Limited progress had been made in research capacity-building: 39 people had received training. However, the analysis did not record overall improvements in financing and diffusion or in the use of research results. Possible explanations are that the body in charge of research at the health ministry (which was responsible for implementing the project) twice had a change of leadership (38) and there was a coup in 2012. Analyses of NHRSs in African countries demonstrated a general trend towards improvement (16,24), but the overall performance in Guinea-Bissau was better than in various African countries with greater resources (28).

Within the Pacific island States, the Cook Islands had made progress with its NHRS partly through cooperation with health researchers in New Zealand, where, for example, institutions provided ethics advice (27). An evaluation of progress in developing NHRSs in the Pacific island States, noted it was highly variable and concluded that “[f]actors favouring improvements in NHRS were political stability, health research leaders and collaboration with a well-developed NHRS as in the case of the Cook Islands” (27). Significantly, it was also suggested that collaboration and resource-sharing with other Pacific and Pacific-rim countries would allow each country to cover some rather than all components of a NHRS, with others provided elsewhere.

PAHO/WHO’s efforts to promote NHRSs were reported to have played a key role in strengthening health research in Caribbean countries (57). Also, while the specific policy on health research developed by PAHO/WHO and its Member States was not often cited in the policies of the individual Member States, it had been used comprehensively to inform the development of the NHRS in Paraguay (117).

Finally, a detailed situation analysis was successfully conducted in central Asian countries in 2007 with the help of COHRED (15). Later research found that limited progress had been made since the initial analysis (1), illustrating that factors such as sustained political support are also required.



3. DISCUSSION

3.1 Strengths and limitations of the review

This is the first known systematic search for worldwide evidence on policies, interventions and tools for establishing and strengthening NHRSSs.² Theoretical perspectives were used to help to organize the wide-ranging empirical literature identified (5,50,51). In particular, the original WHO framework was applied to guide the analysis and presentation of literature in this review (5). The theoretical perspectives used in interpretation of some of the empirical studies revealed the often-limited progress and obstacles faced in developing NHRSSs.

There are inevitable limitations in the amount and quality of the data that could be gathered in a scoping review covering many countries over differing time periods. Further limitations included the nature of the body of literature identified, much of which described rather than precisely evaluated the state and development of health research in countries at a specific time. However, this limitation was partially addressed in two ways: (i) by ensuring that some documents cited in each case study were published between 2015 and 2019, which means that accounts of countries used for the case studies, at least, are reasonably current; and (ii) by including a series of surveys from the WHO African Region that reviewed NHRS developments for more than a decade (16,24).

Reports describing policies and strategies for NHRS development were identified from some countries, but inconsistent reporting of NHRS organization across countries made systematic searches challenging. Furthermore, given that some of the reports published on the Internet were over 10 years old, it is possible that equivalent reports from other countries might have since been removed. A further limitation is that reports in the grey literature published in non-English languages were excluded unless translations were available.

Finally, the review deliberately concentrated on publications with a systems approach. Therefore, the review generally excluded publications that focused solely on a specific function or component of health research without discussing its contribution to the establishment and strengthening of a NHRS. However,

² Ismail et al. previously conducted a systematic search for literature on NHRSSs, but it was limited to materials on Eastern Mediterranean countries (78).

such publications could be synthesized in a further HEN report. The detailed 2018 review of the evolution of the Iranian NHRS illustrates the huge scale of the task that would be involved in conducting a single evidence synthesis to cover all papers on every function and component of all health research systems globally (23).

Further research could include reviews with a narrower focus on strengthening specific function(s) of a NHRS. It would be useful to conduct a scoping analysis of the links between evidence produced by the NHRS and by the health management information system,³ as noted for Rwanda (139). This could build on ideas outlined in COHRED's guide to building and strengthening NHRSs (54). Finally, it would be useful to explore at greater length the range of possible frameworks for NHRSs, including those proposed at the WHO European Region's workshop on NHRSs in November 2017 (44). This would allow a fuller discussion of the appropriate boundaries of NHRSs and take account of how health research systems are perceived by policy-makers.

