

**EQUITY-FOCUSED POPULATION HEALTH INTERVENTION RESEARCH**  
**FRAMEWORK (Equi-PHIR): A MODEL FOR HEALTH RESEARCHERS AND**  
**PRACTITIONERS**

**NAME: ERIC OPOKU**

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## **Abstract**

**Background:** Population health intervention research (PHIR) is increasingly used to develop and evaluate policies, programs and other interventions that are aimed at impacting/improving population health and/or health equity through interventions that modify the underlying determinants of health or directly influence health behaviors. PHIR helps to identify the contexts, mechanisms, and outcomes (CMO) of population health interventions influencing policy formulation, implementation, and analysis.

**Objective:** To develop and propose an equity-based comprehensive and evaluative conceptual framework for population health intervention research (Equi-PHIR) of health interventions, programs, policies, and strategies.

**Methods:** A literature review of models and conceptual frameworks focusing on equity and studies that assessed the health and non-health benefits of health policy interventions was conducted in five databases (i.e., MEDLINE, EMBASE, APA PsycInfo, Google scholar and ScienceDirect). Key characteristics of models and conceptual frameworks were summarized and reported. I gathered information relating to contextual factors within which PHIRs operate, the mechanism of implementation and outcomes of population health interventions and equity consideration.

**Results:** A conceptual framework (i.e., Equi-PHIR) was developed. It encompasses elements of equity-focused PHIR and the mechanism of population health intervention implementation. Thus, the impact of population health intervention on Universal Health Coverage (UHC), determinants of health and the social distribution of health and non-health outcomes. A tool for assessing the inclusion of contextual factors (i.e., ERIC-A) in intervention formulation and implementation was developed and proposed by the study.

**Conclusions:** Equi-PHIR is a comprehensive conceptual framework proposed for use by policy-makers and researchers during the formulation, implementation and analysis of health interventions, policies, programs, and strategies. Decision-makers and researchers should take contextual factors, equity consideration, determinants of health and the action domains of UHC into account during the formulation and implementation of population health interventions and PHIR, respectively.

## INTRODUCTION

Population health<sup>1</sup> is described as the science underpinning the practice of public health and understandings about health that come only from an appreciation of how health is generated in populations (Hawe and Potvin, 2009). According to the Population Health Intervention Research Initiative for Canada (PHIRIC), a population health intervention research (PHIR) involves the use of scientific methods to produce knowledge about policy and program interventions that operate within or outside of the health sector and have the potential to impact health at the population level (Hawe and Potvin, 2009). PHIR is increasingly used to develop and evaluate policies, programs and other interventions that are aimed at impacting/improving population health and/or health equity through interventions that modify the underlying determinants of health or directly influence health behaviors (Craig et al., 2018).

Studies of the impact of actions in sectors outside health, designed for purposes other than health, are included in the PHIRIC definition of PHIR along with ongoing practices and policies in sectors other than health (such as economic/financial policy, education policy and environment policy) that might affect population health (Hawe and Potvin, 2009). There is also an increasing global move to shift the emphasis of population health research away from purely descriptive and analytic studies and towards the study of interventions to reduce health problems and health inequities (Hawe and Potvin, 2009). Over the last 15 years, this has led to PHIR studies employing new economic evaluation strategies (such as Distributional and Extended Cost-effectiveness analysis) that focus on equity and health and non-health impacts.

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<sup>1</sup> The term “population health” is less used, and hence “population health research” and “public health research” can be taken to mean the same thing.

However, there remains a lack of a comprehensive and aggregated conceptual framework for PHIR. This study draws together recent thinking and research to identify how PHIR is or should be conceptualized within contextual factors while taking equity, health, and non-health impacts of population health interventions into account in research and practice. Even though the primary focus of the study is on research that seeks to impact population health and health inequalities, it is also relevant across the whole range of public health and health services research.

*How is intervention research different in general?*

If we characterize descriptive or analytic research in population health as seeking to understand phenomena, then intervention research is about testing those understandings by the act of intervention in the causal mechanisms under investigation. According to the Canadian Institutes of Health Research (CIHR)-Institute of Population and Public Health, PHIR, which is intervention research at the population level, does not simply mean improving health or reducing health risks but, rather, involves interventions intended to change the conditions of risk in order to alter the distribution of health risk. A population health intervention is truly effective if it reduces risk exposure in successive cohorts of people within the setting(s) under investigation. This makes intervention research different from implementation research, which uses scientific methods to study the implementation of health policies, programs, or interventions, and evaluate the effect of such policies, programs, or interventions in the community after implementation, finding scientific evidence on the real impact of implementation, based on short, medium or long-term indicators (Eslava-Schmalbach et al., 2019). The phrase “intervention research” in the health field is more associated with the notion that its primary purpose is to test a hypothesis or causal pathway. In contrast, some health researchers have reserved the term “implementation research” for a phase of work that follows the demonstration of a program’s or a policy’s effects or designed to elucidate

more understanding about the process of a program that has already shown its effectiveness in a demonstration trial. It is often seen in clinical settings (Hawe and Potvin, 2009). Frameworks such as the Consolidated Framework for Implementation Research (CFIR), Promoting Action on Research Implementation in Health Services (PARISH), Equity-focused implementation research framework for health programs (EquIR) and the Quality Implementation Framework have focused on implementation research (Damschroder, 2009; Eslava-Schmalbach et al., 2019) and do not include explicit equity considerations in the context of intervention research.

