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ANALYSIS

Using Implementation Science For Health Adaptation: Opportunities For Pacific Island Countries

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ABSTRACT The health risks of a changing climate are immediate and multifaceted. Policies, plans, and programs to reduce climate-related health impacts exist, but multiple barriers hinder the uptake of these strategies, and information remains limited on the factors affecting implementation. Implementation science—a discipline focused on systematically examining the gap between knowledge and action—can address questions related to implementation and help the health sector scale up successful adaptation measures in response to climate change. Implementation science, in the context of a changing climate, can guide decision makers in introducing and prioritizing potential health adaptation and disaster risk management solutions, advancing sustainability initiatives, and evaluating and improving intervention strategies. In this article we highlight examples from Pacific Island countries and outline approaches based on implementation science to enhance the capacity of health systems to anticipate, prepare for, respond to, and recover from climate-related exposures.

Both the scope and the magnitude of climate change-related health risks are daunting. Health adaptation efforts, which encompass various policies, programs, and interventions, aim to reduce the health risks associated with climate change. They build on essential public health services and serve to strengthen core health system functions to potentially offset these risks.¹ Across the health sector, however, implementation and uptake of these adaptation strategies has been uneven, constrained by limited resources and organizational capacity, inadequate assessments concerning the health risks, and imprecise estimates about the effectiveness of current or future climate-related interventions. Initial efforts, such as the World Health Organization/United Nations Framework Convention on Climate Change Climate and Country Health Profiles,

the Lancet Countdown, and the Centers for Disease Control and Prevention's Building Resilience Against Climate Effects (BRACE) program, help raise awareness, fill information gaps by identifying evidence-based adaptation and mitigation actions, and provide initial evaluations of interventions.^{2–4} These are positive, if limited, efforts, but a greater focus on health adaptation is needed, especially in low-resource settings, because of the combination of increasing exposure to climatic hazards and growing numbers of vulnerable people and locations.

Principal challenges to filling the gap between the need for more health adaptation measures and the investments to undertake them are complicated by limited evidence and financial support for developing and testing adaptation interventions to determine their efficacy and effectiveness.^{5–7} There is, moreover, vanishingly little emphasis on evaluating how context affects

the effectiveness of interventions, despite widespread understanding that what works in one place may be inappropriate for another. Meta-analyses or reviews may help address this gap,⁷ but they often lack information on aspects of the implementation process itself and on key details on the context for implementation. A third set of issues derives from the multisectoral nature of many climate and health interventions, but investments rarely tend to prioritize interdisciplinary work.⁸ For example, climate change adaptation and disaster risk management for health are parallel activities, often performed under different ministries and mandates, that focus on different temporal scales, yet there is a growing recognition of the synergies that, if widely appreciated, would benefit short- and longer-term health adaptation strategies.⁹ Last, additional efforts are needed to integrate research on adaptive capacity (the ability of a system to adjust to climate change; not specific to health)¹⁰ with research on and implementation of health adaptation within the context of global health.

Implementation science, a discipline focused on systematically studying the gap between knowledge and action, can help address the challenges associated with implementing adaptation projects by helping researchers and practitioners define and measure success and identify best practices to achieve longer-term resilience and sustainability. Specifically, it can help generate indicators to measure the extent to which a project or policy is building overall resilience, including capturing the process, benefits, and costs of adaptation within the context of sustainable development.¹¹ Implementation science can also provide cues on how to effectively scale local adaptation projects at the national level and expand them across regions.¹² Yet the growing interest in implementation science methods, particularly in low-resource settings, is not matched by published evidence systematically documenting and reviewing practices and lessons learned across countries and public or global health issues.¹³

At this time, implementation science is not designed for issues such as climate change and other socioenvironmental changes where the future will be much different than the past and where significant uncertainties will need to be incorporated and managed. An important drawback to implementation science techniques is that they struggle to anticipate and account for long-term changes, including the effects of public health interventions employed in response to risk management and fluctuating patterns of climate-sensitive health outcomes. Implementation science for climate change and health adaptation should take place within this context of

iterative risk management and systems-based approaches;¹⁴ otherwise, it may miss opportunities to increase resilience as vulnerabilities shift, better practices develop, and the climate continues to change.

