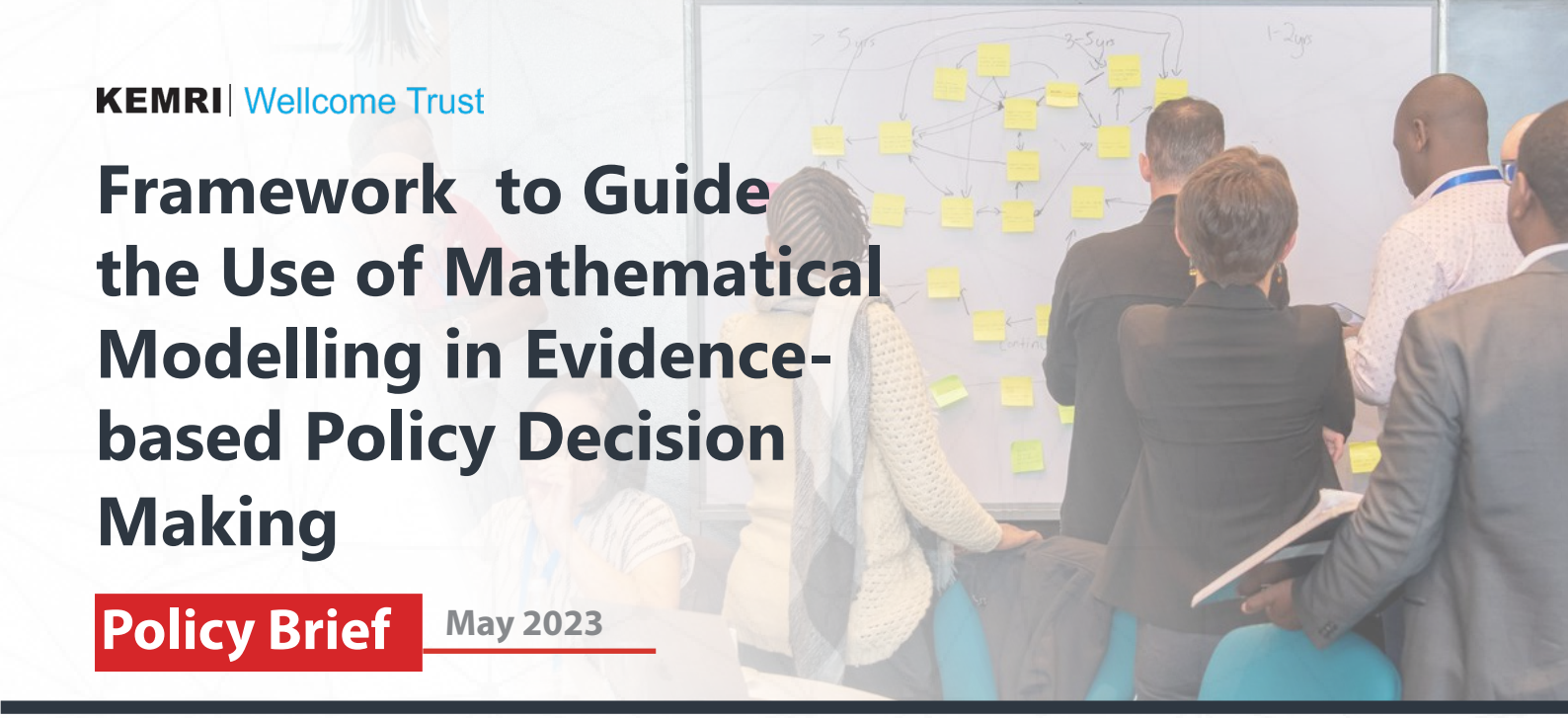
KEMRI | Wellcome Trust

Framework to Guide the Use of Mathematical Modelling in Evidence-based Policy Decision Making



Policy Brief May 2023

Introduction

The COVID-19 pandemic has had, and continues to have, a wide range of devastating effects worldwide. The challenges governments face in responding to the pandemic included how best to respond to an emerging outbreak, when to put measures in place, how stringent they should be and if/when they should lift them. This was further complicated by the scarcity of evidence on a novel infectious disease to support their decisions.

The value of mathematical modelling as a tool for informing policy decisions has been demonstrated during the pandemic. Modelling has been used to assess and predict the potential impacts of the pandemic and guide public health responses. Specifically, models have been used to estimate transmission of SARS-CoV-2, the potential impact of public health responses (e.g., vaccinations, community-based measures, infection control and hygiene practices), inform health system interventions, and identify targeted or geographically specific control strategies.