Moreover, intervention research is different from “evaluation research”. Evaluation research involves using scientific methods to make judgments about the worth or value of an intervention, according to values or standards that are pre-set and usually enshrined in the goals and/or objectives (Hawe and Potvin, 2009). It is worth noting that all evaluation research in population health is PHIR, but not all PHIR is evaluation research because some PHIR studies evaluate the health impact of policies and programs in sectors outside of health. However, both terms are used interchangeably in this article as the study focuses on interventions in the health sector.

To guide future research and practice, there is a need to develop an equity-focused framework for PHIR that could be used to improve evidence-informed formulation and implementation processes. The aim of this study is to develop a conceptual framework that considers health, non-health and equity in the formulation, implementation and evaluation of population health interventions and research.

## METHOD

This study follows three phases:

1. In the first phase, I conducted a literature review of conceptual frameworks or studies that examined the health and non-health impacts of PHIR and took equity into consideration in five databases (i.e., MEDLINE, EMBASE, APA PsycInfo, Google scholar and ScienceDirect). Grey literature was not included in the study. Relevant details from the reviewed literature were summarized and employed in developing a comprehensive conceptual framework. The search strategy was composed of words related to “intervention” ((population health AND (intervention OR intervention research OR strateg\* OR program OR stud\* OR research\* OR polic\*)) OR (public health AND (intervention OR intervention research OR strateg\* OR program OR stud\* OR research\* OR polic\*)) OR intervention research\* OR Implementation Research OR Evaluative Research) and Equity in health (Health equity OR health inequ\* OR health disparit\* OR vulnerable population OR advantaged population OR disadvantaged population). As no single framework met the objective of the study, I adopted elements of several frameworks and combined them into building one simple framework (termed Equi-PHIR). The search was limited to English language and there were no exclusion criteria, but these did not impede the quality of the research. All related titles were included after eliminating duplicates.

2. In the second phase, barring the time limit and deadline for the study, I would have conducted stakeholders’ analysis where decision-makers and researchers of PHIR would have been selected through emails, calls, or interviews in some Lower-Middle-Income Countries (LMICs). These stakeholders or “implementers” would have discussed the benefits and limitations of the model and their suggestions would have been used to improve the framework.

3. Finally, the third phase would have consisted of iterative development of the framework based on key experts in the field (i.e., health equity, population/public health, and social science) and through interviews with stakeholders from Alliance for Health Policy and Systems Research (AHPSR)-World Health Organization (WHO). The interview would have centered on conceptual understanding of the framework and its functionality in application in research and practice.

Since there is not enough time to go through this thorough process, I built the framework alone by reviewing empirical literature, conceptual frameworks, and evaluative tools (i.e., Phase one). The framework would have undergone several revisions, and each would have been followed by stakeholder reviews. This study applies or proposes the Mixed method approach where questionnaire and interview or qualitative approach (i.e., the ERIC-A tool) could be employed to assess the contextual factors and the quantitative approach (i.e., the Distributional and Extended cost-effectiveness analysis approaches) is employed to measure the outcomes of population health interventions and their stratification by equity-relevant variables.

The methodological framework of Distributional and Extended cost-effectiveness analysis, including the measure of health and non-health impact and their respective incremental cost-effectiveness ratios, are explained somewhere (Asaria et al., 2016; Verguet et al., 2016; De Neve et al., 2018). They are not explained in this paper because of time and space limit.

## RESULTS

The Equi-PHIR framework (See Figure 2 in Appendix) is established based on the literature review. The Equi-PHIR framework builds on approaches from population/public health, and social science to demonstrate the application of an equity-lens to PHIR proposals, to provide a guide for the evaluation of PHIR and to facilitate and ensure the successful formulation and implementation of health interventions, strategies, policies, and programs. It also highlights the relevance of contextual factors in the successful implementation of population interventions. The visual design (See Figure 2 in Appendix) is simple and representative of a comprehensive and holistic view of the formulation, implementation, and evaluation of population health interventions. The study employs the Realist approaches to evaluation, where interventions are thought to attain impact through context-mechanism-outcome (CMO) configurations. Thus, as stated in Craig et al. (2018), ‘it is not programs that make things change, it is people, embedded in their context who, when exposed to programs, do something to activate given mechanisms, and change.’