The purpose of this article is to address the limitations associated with understanding and using implementation science in the context of climate change and health adaptation. Although a full review of all implementation science frameworks and methods is outside the article's scope, we highlight potentially useful aspects of using implementation science to prepare for and adapt to the health risks brought on by climate variability and change. Then, using Pacific Island countries as an example, we discuss the potential value and challenges of using implementation science approaches to design and evaluate health adaptation interventions, including plans for dissemination, monitoring, and evaluation.

Implementation Science, Climate Change, And Health

Implementation science (or research) is a relatively new and dynamic field of study originating from several research traditions.¹² As a growing discipline, implementation science aims to bridge the research-to-practice or “know-do” gap and promote the systematic uptake of research findings into clinical and public health practice. Its goal is to link evidence of effective health interventions to policy and program development,^{15,16} thereby promoting integration into health systems using a suite of theories, frameworks, models, and methods. Implementation science methods can be employed in three phases: early in the process of identifying and prioritizing interventions (for example, stakeholder engagement and analysis and co-production approaches, where stakeholders are part of the research process), when designing implementation strategies (for example, identifying barriers and facilitators that influence implementation outcomes), and when evaluating implementation strategies (for example, pre and post tests of knowledge and practice, intervention optimization studies, or impact evaluations).¹⁷ Although several definitions exist,^{14,15} we define *implementation science* broadly as the study of methods and strategies to promote the systematic adoption and integration of evidence-based practices, interventions, and policies into routine health care and population health settings.¹⁸

Global public health researchers are increasingly recognizing implementation science for its ability to inform policy, improve health management and service delivery, and empower

communities.¹² Studies on implementation science cover a range of topics from preventing HIV transmission¹⁹ to scaling up the use of clean cookstoves.²⁰ A helpful illustration is the use of implementation science to explore why established clinical guidelines are not being followed in hospital settings. This example parallels health adaptation in the need to understand why implementation gaps exist even when guidance documents are available. Although some publications highlight the importance of implementation science broadly to health adaptation,^{5,21,22} a review of peer-reviewed literature found no studies that explicitly linked it with climate change and health. For climate change and health adaptation, an opportunity exists to leverage aspects of implementation science to help health systems prepare for current and future challenges.

STRENGTHENING HEALTH ADAPTATION AND DISASTER RISK MANAGEMENT Implementation science is designed for real-world situations, making it a suitable tool for studying how interventions reach broader regions or populations and how they become integrated with fidelity into local health policies and programs. Implementation science is most useful when researchers and end users (for example, practitioners implementing a program or policy makers seeking guidance on a certain decision) work in concert.¹⁴ For example, implementation science can facilitate pathways toward broader application of health adaptation and disaster risk management efforts by helping stakeholders (often policy makers and practitioners) and researchers navigate the complexities among what is needed, what is known based on scientific literature and practice, and what happens in reality. In addition, implementation science goes beyond understanding whether an intervention works to address questions about what works where and why.²³ Using implementation science to guide health adaptation strategies helps incorporate iterative approaches into the process and promotes knowledge sharing among those stakeholders involved. In addition, research on the implementation process can yield robust experimental and quasi-experimental evidence on climate change adaptation interventions.⁶ In online appendix exhibit A1 we provide examples of potential implementation science approaches that can be used to address various health adaptation and disaster risk management needs and challenges.²⁴

CLOSING THE RESEARCH-PRACTICE GAP Employing implementation science frameworks can speed up the translation of research into practice, but this requires substantial stakeholder engagement and buy-in. Through engagement

Employing implementation science frameworks can speed up the translation of research into practice.

with public health professionals and communities, context-specific insights feed into scaling-up efforts and documentation of lessons learned to assist modifications for health adaptation. Often the most impactful research is led by practitioners because they experience issues around quality during their day-to-day activities.²⁵ Therefore, an emphasis on co-design should be coupled with any focus on implementation science to solidify relationships among researchers, decision makers, and stakeholders by enhancing trust, transparency, and cooperation.²⁶

