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Integrating health equity into implementation science to advance chronic disease prevention and control

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Integrating Health Equity into Implementation Science to Advance Chronic Disease Prevention and Control

By

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Abstract

Integrating health equity into implementation science to advance chronic disease prevention and control

By

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The Brown School, Washington University in St. Louis, 2023

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Marginalized populations are inequitably burdened by chronic diseases such as diabetes, heart disease, obesity, and cancer. The goal of health equity work is to ensure all people have a fair and just opportunity to achieve optimal health. Implementation science has made health equity a greater focus and priority in recent years. There has been a proliferation of guidance on what implementation science needs to do to advance equity. However, the field currently lacks specific, actionable guidance on how to integrate equity. The overarching goal of this dissertation is to synthesize conceptual and theoretical underpinnings regarding health equity and bring them to bear in actionable resources and methods for implementation science. Aim 1 seeks to identify and characterize health equity TMFs applied in empirical chronic disease prevention and control research. Aim 2 focuses on developing a practical resource to aid implementation researchers in designing and tailoring equity-focused implementation strategies. Aim 3 applies an equity lens to assess adaptations made to a home-delivered evidence-based intervention focused on healthy eating and physical activity among mothers with overweight or obesity. These studies will offer insights for integrating health equity into implementation science frameworks and methods, and will contribute to growing efforts to advance equitable implementation.

Abbreviations

ASPIRE: Adapting Strategies to Promote Implementation Reach and Equity

DPP: Diabetes Prevention Program

EBI: evidence-based intervention

FRAME: Framework for Reporting Adaptations and Modifications to Evidence-Based Interventions

HEALTH: Healthy Eating and Active Living Taught at Home

IRR = interrater reliability

IS = implementation science

ISC3 = Implementation Science Centers for Cancer Control

NCI = National Cancer Institute

PAT: Parents As Teachers

PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SDOH: social determinants of health

TMFs = theories, models, and frameworks

US = United States

WU = Washington University

Reflexivity and Positionality Statement

Public health programs, referring to both academic training programs and interventions seeking to improve population health, "are inseparable from the cultural, social, and economic context" in which they are situated.[1] Public health is inherently a political and social action.[1,2] I pursued my graduate education in public health and worked at a healthcare research institute during the rollout (and dismantling) of various Affordable Care Act provisions, the March for Science movement, the COVID-19 pandemic, the rise of anti-racism movements in the wake of George Floyd's murder, the Supreme Court overturning Roe v. Wade, the increase of anti-LGBTQ legislation, and many other political and social events. My work as a scientist does not happen detached from the world around me; it is heavily shaped by my lived experiences and my identity and values. As such, although not a required dissertation section, I felt it essential to reflect on my positionality and make explicit how this shapes my research.

I am a white, cis-gender, queer woman born in the US. I was raised in rural, resource limited communities in a low-income household by two parents who did not go to college and who have multiple complex chronic health conditions. At various points in my life, I've experienced financial insecurity, food insecurity, housing instability, lack of health insurance, and un/misdiagnosed health conditions. I received my bachelors, masters, and now doctoral education at well-resourced academic institutions. My educational attainment, current and planned professional roles, and outwardly visible aspects of my identity afford me an advantaged position in society. Simultaneously, the not immediately knowable aspects of my identity and lived experience can and have been subject to marginalization in society.

My research often focuses on people from whom I look different and have had different lived experiences. My status as a white academic researcher holds power and privilege over

many of the people and communities for whom I intend for my research to have a positive impact. As a trainee, I hold little power in the institutions I work in and occupy a relatively vulnerable position in my profession, which constrains what and how I research. I acknowledge that I participate in many of the research practices that I challenge and critique in my dissertation and broader body of scholarship. Science and the production of evidence has historically been and frequently continues to be colonizing endeavor rooted in Euro- and androcentrism.[3] My interest at the intersection of implementation science and health equity is often paradoxical; I am promoting the use of "evidence-based interventions" that are largely developed by and tested among people and groups who do not represent intended recipients, do not include marginalized individuals in meaningful ways as co-creators of knowledge, and values researcher-driven evidence over the lived expertise of affected individuals and groups.

I view this dissertation as an opportunity to unearth the ways in which my current practices to not uphold the principles and approaches that are needed to advance health equity, to improve my understanding of ways to better integrate principles of social justice, self-determination, and equity into my research, and to identify future directions to pursue in my research so that my work does not just talk the talk, but actually walks the walk of advancing equity. This starts by acknowledging that scholars who hold marginalized identities, particularly Black and Brown women, have been conducting health equity work for decades, but are less frequently funded, published, and cited than white and male scholars.[4] To avoid this pitfall of "health equity tourism",[5,6] I integrate work from various marginalized perspectives when these are not represented in commonly cited, prevailing scholarship.