### Context

Population health interventions are sensitive to context as they may either serve as facilitators or barriers to the implementation processes. A context is any set of features and circumstances that consist of active and unique factors within which an intervention takes place that is relevant to understanding how it is implemented, how it effects change or how it is responded to or engaged with (Craig et al., 2018). A complete comprehension of the association between interventions and contexts<sup>2</sup> is crucial in understanding implementation success and failure, how interventions achieve impact, why such impacts vary by equity relevant variables (i.e., sex, region, income

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<sup>2</sup> This study takes the broader definition of context to include contextual (applying to a whole population) and compositional (varying between individuals within a population) into consideration.



quintile) and whether interventions can be sustained or successfully replicated or generalized or transferred from one context to another (Craig et al., 2018). Myriad studies have employed questionnaire, the Theoretical Domains Framework (TDF; Cane et al., 2012), the Context Assessment for Community Health (COACH; Bergström et al., 2015) tool, and the Alberta Context Tool (ACT; Estabrooks et al., 2009) to assess contextual factors of implementation research. Craig et al. (2018) reviewed several frameworks including a conceptual model by Poland et al. (2009), which is proposed to be used for health-promotion interventions, the Consolidated Framework for Implementation Research (CFIR; Damschroder et al., 2009), the Context and Implementation of Complex Interventions (CICI) framework (Pfadenhauer et al., 2017) for health technology assessments and other studies. They concluded that those frameworks were not satisfactory for the study of complex population health interventions. Hence, they set out to identify 12 contextual factors for population health interventions, namely social, and economic, epidemiological, cultural, geographical or environmental, service and organizational, ethical, policy, legal, financial, political, historical, and external shocks, and catalytic events (Craig et al., 2018). Based on the empirical literature, I included demographic factors to their contextual factors and used them to develop the Evaluative Research on Intervention and Context Assessment (ERIC-A) tool that can be used to assess contextual factors in PHIR and evaluative research (See Table 1 in Appendix) using qualitative research methods. The ERIC-A tool for PHIR is made up of 13 domains and 28 constructs. A PHIR or evaluative research scores ‘one’ if it considers a construct and deals with it favorably/effectively (if such is required) and ‘zero’ if it considers it but fails to rectify any issues associated with it (if such is required) or does not consider such a construct at all. The scores are summed and translated into percentages. A 70% (or above) will mean that such a PHIR or intervention considered ‘context’, based on the empirical literature and the assessment

details of similar tools. The domains and constructs are explained in the Appendix (i.e., Table 1). To the best of my knowledge, the ERIC-A tool would serve as the first tool designed to specifically evaluate PHIR or a population intervention based on contextual factors. It also provides a guide for interventions that are yet to be initiated or adopted.

## **Mechanism**

Context and outcomes can be assessed, but mechanism provides details and information on the pathway of operation of the framework.

### *Structure of the Equi-PHIR framework*

The mechanism of operation of population health interventions are explained as follows. The framework begins with an identified population health intervention in the form of Universal Public Financing<sup>3</sup> of programs, strategies, policies, or interventions within a target population or macroeconomic policies or other health strategies (such as reduction in salt consumption). Some articles have considered population health interventions such as Universal Public Financing of treatment or surgery interventions (Assebe et al., 2020; Essue et al., 2020) or vaccination programs (Pecenka et al., 2015; Levin et al., 2015; Johansson et al., 2015) for several diseases/illnesses and others have considered macroeconomic health policies such as excise tax on sugar-sweetened beverages and/or tobacco (Verguet et al., 2017; Postolovska et al., 2018; Jha et al., 2020). Others include national strategies such as salt reduction policies (Watkins et al., 2016).

Population health interventions are aimed at impacting population health and/or health equity by modifying the underlying determinants of health or directly influencing health behaviors (Craig et al., 2018). Thus, such interventions could generate health (i.e., DALYs or deaths averted or

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<sup>3</sup> This is where the government finances an intervention irrespective of who the recipients are.

HALYs gained) and non-health benefits (i.e., Financial Risk Protection, Financial consequences, and educational impact) by modifying the determinants of health (i.e., social, structural, ecological and climate change, eco-social and inter- and intra-personal determinants) or by increasing (existing or new) intervention coverage to attain the UHC<sup>4</sup> level (which operates in action domains determined by the WHO) or closer. Eliminating financial barriers to access to health care would position Universal Public Financing as a crucial policy device for attaining UHC (Verguet et al., 2016), which impacts morbidity and mortality or population health. Moreover, UHC and ‘determinants of health’ may also impact each other as depicted in the framework. Population health interventions generate health and non-health outcomes that are stratified by equity-relevant variables (explained using the PROGRESS framework).

### *Determinants of Health*

There are several determinants of health, and they are explained as follows. The WHO adopted a social determinants of health framework (SDH; Solar and Irwin, 2010) which was sub-divided into structural determinants (i.e., social determinants of health inequities) and intermediary determinants (i.e., social determinants of health). The structural determinants included socioeconomic and political context (i.e., governance, macroeconomic policies, social policies, public policies, and culture and social values), socioeconomic position, social class, gender, ethnicity (racism), education, occupation, income, social cohesion, and social capital. The intermediary determinants consisted of material circumstances, behaviors, and biological factors,

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<sup>4</sup> The World Health Organization (WHO) defines “universal health coverage” to mean that all people can access quality health services, without suffering financial hardship associated with paying for care (World Health Organization, 2013).

and psychosocial factors, and health system. They explained that the social determinants of health and health inequities have an impact on equity in health and well-being.