3.2 Key approaches for NHRS strengthening

The review identified the main approaches linked to strengthening health research systems as an initial assessment of the local context; sustained political commitment to a comprehensive strategy covering the four functions of an NHRS (stewardship and governance, securing funding, capacity-building, and producing and using research); engagement with stakeholders in developing and implementing a strategy; appropriate monitoring and evaluation linked to the system's objectives; and, particularly in low-income countries, development of partnerships.

The importance of identifying approaches to NHRS strengthening was highlighted by evidence within some regions/subregions that the differences in NHRS performance are not explained by the relative wealth of the countries (1,27,28). Therefore, other factors might be responsible. Several factors linked to effective strengthening of health research systems (section 2.3) also clearly emerged in the findings related to NHRS functions and components (section 2.2) and in the case studies.

Situation analysis often featured heavily as a vital first step in the creation of comprehensive national strategies (33,43,55,63,64,84) and the actions taken in regional collaborative interventions such as those by WAHO (17). Reforms are more likely to be successful if the need for change is understood, and policy-makers might

³ Defined as "an information system specially designed to assist in the management and planning of health programmes, as opposed to delivery of care" (140).



be more likely to commit to them if they can develop a common understanding of how a health research system best operates.

The analysis of various functions and components demonstrate that stakeholders (i.e. policy-makers, health-care professionals, patients, the public, industry and researchers themselves) play an increasingly important role in various aspects of strengthening health research systems, including the creation of national strategies, the development of relevant research agendas and the processes and uptake of research (18,19,31–34,43,63–65,70,76,84,88,99,119,134). There is an increasing focus on how to maximize the benefits from engaging with patients and the public in health research systems. The crucial role of stakeholder engagement was underlined by an analysis of what the different types of stakeholder might need from a health research system (50). Reforms of the English health research system seemed to meet the needs of many stakeholders and, importantly, helped to retain their commitment to the system (50). Finally, inadequate stakeholder participation in research was identified as a key challenge in a review of 28 single-country case studies describing NHRS development in 26 LMIC (20).

To ensure the implementation of activities key for the success of a NHRS, it was often seen as important that monitoring and evaluation should assess the extent of wider impact on policy and practice from the research (3,31,32). Furthermore, all parts of the NHRS should be striving to achieve the agreed vision and objectives (105). *The world health report 2013* emphasized the importance of assessing and demonstrating the wider impacts of health research (3). This was illustrated by a recent analysis of the Iranian NHRS that referred to a claim that failure to increase expenditure on research and development was linked to “policy-makers’ lack of belief in the return of investment in research” (23).

Organizations responsible for promoting health and health research often recognize that the tasks involved in NHRS strengthening are important but are particularly challenging when resources are limited. Therefore, there have been sustained efforts to build partnerships and regional collaborations, most notably in Africa. Evidence on the WAHO initiative illustrated that groups of LMIC have achieved some successes through joint action and collaboration, although substantial challenges remain (17,38). A similar situation has been identified for the Caribbean countries, where subregional efforts were seen to play a key role in strengthening research for health in one of the most needed areas in the PAHO Region (57). Over the years, other calls have been made for collaboration between groups of LMIC wishing to make progress in building their NHRS (15,27,29,44).

Finally, the case studies illustrated key emerging themes, including the value of situation analyses, sustained political commitment to comprehensive and coherent strategies, involvement of the health ministry (or a research council responsible to it), stakeholder involvement in NHRS development and operation, monitoring and evaluation that focus on the main aims of the NHRS, and investment in collaborations and partnerships.

3.3 Policy considerations

The evidence derived from this analysis suggests that establishing an effective NHRS requires sustained commitment and funding, as well as the involvement of the health ministry. Based on the findings of the review, the main policy considerations to establish or strengthen a NHRS are to:

- undertake an analysis of the current state of health research in the country to inform the development of national health research policies and strategies – this can be a one-off activity in an individual country or part of a multicountry initiative with organizations such as WHO;
- develop, apply and sustain a comprehensive strategy (policy or legislation) for health research covering all four health research system functions (stewardship and governance, financing, capacity-building, and producing and using research) and aligned with the national vision and health priorities;
- embed stakeholder engagement into the development and routine implementation of the health research strategy to improve priority-setting, enhance the likelihood of research translation and increase the commitment of, and support from, key health research stakeholders;
- develop and apply monitoring and evaluation tools that focus on demonstrating the benefits of health research systems in improving health policies and systems, and facilitate learning and knowledge exchange of good practices among key actors in the system, including helping to inform implementation research and processes; and
- invest in and advocate for intercountry (and in-country) health research partnerships and regional collaboration.