In building climate-resilient health systems, the use of input from stakeholders and target populations is valuable in developing quality improvement and optimization measures. Assessing community-based adaptation options, such as updating community disaster plans or harvesting rainwater to improve water security, is one way to actively engage target populations and address the needs of stakeholders. Yet these efforts can be sporadic, ad hoc, and without follow-up, resulting in overlooked contextual factors that could be valuable in the implementation and uptake of an intervention. Public health and health care professionals, along with researchers, can use implementation science methods as a platform by which these intricacies can be teased out, compiled, and examined. An organizational readiness assessment, for example, can identify and categorize factors (such as political leadership, coordination mechanisms, and access to funding) that may contribute to a health center's capacity to implement adaptation measures.²⁶

MONITORING, EVALUATION, AND LEARNING Implementation science may also play a role in supporting monitoring, evaluation, and learning for climate change adaptation. Monitoring, evaluation, and learning is an overarching concept that aims to determine whether adaptation actions achieved their desired results and whether resources were used effectively and efficiently.

ly.²⁶ For the health sector, a well-designed monitoring, evaluation, and learning system for climate change adaptation and its corresponding indicators can assess the ability of communities and nations to prepare for and adequately respond to the health risks of a changing climate over time.¹⁰ Health adaptation metrics include those that monitor the burden, seasonality, and geographic distribution of climate-sensitive health outcomes over time to inform evaluations of the effectiveness of interventions as temperatures increase and precipitation patterns change.

Other key metrics are those that characterize the process of adaptation or disaster risk management. These may be used to monitor how empirical information on climate change is used to shape interventions in real time and to examine collaboration among the agencies and organizations responsible for upstream drivers of health, such as access to safe water and sufficient electricity. Whether developed at the national or global level, indicators should use ethical guidelines to ensure that stakeholders' needs are met and that countries maintain ownership of their data, which is a concern that can affect the implementation of health adaptation projects by further complicating data collection, decision-making, and reporting processes. Monitoring, evaluation, and learning also helps avoid maladaptation, resulting in potential cost reductions and sustainable, climate-resilient development.²⁷

Interventions that prioritize iterative learning and refinement foster enabling environments, more successful implementation, and improved performance outcomes.¹⁴ Further, in efforts to determine how successfully an intervention was implemented, implementation science literature proposes several outcomes, including acceptability, adoption, appropriateness, feasibility, fidelity, cost, penetration, and sustainability.²⁸ Although not all of these metrics may be relevant for health adaptation or disaster risk management, they can augment other indicators to target implementation-specific informational needs. Fidelity, for example, is a common metric in clinical settings (for example, adherence to a protocol)²⁹ but could be informative in assessments of new standard operating procedures for incorporating climate and weather data into disease surveillance systems.

Health Adaptation In Pacific Island Countries

Pacific Island countries are often framed in the context of their vulnerabilities.³⁰ In these countries, rising temperatures, changing rainfall

patterns, sea-level rise, and intensification of extreme weather events, such as drought, flooding, and cyclones, increase health risks along multiple pathways.³⁰ However, in the face of multiple risks from climate change, Pacific islanders have demonstrated resiliency from creatively coping with challenges for thousands of years.³⁰ Country-level expertise and experience, including traditional knowledge-practice-belief systems and community-based adaptation efforts, should inform the development of adaptation actions in the health sector, as well as the implementation of these policies and measures to manage climate change-related risks.²⁹

Communities and health systems in Pacific Island countries can be affected by extreme events as well as by challenges associated with managing climate-sensitive health risks, such as disease outbreaks. Often characterized as a “threat multiplier,” climate change can increase the severity of health impacts as a result of concurrent, compounding, and cascading climate-related disasters.³⁰ In Pacific Island countries, for example, the dual threat of coping with a dengue fever outbreak on top of a flood event, storm, or drought can push already-strained health systems beyond their capacity.³⁰ The current global coronavirus disease 2019 (COVID-19) pandemic illustrates the ever-evolving challenges facing health systems to combat multiple, dynamic threats and withstand shocks from all hazards.³¹