Watts et al. (2015) developed a framework that explained the effect of climate change on health. Their framework had four building blocks, namely direct effects of climate change (i.e., storms, drought, flood and heatwave), indirect effects (i.e., water quality, air pollution, land-use change and ecological change), social dynamics (i.e., age and gender, health status, socioeconomic status, social capital, public health infrastructure and mobility and conflict status) and health impact (i.e., mental illness, undernutrition, allergies, cardiovascular diseases, infectious diseases, injuries, respiratory diseases and poisoning). Thus, climate change affects health directly or through the social dynamics or its direct or indirect effects.

With regards to ecological determinants of health, Steffen et al. (2015) developed a framework (termed as the Planetary Boundaries framework) aimed at defining a safe operating space for human societies to develop and thrive. They identified nine dimensions or planetary boundaries as the building blocks of the framework: Climate change, novel entities, stratospheric ozone depletion, atmospheric aerosol loading, ocean acidification, biochemical flows, freshwater use, land-system change, and biosphere integrity. They defined high risk, increasing risk, unquantified boundaries, and safe boundaries of operations. Adding to the Planetary Boundaries (PB) framework, Raworth (2017) built the ‘Doughnut framework’, which combines both social and ecological boundaries (i.e., eco-social determinants) that encompass human well-being together. They maintained the nine dimensions of the PB framework and termed it as outer boundary or ecological ceiling, beyond which lies an overshoot of pressure on Earth’s life-supporting systems, such as climate change, ocean acidification, and biodiversity loss (in the PB framework). They introduced an inner boundary and termed it as the social foundation, below which lie shortfalls in

well-being, such as hunger, ill-health, illiteracy, and energy poverty. The social foundation encompasses twelve elements in the Sustainable Development Goals: energy, water, food, health, education, income and work, peace and justice, political voice, gender equality, social equity, housing, and networks. Canada Public Health Association adopted an eco-social framework for public health action (See figure 1 in Appendix), and it highlights the relevance of the effect of ecological or eco-social determinants on health. They highlighted that there is a growing recognition that the Earth is itself a living system and that the ultimate determinant of human health (and that of all other species) is the health of the Earth's life-supporting systems. The ecosystem-based 'goods and services' that we get from nature are the ecological determinants of health (or population health).

MacDonald et al. (2013) developed the 'population health framework' which describes inter- and intra-personal determinants of health to include personal health behaviors (i.e., lifestyle choices such as diet, physical activity, smoking of tobacco products, and consumption of salt or sugar-sweetened beverages), individual capacity and coping skills, medical services (sometimes included in the SDH), genetics or biology. According to MacDonald et al. (2013), the SDH framework is defined as 'the social, economic and political contexts in which people live and work and which contribute to population health and the health of individuals and it does not include the inter- and intra-personal determinants of health described above.

#### *Action Domain of UHC*

A framework developed by the World Health Organization (2016) explains that health system building blocks or service delivery at the individual and population-level (i.e., Governance, health workforce, health financing, essential medicines and technologies, and health information system) impact health (i.e., reduced health risks and improved health and equitable health outcomes) and

non-health outcomes (i.e., improved financial protection) through five action domains of UHC (i.e., Quality, Efficiency, Equity, Accountability, and Sustainability). These action domains are intended to guide developing country-specific road maps/interventions (such as health financing or Universal Public Financing) towards UHC and, consequently impact population health. Member States are encouraged to prioritize multiple actions that are mutually reinforcing and embed them in their interventions as they move towards the attainment of the UHC vision (World Health Organization, 2016). These action domains include WHO recommendations that ensure that UHC translates into improved population health and non-health outcomes (See Table 2 in Appendix for details).

### **Health and Non-health Outcomes**

It is deduced from the empirical literature that the impact of policy instruments for an intervention on population health is measured in terms of Health Benefit Gains, and Non-health benefits (i.e., Financial consequences, Financial Risk Protection, and education gains) and they are stratified by income quintile (i.e., poorest, poorer, middle, richer and richest quintiles) or equity-relevant variables (Johansson et al., 2015; Verguet et al., 2016). The domains of health intervention outcomes are explained as follows (Verguet et al., 2016).

The implementation of health policy interventions leads to health benefit gains (or health outcomes) accruing to the target population in terms of premature deaths or Death-adjusted life years (DALYs) averted or Health adjusted life years (HALYs) gained. The onset of illnesses poses financial burdens on patients (i.e., financial consequences) in terms of direct payment of medical care out of pocket, direct non-medical costs out of pocket and time and productivity losses, which can be translated into wages and income foregone (i.e., indirect or friction costs). The implementation of population health interventions eliminates these financial burdens. Financial

Risk Protection is estimated using three metrics: (1) Cases of catastrophic health costs averted (2) cases of poverty averted (3) money-metric value of insurance. Some people suffer medical impoverishment from ‘catastrophic’ health expenditures<sup>5</sup> and the financial risk protection afforded by a population health intervention will be the number of such cases averted (i.e., Cases of catastrophic health costs averted). Medical expenditure can also push people below the poverty line and the financial risk protection afforded by a population health intervention will be the number of poverty cases averted (i.e., cases of poverty averted). Risk-averse individuals value protection from the risk of uncertain adverse events such as the financial risk of illnesses. The financial risk protection afforded by a population health intervention will be the money-metric value of insurance provided to such group of people (i.e., money-metric value of insurance). The implementation of health policy interventions leads to education gains accruing to the target population in terms of the number of school absenteeism averted (i.e., education gains).