4. CONCLUSIONS

This report found evidence from a range of countries worldwide on policies, interventions and tools for establishing and strengthening NHRSs and on their effectiveness. It described how health research is important to improving health and how the challenges of securing sufficient research funding and capacity, and then using them effectively, has led to renewed interest in adopting a systems approach to strengthen the four functions of a NHRS (stewardship, financing, capacity-building, and producing and using research). Where appropriate, the ultimate aim can be integrating the NHRS into the health system in order to better inform policies and improve health. It is also important to ensure that resources are used as effectively as possible in order to avoid waste. The report highlighted how a health research strategy plays a key role in creating an overall system that is stronger because it combines diverse interventions related to specific functions. Key approaches to establish and strengthen a NHRS include sustained political commitment to a comprehensive strategy, as informed by a situation analysis; involvement of the health ministry; engagement with stakeholders; appropriate monitoring and evaluation frameworks; and investment in multilateral/bilateral partnerships or collaborations.

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ANNEX 1. SEARCH STRATEGY

Databases and websites

A search of peer-reviewed literature in the Scopus database was carried out up to September 2017 and updated in September 2019, with no restrictions on geographical region, publication date or document type. A structured search of grey literature using the more basic and less-stable Google advanced search engine applied a similar but simplified search strategy. A detailed search of the COHRED website and a review of the reference lists of key papers (including snowball searching) were also performed to identify further records. Seven additional relevant papers known to the authors were also added: one for each of three countries included as case studies, three published too recently to have been added to the Scopus database and one related to a key theme in the report. Subsequently, eight additional publications were included following recommendations from an expert peer reviewer.

Study selection

Two reviewers first screened the title and abstract of identified records independently based on inclusion and exclusion criteria.

Inclusion criteria were that the paper was published in English or had been translated into English, and covered any of the following:

- discussed health research systems;
- discussed policies of health research systems;
- reported tools to support health research system strengthening or development;
- discussed interventions to promote or strengthen health research systems; or
- evaluated health research system interventions.

Exclusion criteria were that the paper:

- was published in a non-English language, with no available English translation;
- reported only a single function of the country's health research system (e.g. a disease-specific component) or a single subject area (e.g. nursing), health research on policy, tools to support health systems research, interventions to promote health or health systems, or a research evaluation;
- contained duplicate information (e.g. information reported in both peer-reviewed publications and organizational reports/conference presentations); or
- was an editorial, unless it added any information not already covered in the core papers.

Disagreements were resolved through discussion. In reviewing the full papers using the same inclusion and exclusion criteria, some papers that from their title appeared only to cover capacity-building, and therefore would have been excluded because their focus was narrower than that of the systems approach, also turned out to adopt a broader perspective and were relevant to the evidence synthesis. Additionally, following initial decisions based on the predetermined criteria, the authors also realized that some countries would be useful to include as case studies. A decision was made to include additional papers from candidate countries that had been identified in the searches but might otherwise have been excluded because they added little to the extracted data even if they were not exact duplicates.

A total of 1507 documents were identified in the literature search and 37 were retrieved through other means. After duplicate removal, 1287 were assessed by title and abstract screening and 145 full-text articles were assessed for eligibility. A final group of 112 were included in the narrative review.

Search terms

The following Medical Subject Headings (MeSH) terms and keywords were used for searching the Scopus database and the Google search engine (including specific searches of the WHO and COHRED domains).