Chapter 1: Introduction

Numerous intergovernmental organizations, national governments, nongovernmental organizations, and professional societies recognize health and wellbeing as a basic human right.[7-9] However, this right is not a guarantee; billions of people across the world are adversely impacted by diseases that are largely preventable. Noncommunicable diseases, often called chronic diseases in the US, are conditions (e.g., cardiovascular disease, diabetes, cancer) that are not mainly caused by acute infection, last one year or more, and require long-term care and may limit activities for daily living.[10,11] Chronic diseases are the leading contributors to morbidity and mortality; seven of the ten leading causes of global mortality are chronic diseases.[12] In 2000, 60.8% of global mortality was attributable to chronic diseases; this increased to nearly 74% in 2019, amounting to 41 million deaths.[13]

Obesity-related chronic disease in the US

In the US, approximately 60% of adults have at least one chronic disease, and 40% have two or more.[14] Prior to the COVID-19 pandemic, 70% of deaths in the US were attributable to chronic diseases.[15] Obesity and obesity-related chronic diseases are of especially great concern. Obesity rates among adults and children have doubled since the mid 1980's. Over 42% of US adults ages $\geq$ 20 and around 20% of children aged 2-19 have obesity,[16] amounting to over 100 million people. Obesity is the occurrence of increased amount and size and of fat cells in the body.[17] The progression of prolonged weight gain over time and obesity is accompanied by chronic low-grade inflammation, which puts multiple organ and tissue systems under increased stress.[18] Obesity is associated metabolic system dysfunction, which can include insulin resistance, making it difficult for cells to absorb glucose, and dyslipidemia which can lead to vascular system disfunction and constricted arteries, which reduce blood flow and elevate blood

pressure.[18,19] Obesity, now considered a chronic disease, can lead to other chronic conditions, such as type 2 diabetes, cardiovascular diseases (e.g., coronary heart disease, heart failure, stroke), and certain cancers (e.g., breast, colorectal, prostate, esophageal).[19-24]

Heart disease is the single largest cause of mortality in the US, leading to nearly 700,000 deaths in 2020. In that same year, cancer accounted for over 600,000 deaths, 160,000 deaths were due to stroke, nearly 153,000 due to chronic lower respiratory diseases, and over 102,000 due to diabetes.[25] Beyond loss of life, physical and mental chronic conditions have a vast toll on society, and cost the US an estimated $3.1 trillion to $3.7 trillion annually.[14,26] These figures include the direct costs of healthcare spending, as well as economic costs, such as lost workplace productivity. Over 55% of healthcare spending was attributable to just 3 chronic diseases: cardiovascular disease, diabetes, and cancer.[26]

Many chronic diseases and their consequences are avoidable. Prevalent chronic diseases, including obesity, type 2 diabetes, heart disease, and certain cancers, are attributed to a common set of risk factors: poor nutrition, physical inactivity, tobacco use and exposure to secondhand smoke, and excessive alcohol consumption.[13,14] Although these risk factors are largely behavioral, the conditions that shape these behaviors are often beyond the control of individuals.

In the US, marginalized racial and ethnic groups, people of low socioeconomic status, people living in rural areas, and other marginalized groups have the highest risk of developing chronic disease, and greater morbidity and mortality.[27-29] Latino/a, Black, and North American Indigenous people experience the highest rates of obesity; prevalence is especially high among Black women (over 55%).[16] Those living in rural areas and those with lower educational attainment tend to have higher rates of obesity and other chronic diseases compared to urban and more highly educated groups.[16] Cardiovascular disease is higher among Black adults than any

other race or ethnic group and disproportionately affects the southern US, sometimes referred to as the Stroke Belt.[21,30] Diabetes prevalence is higher among marginalized racial and ethnic groups compared to white Americans, and is especially high among North American Indigenous, Black, and Hispanic adults.[31] Women of childbearing age are especially at risk for unhealthy weight gain, which can lead to the development of gestational diabetes among pregnant women, putting both mother and child at risk for adverse outcomes during pregnancy and years after.[32,33] The CDC estimates that more than 684,000 obesity-linked cancers occur in the US annually, over 2/3 of which occur among women.[23] Cancer mortality rates tend to be highest in the southern and midwestern US, among rural populations, and those with lower socioeconomic status.[34] Black and North American Indigenous adults have disproportionately high late state cancer diagnoses for multiple cancer site compared to other racial and ethnic groups.[34]