In the quest of incorporating equity, health and non-health benefits into the economic evaluation of PHIR, myriad studies have employed the following techniques. Olsen et al. (2021) employed Markov modeling, the Distributional cost-effectiveness analysis, and the GINI index to measure health impacts and inter-individual and geographical inequality impacts of a Community Case Management or treatment of childhood pneumonia program (CCM). They found that, in total, scaling up CCM coverage to 90 percent in all regions would decrease the Ethiopian Under-five mortality rate (i.e., health benefits) from 67 to 57 deaths per 1000 live births, translating as increased life expectancy (from 63.18 to 64.73 years, a 1.55-year gain) and decreased inter-individual inequalities in all regions. Assebe et al. (2020) employed the Extended cost-

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<sup>5</sup> catastrophic health expenditure is defined as exceeding a certain fraction of total household expenditures.

effectiveness analysis to estimate the health gains and non-health benefits of increasing the coverage of selected malaria interventions (artemisinin-based combination therapy (ACT), long-lasting insecticide-treated bed nets (LLIN), indoor residual spraying (IRS) and malaria vaccine (hypothetical) in Ethiopia by 10 percent. It was revealed that the ACT, LLIN, IRS and the vaccine would respectively avert 358, 188, 107 and 38 deaths each year. In terms of eliminating financial burden, the four interventions would avert about \$4,627,800 of out-of-pocket expenditures (OOP) in total. The ACT, LLIN, IRS and the Malaria vaccine respectively averted 440, 220, 125 and 18 cases of catastrophic health expenditures annually. About 50 percent of deaths averted by ACT, LLIN, and IRS and 52 percent by the malaria vaccine (hypothetical) accrued to the poorest and poorer quintiles.

Essue et al. (2020) also employed the ECEA to evaluate the health and non-health impact of eliminating medical and non-medical out-of-pocket payments of cataract surgery in Vietnam, across sex and income quintiles. They considered Program A, which consisted of eliminating medical OOP costs for small incision cataract surgery and Program B, which included program A plus a voucher covering non-medical OOP costs. They found that 45 DALYs were averted for males and 207 DALYs were averted for females for program A and also program B (i.e., same effects). The elimination of out-of-pocket costs were estimated to result in more individuals having surgery (from 1668 to 2326 surgeries among males and from 8728 to 12,185 among females). A net of 1,732 cases of catastrophic health expenditures were averted from program A and 5,473 cases from program B. About 115 poverty cases were averted from program A and 493 poverty cases were averted from program B. Postolovska et al. (2018) used the ECEA to examine the health and non-health impacts of increasing excise tax on tobacco in Armenia. They found that about 88,000 premature deaths were averted, OOP expenditures from tobacco-related disease treatment



averted was US\$ 63 million, poverty cases averted were 22000, cases of catastrophic health expenditures averted were 33,000 and half of tobacco-related premature deaths and 27% of associated poverty cases averted were concentrated among the bottom 40% of the income distribution population. Watkins et al. (2016) employed the ECEA to estimate the health and non-health impacts of a salt reduction policy on cardiovascular diseases (stroke, ischemic heart disease (IHD), hypertensive heart failure (HHF) and end-stage renal disease due to hypertension (ESRD)) in South Africa, across income quintiles. The intervention considered the government's target in salt consumption reduction by 38% (from 8 g per person daily to 5 g per day). About 403 cardiovascular diseases deaths were averted, a total OOP savings of \$294,860 were generated, catastrophic health expenditures cases averted were 175, poverty cases averted were 145 and more catastrophic health expenditures cases were averted in the upper income quintiles driven by more expensive care accesses by the wealthy.

De Neve et al. (2018) employed the extended cost-effectiveness analysis to assess the health gains (e.g., infections, disability-adjusted life years or DALYs averted), household financial gains (i.e., out-of-pocket expenditures averted), and education gains (i.e., cases of school absenteeism averted) for five Neglected tropical diseases (NTD) interventions that the government of Madagascar aimed to roll out nationally. The five NTDs considered were schistosomiasis, lymphatic filariasis, and three soil-transmitted helminthiasis (*Ascaris lumbricoides*, *Trichuris trichiura*, and hookworm infections). The results from the five NTD interventions are as follows. About 1,362,000 total infections were averted, 9,900 DALYs were averted, 113,000 household expenditures were averted, and 204,000 cases of school absenteeism were averted.