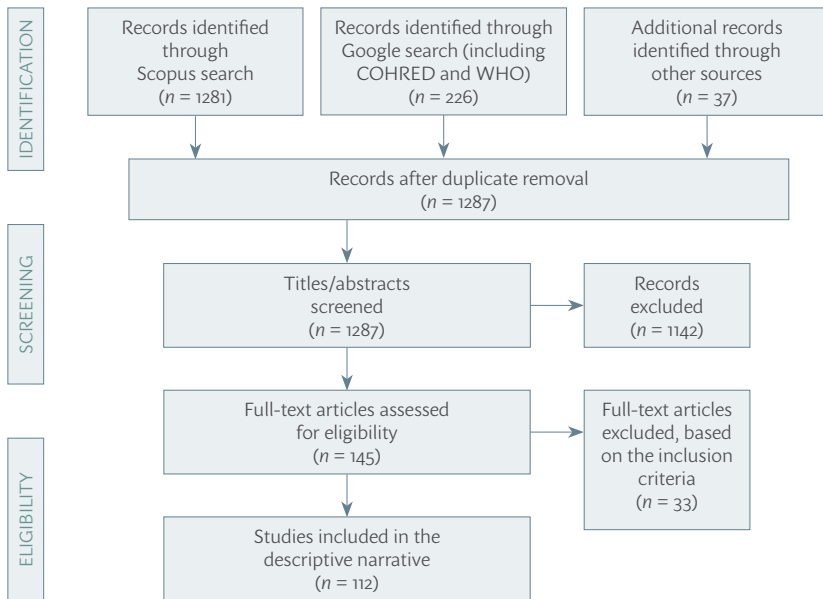
((TITLE ((health AND research) AND (system OR systems OR environment OR organisation OR organization OR structure OR strategy OR governance)) OR ABS ("Health Services Research")) AND (LIMIT-TO (SUBJAREA, "MEDI") OR LIMIT-TO (SUBJAREA, "SOC") OR LIMIT-TO (SUBJAREA, "MULT") OR LIMIT-TO (SUBJAREA, "NURS") OR LIMIT-TO (SUBJAREA, "HEAL") OR LIMIT-TO (SUBJAREA, "PHAR") OR LIMIT-TO (SUBJAREA, "DENT") OR LIMIT-TO (SUBJAREA, "PSYC") OR LIMIT-TO (SUBJAREA, "Undefined"))) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (EXACTKEYWORD, "Health Services Research") OR LIMIT-TO (EXACTKEYWORD, "Research") OR LIMIT-TO (EXACTKEYWORD, "Medical Research") OR LIMIT-TO (EXACTKEYWORD, "Organization And Management") OR LIMIT-TO (EXACTKEYWORD, "Health Care Policy") OR LIMIT-TO (EXACTKEYWORD, "World Health Organization") OR LIMIT-TO (EXACTKEYWORD, "Public Health") OR LIMIT-TO (EXACTKEYWORD, "Public Health Administration")))

Fig. A1.1 illustrates the selection of studies based on the PRISMA statement (1).

Data extraction and analysis

The reviewers designed a data extraction template, piloted it using three of the identified records and agreed on the results.

Fig. A1.1. Selection of studies



Potential policies, interventions and tools were analysed in relation to two overlapping dimensions: (i) establishing and strengthening the overall systems approach (i.e. building a holistic NHRS at country level, irrespective of the amount of research activity already being conducted); and (ii) learning lessons from the literature on the overall approach to increase and improve specific components of the NHRS and thereby improve health research activities in a country.

As this report is descriptive, no attempt was made to assess the quality of the included studies. However, for the case studies, multiple reports were used to improve the quality and depth of reporting.

Reference

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ANNEX 2. TOOLS TO SUPPORT NHRS DEVELOPMENT

Various items identified directly in the literature search, or cited in papers included in the synthesis, might provide supporting materials for NHRS development (Table A2.1).

Table A2.1. Tools for NHRS development

Tool	Description
WHO	
Global Observatory on Health R&D (website) (1)	The Observatory is a central source of information and analyses on research and development. The website promotes information about various functions for NHRS development
Standards and operational guidance for ethics committees dealing with research involving human participants (2)	This guidance provides comprehensive guidance related to all aspects of the work of ethics review committees, including in relation to their legal framework, membership and role
Checklist for health research priority setting (3)	The checklist with its nine common themes of good practice is intended to provide generic assistance for planning health research prioritization processes. It explains what needs to be clarified in order to establish priority-setting contexts, reviews approaches to health research priority-setting, discusses stakeholder participation and information gathering, describes options for the use of criteria and methods for deciding upon priorities, and emphasizes the importance of well-planned implementation, evaluation and transparency
The NHRS barometer (4)	The barometer was developed to analyse NHRS performance all 47 countries in the WHO African Region. It is a comprehensive approach to comparative measure that can be used to gather and organize data on 17 items broadly organized according to the four functions of the NHRS. Although developed to be applied to all countries in the Region, individual countries might use it to consider their performance