Building systems and structures that support the generation, communication and use of modelling estimates to inform public health responses will be critical in responding to future pandemics and ensuring resilience of health systems during such public health emergencies. Wide ranging system changes and investments will be required to reach this goal. This is especially significant in low-and middle-income countries (LMICs), whose health systems are already under a lot of strain and experience substantial resource constraints. **However, many LMICs lack adequate infrastructure and technical capacity to support and strengthen the use of modelling estimates in decision making.**

This brief describes a framework that LMICs can use to guide their strategies for building systems and structures that support generation and use of model estimates. The framework was developed in consultation with policymakers, policy advisors and infectious disease modellers and is supported by the findings from a multi-country study on the experiences and lessons learnt during COVID-19.

The framework is intended to be a tool to guide policy makers, funders/development partners and researchers in planning for and prioritising key interventions in improving their country's capacity to generate and use mathematical models as part of the evidence eco-system in informing decisions.

Given that the context in each country differs, the framework does not propose one single model for incorporating modeling estimates in decision making. Instead, it highlights 5 interdependent components that need to be considered to achieve this goal. Countries should adapt the framework to their setting according to their existing local capacity.

The framework

Realisation of the routine use of models in public health decision making will depend on a wide range of interdependent factors. The framework presents an aspirational vision in which model estimates are appropriately used in routine public health decision making to improve health outcomes (Figure 1).

The five interdependent components in the framework are:

1. Sustainable funding
2. Capacity building
3. Data infrastructure
4. Knowledge translation
5. A culture of evidence use

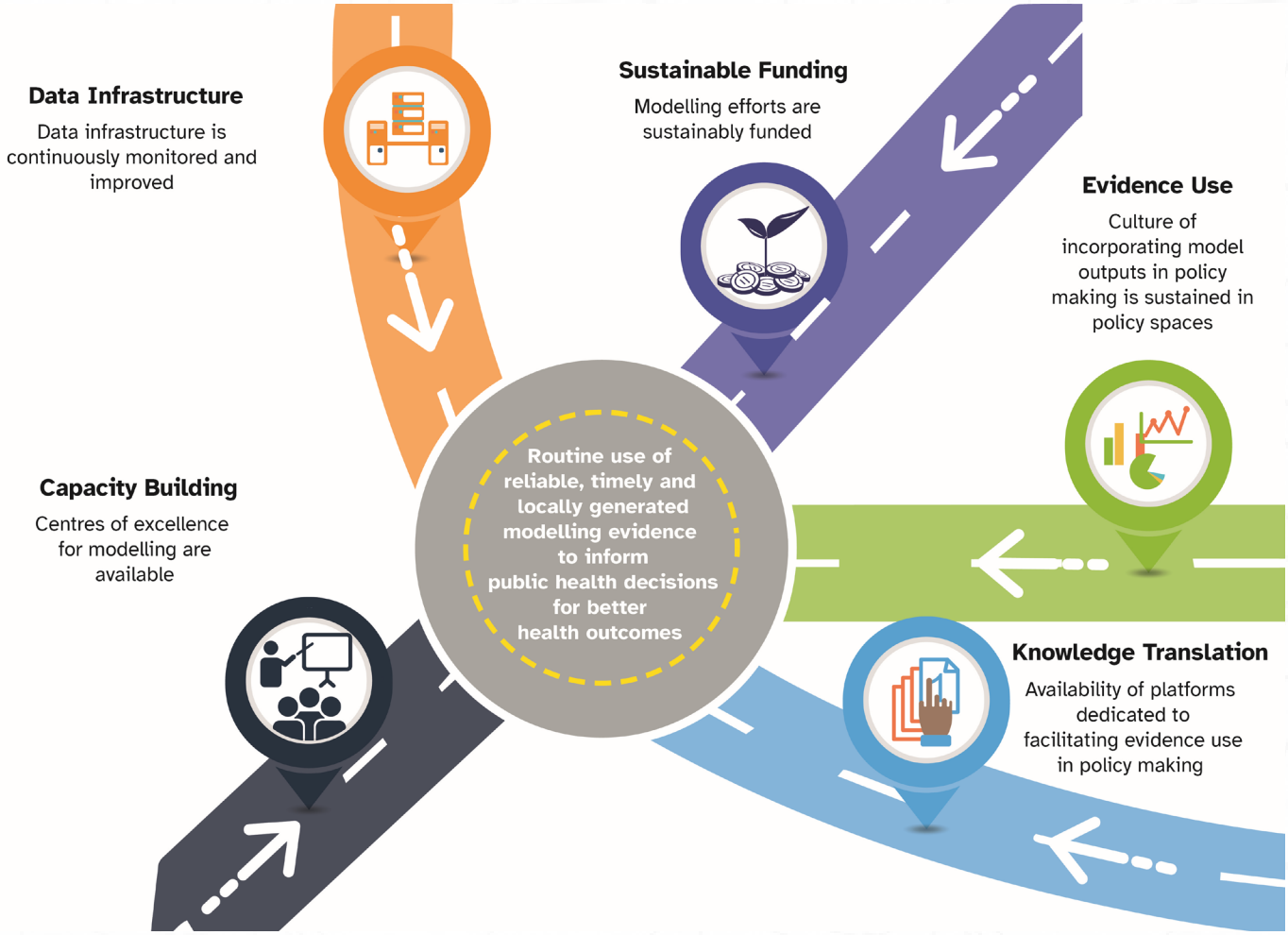


Figure 1: This simplified illustration depicts the five components of the framework that need to be addressed in order to improve the routine use of locally generated modelling evidence to inform public health decision making. These components are not hierarchical nor sequential. Countries would need to conduct a situational analysis on each component to determine which areas they need to strengthen