### *Equity consideration (The PROGRESS framework)*

The World Health Organization has defined health inequalities as the “differences in health status or in the distribution of health determinants between different population groups” (O’Neill et al., 2014). The health and non-health impacts of health interventions are stratified by equity-relevant variables (Verguet et al., 2016) denoted by the ‘PROGRESS’ acronym. O’Neill et al. (2014) identified an acronym ‘PROGRESS’ (See Table 3 in Appendix) which stands for Place of residence, Race/ethnicity/culture/language, Occupation, Gender/sex, Religion, Education, Socioeconomic status, and Social capital (Evans and Brown, 2003), as a measure of equity in the implementation of health intervention. The ‘PROGRESS’ acronym is applied to the Equi-PHIR framework as it provides a standardized approach for identifying and analyzing equity-relevant information within PHIR and any other studies. It helps to answer not only the question of effectiveness (does it work?), but also how, why and for whom was the population health intervention effective?

## **DISCUSSION AND POLICY RECOMMENDATIONS**

A conceptual framework (i.e., Equi-PHIR) was developed. It encompasses elements of equity-focused PHIR and the mechanism of population health intervention implementation. Thus, the impact of a population health intervention on Universal Health Coverage (UHC), determinants of health and the social distribution of health and non-health outcomes. A tool for assessing the inclusion of contextual factors (i.e., ERIC-A) in intervention formulation and implementation was developed and proposed by the study.

Equi-PHIR is a comprehensive conceptual framework proposed for use by policy-makers and researchers during the formulation, implementation and analysis of health interventions, policies, programs, and strategies. Decision-makers and researchers should take contextual factors, equity consideration, determinants of health and the action domains of UHC into account during the formulation and implementation of population health interventions and PHIR, respectively.

The study is novel and would guide decision-makers and researchers in evaluation population health research and interventions. However, one major limitation of the study is that stakeholders' analysis was not undertaken and hence, the quality and applicability of the framework could be further improved.

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## APPENDIX

**Table 1. The Evaluative Research on Intervention and Context Assessment Tool (ERIC-A)**

	Domain	Description	Constructs	Questions	Relevance, associated Contextual Change Techniques (CCT)
1.	Epidemiological	Baseline incidence, prevalence and distribution of the health problem of interest and its determinants in the target population.	Disease incidence or prevalence or burden	What is the disease incidence/prevalence in the target population?	<b>CCT:</b> prioritize population sub-groups with relatively higher base case incidence.  <b>Relevance:</b> Is available data on the incidence reliable?
			Intervention coverage (Base case or before and after the intervention)	What is the coverage of treatment/strategy/intervention?	
			Case fatality	What is the case fatality?	
2.	Social and Economic	Distribution of social and economic resources among communities or populations affected by the intervention.	Income quintile (1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> and 5 <sup>th</sup> quintile)	What is the disparity in income within the target population?	<b>CCT:</b> Eliminate barriers posed by income disparities.  <b>Relevance:</b> Do Communities or individuals within the target Population lack the resources to respond to the intervention? Or are they deterred by co-payments or other costs associated with participation? or are they reluctant to change practices from which they derive an immediate economic benefit.
			Educational levels (Tertiary, Secondary, Primary, no education)	What is the distribution of educational levels within the target population?	
3.	Cultural	Beliefs, attitudes, and practices among policy-makers, practitioners and those targeted by the intervention.	Inequality Aversion	Are policy-makers, practitioners and target population inequality averse?	<b>CCT:</b> Align intervention objectives with beliefs/cultural norms, attitudes, and practices. <b>Relevance:</b> Are Practitioners reluctant to implement interventions that call into question traditional beliefs?
			Belief system	Does the objectives of the intervention contradict with the belief systems of the target population?	
			Method of practice and skills mismatch.	Are the methods of practice of the intervention in line with the skills of the target population? E.g., Technology	
4.	Geographical/environmental	Features of the immediate or more distal (e.g., regional, or national) physical	Transportation cost	Is transportation cost a barrier to accessing the program?	<b>CCT:</b> Deal with geographical barriers through compensations benefits etc.

		environment, either natural or built.	Other Geographical and environmental barriers	What geographical/environmental barriers exist?	<b>Relevance:</b> Are Costs of delivering, scaling up or accessing an intervention higher especially in a more dispersed population? Does existing urban form limit or potentiate the impact of new infrastructure?
5.	Service and organizational	Characteristics, such as readiness to change and motivation, of the individuals delivering the intervention, the organizations in which they work and the wider service environment in which those organizations operate.	Strength of leadership and quality improvement	What kind of leadership/quality improvement possibility exist in the environment of operation? (Weak/strong)	<b>CCT:</b> Make sure the delivery organization and leadership are committed to the objectives of the intervention.  <b>Relevance:</b> Is there a tradition of quality improvement or strong/weak leadership within the delivery organization? Or is there a commitment to the particular issue/intervention? Are there any rooms for innovations?
			Political will	What is the political will towards the implementation of the intervention?	
		Co-interventions that target the same risk factors, behaviors, or outcomes within the same population as the intervention of interest.	Availability of Competing interventions	Are there competing interventions and how effective are they?	<b>CCT:</b> Scan the environment for competing interventions, complementary services and potentiality for future changes in risks or new interventions and assess their effectiveness.  <b>Relevance:</b> How effective is the ‘treatment as usual’ or the ‘status quo’ intervention? How effective are the available complementary services and what are their quality of development? Any foreseeable changes in health risks in the future or possibility of new interventions?
			Effectiveness and development of complementary services	How are complementary services faring as far as the objectives of the intervention is concerned?	
6.	Ethical	The extent to which implementers and recipients are in equipoise about the benefits and harms of the intervention and can provide informed consent to exposure to the intervention and participation in associated research.	Ethics	Is the intervention ethically accepted by stakeholders and participants?	<b>CCT:</b> Make sure that the intervention receives the go-ahead from recognized ethical board(s).  <b>Relevance:</b> Do stakeholders and participants hold strong beliefs about the benefits or harms of the intervention that may deter them from supporting it or individuals from participating in it?
			Morally acceptance	Is the intervention morally right or accepted by stakeholders and participants?	
7.	Policy	The wider policy framework within which	Existing policy frameworks and their interactions with the intervention.	What policies exist in the environment of operation and how do they interact with the intervention?	<b>CCT:</b> Ensure that the intervention does not deviate from existing set of policies.