Table A2.1 contd

Tool	Description
WHO	
TDR strategy for 2018–2023 (5)	The current strategy promotes the TDR's objective of strengthening the capacity of disease-affected countries to perform research themselves. In addition to developing new tools such as massive open online courses that aim to substantially increase the research capacity in LMIC, TDR has built an implicit component of research capacity strengthening into all of the research activities it supports
COHRED^a	
Guide to developing and managing effective health research systems (6)	This 2006 (draft) guide for managers provides many insights for those building a NHRS and proposes a country-led, intersectoral, systems approach based on local evidence. It provides a framework for examining the functioning of a system, a process within which practical steps to manage development efforts can be planned and a series of technical components that can be tailored to a country's particular needs and contexts
Management process for priority-setting in research for health (7)	This comprehensive priority-setting guide is intended to help users design the most appropriate process for their country. Six practical steps are identified and form a cyclical management process: assessing the situation, setting the scene, choosing the best methods, planning priority-setting, setting priorities, and making priorities work
The Research Fairness Initiative website (8)	The website provides guides to high-quality reporting on 17 measures and conditions that promote fair research partnerships. The Initiative encourages all stakeholders in research and innovation for health to describe what is done within their organization to promote fair partnerships in three broad areas: before research happens (fairness of opportunity), during research (fair process) and after research (fair benefit sharing)



Table A2.1 contd

Tool	Description
COHRED^a	
Monitoring and evaluation resource for NHRS (9)	This monitoring and evaluation guide presents a strategic approach for national research governance institutions to demonstrate their return on investments in such a way that institutions can begin to show how far they contribute to the social good. The approach is intended to provide organizations with the information they need for forward planning, internal learning and for garnering political backing and funding to support the research system in their country. Initial outcome mapping to understand the vision and mission of an institution is followed by looking at which external partners need to be influenced to achieve the desired outcomes. In this way, all of the processes, activities and results that the institution would like to achieve are linked to its mission and vision
Other sources	
EViR Funders' Collaboration and Development Forum (10)	The Forum's consensus statement commits research funding organizations such as England's NIHR to work together to develop new approaches to increasing the value of health-related research. It identifies areas that need attention, such as priority-setting, regulation and management, accessibility and use of findings
The Payback Framework (11)	The Framework describes how both the academic and wider impacts of health research can be assessed. It consists of two elements: (i) the multidimensional categorization of benefits covers both two traditional academic benefits (knowledge production and the training of future researchers) and three wider societal impacts (informing policy-making and product development, improvements to health and healthy equity, and broader economic benefits); and (ii) the organization of assessment of the research to indicate where the various categories of impact might arise

Table A2.1 contd

Tool	Description
Indicators of sustainable capacity-building in health research (12)	The indicators cover the increasing complexity that arises as projects mature. They include the awareness and experiential stages (early engagement of stakeholders, explicit plans for scaling up, strategies for influencing policies, quality assessments), the expansion stage (improved resources, institutionalization of activities, innovation) and the consolidation stage (securing funding for core activities, management and decision-making)
Inserm 2020 strategic plan to anticipate future challenges (13)	Objective 7 of the plan sets out a range of measures to promote professional careers through the development of existing potential and new recruitment
SUPPORT tools for evidence-informed health policy-making (14)	The tools are a series of 18 guides that can be used by those involved in finding and using research evidence to support evidence-informed health policy-making. The guides cover four broad areas: supporting evidence-informed policy-making; identifying needs for research evidence in relation to three steps in policy-making processes (problem clarification, options framing and implementation planning), finding and assessing systematic reviews and other types of evidence to inform the steps, and moving from research evidence to decisions (including the role of policy briefs and policy dialogues)

^a COHRED provides a stream of useful materials including frameworks for assessing and strengthening NHRs: the first is a generic guide covering many topics and the other three address specific components.

R&D: research and development; TDR: Special Programme for Research and Training in Tropical Diseases.

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