Sustainable funding

The availability of adequate and sustainable funding is essential to achieving the goal. To build technical and infrastructural capacity to support evidence-based policy decisions, we suggest that countries with limited funding should source short-term grants from funding bodies and agencies. These grants can be used for small scale modelling projects to demonstrate the usefulness of mathematical modeling in decision making, thereby attracting additional funding and eventually transition to stable, longer term "core" funding through endowment funds and government grants.

Capacity building for policy relevant modelling

Capacity building for mathematical modelling to support policy decisions involves training individuals and institutions in the methods and tools and providing resources and infrastructure. The modellers need training to build policy relevant models while policy makers need training to understand and utilize modeling evidence. In the short term, capacity building can involve short courses and workshops and in the longer term, formal academic programs at the undergraduate and graduate level. In addition, capacity can be built through research collaborations, modelling networks and institutional partnerships. These collaborations can provide access to expertise and resources. Over time, these factors can contribute to developing centers of excellence (CoE). Centres of excellence (CoE) can provide regional leadership, nurture capacity, define best practices, and provide support for modelling for policy, all of which are critical to support the use of model outputs to inform public health.

Data infrastructure

For models to be accurate and reliable, they must be based on high-quality data. Data infrastructure refers to the systems, tools, and processes used to collect, store, manage, and analyse data. Without adequate data infrastructure, mathematical models may be incomplete, inaccurate, or inconsistent, leading to unreliable predictions. To improve data infrastructure countries can be guided by a comprehensive national data strategy that outlines the goals for data collection, management, and ethical use, while ensuring alignment with national health and development priorities. Countries with little to no capacity can start by working with existing organisations and institutions that already collect data on key health indicators to = assess the reliability and suitability for use to support policy decisions. In addition, it will be essential for countries to develop basic data management systems and processes, with data sharing agreements. In the long term, countries can implement more advanced data management systems and tools, such as electronic health records, dashboards and data warehouses, to improve the efficiency and quality of data collection, storage, and analysis.

Knowledge translation (KT)

The utility of modeling estimates is contingent upon its effective communication to policy makers and other relevant stakeholders. Knowledge translation is a continuous process that requires collaboration between researchers, policymakers, and implementers to ensure that the research remains relevant and applicable within the policy-making process. To improve capacity for KT in the short term, policy makers and researchers can engage with knowledge brokers or KT experts who can act as channels of communication between researchers and policy makers. In cases where KT brokers/experts are not available, modellers can undergo short training courses on KT and how to engage with policy makers. In the long term, and with a view of institutionalising evidence use, it will be important to invest in the development of knowledge translation platforms. These platforms promote the systematic and transparent use of evidence in policy making.

A culture of evidence use

A culture of evidence use should exist amongst policy makers to promote the use of model estimates in policy making. This begins by ensuring that policy makers have access to, and value models as sources of evidence. An important facilitator of this is improving interactions between modelers and policy makers, both in quality and quantity through stakeholder engagement activities, collaborations, and research partnerships. As the appetite for models increases, it can be maintained by implementing activities such as secondments which embed modelers into policy spaces and policy makers into research spaces. Such spaces should include stakeholders with multidisciplinary expertise as model estimates are just one type of evidence within the evidence ecosystem and should be considered as one piece of the puzzle. Establishing processes and guidelines to inform the ethical and sound use of model estimates will be important in increasing transparency and accountability for decision making in public health.