		a specific intervention is embedded.			<b>Relevance:</b> Does the intervention interacts positively or negatively with other components of a broader set of policies
8.	Legal	Legal rules, regulations, and mandates that constrain or enable implementation of the intervention.	Regulatory processes and their interactions with the intervention.	What regulatory processes exist in the environment of operation and how do they affect the intervention?	<b>CCT:</b> Adopt and adjust timelines that takes regulatory processes into consideration.  <b>Relevance:</b> Do Supranational judicial or regulatory processes prevent or delay implementation of national policies and hence the intervention?
9.	Financial	Sources and mechanisms of funding for the intervention and the wider payment, reward, incentive or charging structures in which they are embedded.	Funding source and beneficiaries identification	Who are the organizations providing funding of the intervention and the beneficiaries of the intervention?	<b>CCT:</b> Ensure that the costs and benefits of the intervention are aligned. Thus, some benefits should be directed to the organization that provides the funding or channeled to their area of operation.  <b>Relevance:</b> How aligned are the distribution of costs and benefits? E.g., local government (prevention) vs. health sector (reductions in morbidity).
			Alignment of costs and benefits	What are the directions of the costs and benefits from the intervention and how are they aligned?	
10.	Political	Distribution of power among stakeholders and others with an interest in promoting or obstructing the optimum design or implementation of the intervention.	Existing power relations and commercial interests	What power relations/commercial interests exist in the environment of operation and how do they affect the intervention?	<b>CCT:</b> Find out about existing power relations and commercial interests that may threaten the intervention and resolve them or work around them by re-evaluating the objectives of the intervention.  <b>Relevance:</b> Does the intervention undermine existing power relations/commercial interests?
			Lessons from alternative interventions on power relations and commercial interests preservation.	What alternative interventions exist and preserve the existing power relations/commercial interests and what can be learned from them?	
11.	Historical	Continuing influence of past conditions, sociopolitical relationships, policies and legal frameworks.	Existing sociopolitical relationship	What kind of sociopolitical relationship exists in the environment of operation? E.g., community mobilization or segregation.	<b>CCT:</b> It is worth noting that a tradition of community mobilization may encourage participation in community-led interventions; alternatively, a history of segregation may undermine the implementation of interventions associated with a dominant group or institution. Hence, align the nature of intervention with the existing sociopolitical relationship in the environment of operation.
			The nature of the intervention	What is the nature of the intervention as far as its objectives are concerned?	

			Sociopolitical relationship and its alignment with the nature of the intervention.	How does it align with the sociopolitical relationship in the environment of operation?	<b>Relevance:</b> Given the nature of the intervention, would existing sociopolitical relationship serve as a facilitator or barrier to the intervention?
12.	External shocks and catalytic events	Extreme weather events, economic crises, regime changes, onset of armed conflict, etc., that affect implementation, sustainability or uptake of the intervention or impact directly on outcomes targeted by the interventions.	Anticipation of external shocks and trends of events.	What external shocks or trends of events should be anticipated?	<p><b>CCT:</b> Research on previous external shocks and potential future shocks and trends of events that may impact the intervention negatively.</p> <p><b>Relevance:</b> Is the intervention susceptible to adverse trends of events or change in the social patterning of health behaviors?</p>
13.	Demographic factors	Distribution of demographic factors	Change in demography	What is the demography of the target population and how is it changing and how does that affect the intervention?	<p><b>CCT:</b> Ensure that intervention is adjustable to accommodate changes in demography of the target population.</p> <p><b>Relevance:</b> Does a change in demography affect the intervention?</p>

Source: Craig et al. (2018) and Author's.