There is a clear and urgent need to build climate-resilient communities and health systems in the Pacific in the context of limited resources, the inherent isolation of islands, and demographic and socioeconomic challenges.⁹ This includes health adaptation actions such as training the health workforce on managing climate-related health risks, promoting climate-informed health programs, and integrated risk monitoring, among others.⁹ Initial health-related adaptation efforts are planned or under way in the Pacific. For example, in early 2020 the first-ever National Climate Change and Health Dialogue was held in the Republic of the Marshall Islands, providing a useful template for cross-sector coordination. However, overall, health adaptation and disaster risk management actions are typically designed to achieve short-term objectives (for example, change in policy, implementing an early warning system, and increasing the number of trained health professionals), with the assumption that achieving the objectives would build longer-term resilience. Although this assumption appears reasonable, it is not clear that recent efforts to address climate change will be sufficient to address the rapidly growing health risks projected to come with additional climate change.³² Using implementation science, public

health officers in Pacific Island countries, in collaboration with researchers, can focus on strengthening their health systems across the phases of implementation by engaging policy makers to address health system needs, as well as measuring quality improvement and optimization.

One goal of health adaptation planning is the mainstreaming of climate change into public health policy and practice broadly (for example, across all relevant departments and programs, such as maternal and child health).⁹ In many Pacific Island countries, climate outlooks are generated by national meteorological services and international partners for specific sectors, including health, that detail expected changes in weather and climate variability over the coming quarter and year. The utility of these forecasts could be optimized through systematically evaluating how these products are being used within the health sector; the level of impact on beneficiaries, including vulnerable populations; and opportunities for improvement. An implementation science determinant framework, such as the Consolidated Framework for Implementation Research, may prove useful to better understand and organize potential factors that can influence the integration of climate and health forecasted outlooks into health planning. The Consolidated Framework for Implementation Research contains five domains and thirty-nine constructs most likely to affect implementation, such as stakeholders' perceptions, external policy incentives, belief about an intervention, and leadership engagement.²³

An implementation science perspective can also clarify why disconnects happen during implementation phases and support iterative approaches that lead to successful adoption and evaluation. For example, MalaClim is a project that combines meteorological data with malaria case records to better understand relationships between vector-borne disease and climate and develop a climate-informed health early warning system in Guadalcanal, Solomon Islands.³³ An implementation science approach could be used to better understand implementation bottlenecks and scale up MalaClim, using methods such as concept mapping to collect data on collaboration opportunities and feasibility, to identify contexts in which the program is likely to be more or less successful, and to test hypotheses for what drives the success and failure of implementation in new settings.³⁴

Further, impact evaluations, quality improvement methods, and dissemination studies are implementation science tools that can help identify bottlenecks within a system, raise interest in local populations, and generate concrete recom-

An implementation science perspective can clarify why disconnects happen during implementation phases.

mendations to improve intervention uptake and success. The Reach Effectiveness Adoption Implementation Maintenance (RE-AIM) model is an implementation framework used to evaluate population health impacts of promotion interventions.³⁵ RE-AIM can be used to answer questions related to the five dimensions of the acronym. For example, in evaluating a climate and health training program, one may ask how to reach those in need of the training (Reach), how to know if the training is feasible (Implementation), or how to ensure long-term institutionalization (Maintenance).

Nevertheless, many Pacific Island countries face a shortage of trained health staff mixed with high staff turnover rates challenging health adaptation and disaster risk management.³⁶ A national core team dedicated to climate change and health issues may exist, albeit usually within a broader environmental health portfolio. An overload of information (for example, separate assessments for climate change and health, population health, development, and climate change adaptation) and reporting (for example, large numbers of global and national frameworks with many indicators)³⁷ can lead to "assessment fatigue" among health care workers and technical working groups. Absent or ineffective coordination mechanisms also negatively affect health adaptation, including unsuccessful implementation of interventions, difficulty mobilizing resources, duplicative efforts, and gaps in reporting and evaluation.³⁸ Implementation science can explain what influences an implementation outcome related to coordination. In settings where decision making is driven by organizational priorities or resources, however, this information may be less valuable. Moreover, any incorporation of implementation science should aim to reduce overlap with existing monitoring, evaluation, and learning systems and should promote collaboration with traditional leaders and systems, which has been shown to