Implementation approach

The improved use of model estimates in public health decision making will most likely be a long journey requiring political will and sustainable investment (Figure 2). Each country should set its own goals and adapt its own strategies for achieving this goal. Efforts can be prioritised according to the five components identified in this framework. The strategies should ideally consider the local context including existing barriers and capacities. Therefore, the first step of implementation is assessing the current needs and capacity available through a situational analysis and prioritising strategies based on these assessments. We propose that the implementation approach should be:

- Country focused: these initiatives should be primarily driven by countries with help from external partners where necessary. This is to ensure that efforts are aligned to local contexts.
- Participatory: strategies should be developed in consultation with local stakeholders to foster buy- in and promote accountability.
- Results oriented: monitoring and evaluation of progress through the tracking of specific measurable indicators will be critical.
- Sustainable: the strategies and approached used should be sustainable to ensure that results lead to long term development

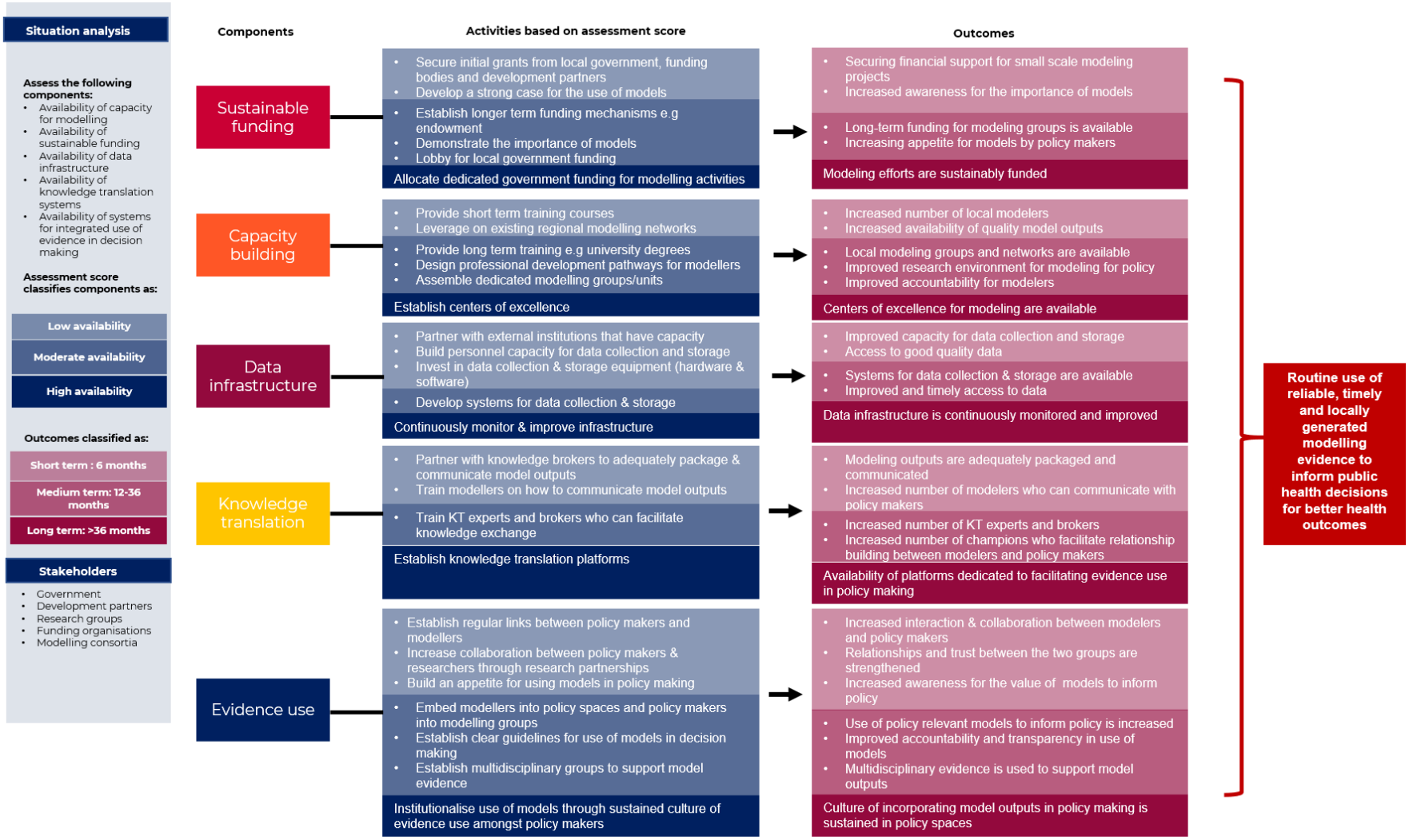


Figure 2: This illustrates the 5 components and the pathways to change to achieve routine use of modelling evidence. We highlight the need to perform a situational analysis to determine the availability of resources and capacity for each component to plan implementation of the framework.

Monitoring framework implementation

As the implementation of this framework is highly context-specific, we cannot provide universal indicators to measure progress in the routine use of models in public health decision making. More research will be needed to inform on indicators and appropriate metrics for these components. In the meantime, each country will have to set goals and targets that align with their capacities and commitment to achieving their goal.

This work was supported by Bill and Melinda Gates Foundation, in collaboration with colleagues from various modelling groups and WHO
Authors' contact information: Fatuma Guleid FGuleid@kemri-wellcome.org and Jacquie Oliwa JOliwa@kemri-wellcome.org