Table 2. Action Domains of UHC

	Health System Attributes	Relevance and Recommendation
1	QUALITY	Improvement in population health largely depends on the quality and safety of health services delivered at individual and population levels. Barriers to quality and safety of can be addressed by strengthening regulations and the regulatory environment, developing effective and responsive individual and population-based systems and services, and engaging individuals, families, and communities (World Health Organization, 2016).
2	EFFICIENCY	Maximizing (health) output from a given level of (scarce) resources, termed as efficiency, is fundamental to improving population health. Efforts to improve health system efficiency could include ensuring health system design meets population needs, incentivizing appropriate provision and use of services, and enhancing managerial efficiency and effectiveness (World Health Organization, 2016).
3	ACCOUNTABILITY	Good governance and maintaining feedback/accountability mechanisms to obtain information for improving performance entail strengthening management and institutional processes. Priority actions for improving accountability include strengthening government leadership and rule of law for health, engaging in partnerships for public policy, and ensuring mechanisms for transparent monitoring and evaluation (World Health Organization, 2016).
4.	SUSTAINABILITY	Disasters, emerging diseases, and economic volatility pose serious threats to public health security and the ability of health systems to respond to such events. To ensure resilience for combating shocks and sustaining progress, countries need to enhance public health preparedness, develop community capacity for health protection and promotion, and ensure health system adaptability and sustainability.
5.	EQUITY	Reducing health inequities is challenging, but necessary to ensure social justice along with improved overall health outcomes. Key actions to achieve health equity include implementing financial protection mechanisms to reduce any economic barriers to accessing health services, promoting connectivity between health and social protection, ensuring access to quality services by disadvantaged groups, and applying non-discrimination as a broader social policy (World Health Organization, 2016).

Source: (World Health Organization, 2016)

Table 3. Features of PROGRESS-PLUS

	FRAMEWORK	DESCRIPTION
1.	Place of residence	This includes rural/urban, high-middle-or low-income countries, particular region, town, or community, country/state, housing characteristics.
2.	Race, ethnicity, culture, and language	Differences in health outcomes across different races, ethnic backgrounds, cultures, and languages
3.	Occupation	Unemployed/underemployed, informal/formal workers, unsafe working environments, professional, skilled/unskilled.
4.	Gender/sex	Differences in health outcomes between males and females.
5.	Religion	Differences in health outcomes across religious affiliations/backgrounds based on beliefs towards healthcare access etc.
6.	Education	Differences in health outcomes stratified by the years in and/or level of education (no education/primary/secondary/tertiary and above) attained, school type.
7.	Socioeconomic status (SES)	Differences in health outcomes stratified by SES or income quintile (poorest, poorer, middle, richer, and richest), means tested benefits/welfare, affluence measures.
8.	Social capital	Differences in health outcomes stratified by social capital. It includes social relationships and networks, interpersonal trusts between members, civic participation, family support/community/neighborhood.

Source: O'Neill et al. (2014) and Author's.

Figure 1: Eco-social for Public Health Action

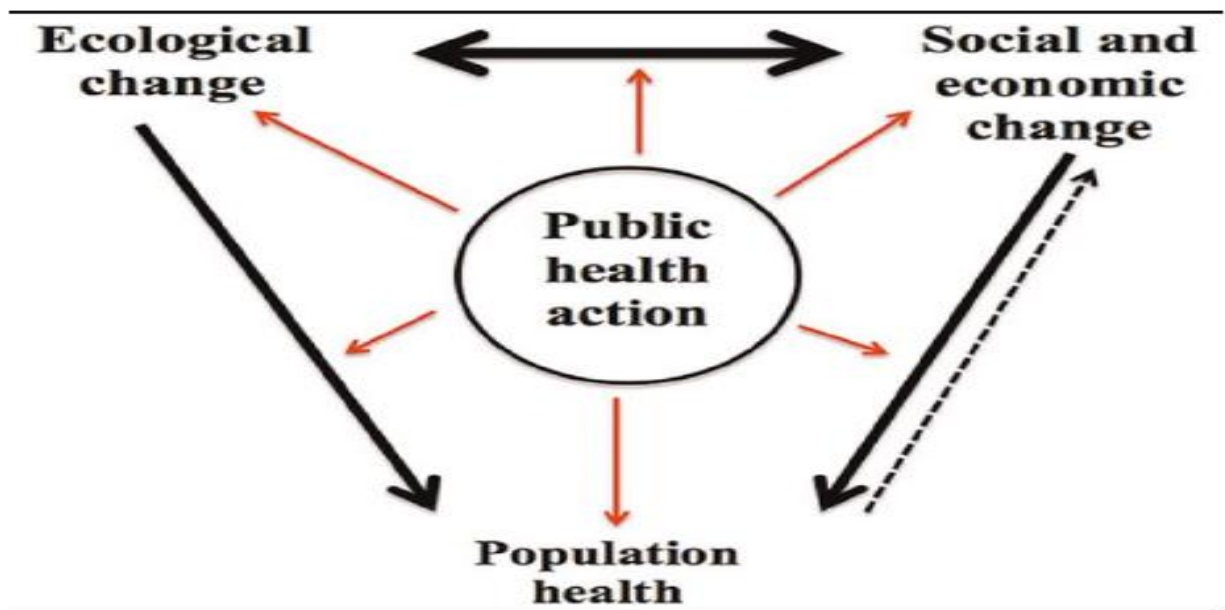




Figure 2. The Equi-PHIR framework