Even when evidence-based practices are identified, they often take years to be incorporated into general health care practices and public health programs.

be effective for public health interventions in Pacific Island countries.³⁹

Finally, implementation science is not immune to typical data-related challenges facing planning and evaluation.⁴⁰ The limited availability and quality of climate, weather, and health data are a challenge for designing, implementing, and evaluating effective interventions. Differing temporal and spatial scales makes the integration of climate and health data complex, especially for outer islands that rely on paper-based records and have limited connectivity. Additional difficulties include capturing information on adaptation activities (planned and autonomous) and adaptation occurring outside the health sector that affects health.

Discussion

Basic, systems-focused measures to strengthen health systems are vital to building resilience in a changing climate and to managing the multiple, simultaneous challenges projected in the near future.⁹ However, health adaptation projects worldwide are underresourced and insufficient to protect and promote population health in a changing climate.⁴ Although health is often prioritized in national strategies and plans focused on climate change adaptation, financial and human resources to address climate-related risks and achieve global health goals are too often lacking.⁴

Integrating disaster risk management and health adaptation reduces the burden of implementing separately, including duplicating human and financial resources.⁸ This has been explored at community levels in the Solomon Islands, Vanuatu, Fiji, and Samoa, with researchers highlighting the need for practical guidance

on implementation, documentation of lessons, and integration at community levels.^{41,42} Using implementation science could identify constraints and enabling factors to guide the design of integration strategies that aim to maximize limited resources and promote sustainability through whole-of-government approaches.

In addition, limited coordination and integration across the health sector and low stakeholder engagement can leave climate-related health interventions fragmented and ineffective. Adding to these challenges is the lack of evidence-based adaptation interventions to reduce climate change-related health impacts. Further, even when evidence-based practices are identified, they often take years to be incorporated into general health care practices and public health programs. Behavior change, which is frequently at the root of public health interventions, is an equally lengthy endeavor, providing little guarantee of sustainable population health impact. The long-term solution would be to have enhanced national health systems and institutions with climate change risk and resilience aspects integrated into health governance, strengthened health information management systems, and effective and accessible delivery of health services.

There are initial next steps to inform near-future climate change adaptation projects for health, as well as support long-term program planning for health adaptation. Implementation science frameworks, models, and tools can be identified and used in the context of climate change and health in general and in Pacific Island countries specifically. Examples such as RE-AIM, the Consolidated Framework for Implementation Research, and the UN Special Programme for Research and Training in Tropical Diseases Implementation Research Toolkit are flexible and may prove useful. However, for them to be effective, their use should be rooted in the needs of stakeholders and practitioners. Diane King and colleagues conducted a similar exercise to adapt RE-AIM for built environment public health interventions. They adapted the framework and found it useful yet difficult to apply, citing challenges in understanding the nuances among RE-AIM dimensions, including how to collect specific data and monitor exposure.⁴³ Ongoing evaluation of health adaptation strategies is also key. This may include using the implementation metrics mentioned to examine comparative effectiveness of health adaptation strategies.²⁹ For instance, a recent study assessed community-based adaptation initiatives in Pacific Island countries using evaluation components (appropriateness, effectiveness, equity, impact, and sustainability) and identified points of opti-

mization (for example, local ownership and systems thinking).⁴⁴

Conclusion

Even with knowledge of what is needed and understanding of some of the barriers to action, major challenges stand in the way of implementing climate and health strategies in Pacific Island countries and globally. This warrants further scientific investigation and rigorous methods by which to explore questions underlining effective interventions, including factors that influence implementation failure and success. Aspects of implementation science, in the context of chang-

ing climatic conditions and development scenarios, can serve as a guide to introduce and prioritize potential evidence-based health adaptation solutions into a health system, to scale up and promote sustainable projects, and to evaluate and improve health adaptation interventions. Certainly, implementation science will not resolve all of the challenges associated with identifying and implementing effective interventions. Yet these approaches, which focus on better understanding the gap between knowledge and action, may help researchers and practitioners systematically identify context-specific gaps, determine why they exist, and propose effective solutions. ■

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