Health equity and inequities

People who have historically been and continue to be marginalized due to systemic and structural racism, sexism, heterosexism, classism, ableism, xenophobia, homophobia, and the other "isms" and "phobias" that peripheralize people based on their identities, experiences, and environments, face the most systemic exclusion from resources and power and bear the greatest burden of chronic disease.[27,35,36] It is undeniable that systemic discrimination is embedded within policies, societal institutions, and social and economic systems such that these favor those with greatest power and wealth while excluding and oppressing people who are less valued in society based on how their skin color is socialized into race, their sex, gender identity, sexual orientation, ethnicity and cultural background, among other intersecting characteristics.[27,37,38] These "structural determinants of health" drive the unequal distribution power, wealth, and resources that create social stratification and promote or undermine health.[39-41] These structural

determinants of health shape "the conditions in which people are born, grow, live, work and age", referred to as the "social determinants of health (SDOH).[39,42] SDOH act as protective or risk factors (e.g., high incomes, safe neighborhoods and quality housing are protective factors, while low incomes, unsafe and poor quality home and neighborhood conditions are risk factors) that can promote or hinder good health.[39,43] These structural determinants of health and their resulting SDOH drive the inequities observed in the distribution of chronic diseases and other health conditions and their risk factors.

Equity is defined as the state, quality, or ideal of being just, impartial and fair.[43] While *equality* denotes the same amount of resources for everyone, *equity* recognizes that individuals and groups do not all start at the same place, thus require different levels and types of resources over time to overcome intentional or unintentional conditions arising from systemic structures and biases.[43-45] The guiding definition of health equity in this dissertation states that **health equity is "the assurance of the conditions for optimal health for all people,"** which necessitates "valuing all individuals and populations equally, recognizing and rectifying historical [and ongoing] injustices, and providing resources according to need."[43]

Human rights and justice are inherent in the definition of equity. The equal worth of all people is central to the fundamental human rights principle that "all human beings equally possess certain rights."[46,47] Every person has the right to achieve their optimal health status; health equity requires that no one is denied the possibility to be healthy for belonging to a group which has historically been (or continues to be) systematically marginalized or discriminated against.[40,46] This reflects the human rights principle of non-discrimination, which includes intentional and unintentional discriminatory treatment embedded within "structures and institutions, regardless of whether there is conscious intent to discriminate" against any particular

individual or group.[46,48] Health equity "involves concerted effort to achieve more rapid improvements among those who were worse off to start, within an overall strategy to improve everyone's health."[46] Aligned with ethical principles of beneficence and not doing harm, health equity efforts do not pursue the betterment of health for marginalized groups by worsening health for more advantaged groups.[46]

Health equity can be viewed both as a process and an outcome. **Health equity as a process** "involves active inputs, constant vigilance, and continuous correction."[43] Although health equity necessitates identifying and remedying injustices that lead to the inequitable societal distribution of power and resources that influence health,[43,49] it moves away from a deficit perspective to an empowerment one that considers assets, strengths, and opportunities among marginalized groups that can be leveraged and built upon for greater opportunities for health and wellbeing.[50] Health equity as an outcome is often conceptualized as the reduction and ultimately the elimination of inequitable differences in health.[46] The terms "health disparities," "health inequalities," and "health inequities" are used to refer to these differences in health, with evolving definitions, uses across context, and ongoing debate about preferred terms.[51] This dissertation takes several stances on the conceptualization of health equity and the language used to discuss this topic.

- This dissertation predominantly views health equity as a process. The rationale for this choice is that this denotes the action-oriented, continual nature of health equity, as described in the guiding definition above, rather than something that can be achieved in absolute. When describing an outcomes orientation to health equity, this dissertation avoids the phrasing "achieve health equity" and favors alternatives such as "advance" or "promote" health equity, "achieve greater" health equity or other verbiage that denotes progress towards equitable

outcomes. This is to avoid suggesting that there is an objective, absolute health equity that can be achieved in totality.

- The term "health inequity" is favored over "health disparity" to denote the unfair, disproportionate burden of morbidity and mortality experienced by groups marginalized by "interlocking oppressive systems" (e.g., structural racism, sexism, classism).[51] This dissertation uses disparity when describing other literature to align with the original authors' intent (e.g., indicating a previous study that sought to "reduce health disparities" among certain groups), but otherwise avoids this term.
- This dissertation conceptualizes health equity and health equity-oriented actions on a spectrum with varying depth or centrality of equity, such as illustrated in the equity iceberg analogy by The Center for Implementation.[52] In the iceberg analogy, the most meaningful actions towards equity are at a deeper level below the surface and require greater level of effort to engage in and sustain. The term "equity lens" is used when applying guiding principles of equity and health to concurrently or retrospectively examine an issue, phenomenon, or empirical study that may be related to equity in its focus (e.g., developing, testing, and implementing a public health program intended for marginalized racial and ethnic groups) but did not have an explicit grounding in equity from the onset. "Equity related" or "equity relevant" describes concepts that do not directly have equity or health equity in their names or definitions but are connected to equity (e.g., structural racism as a driver of inequitable health among Black and Brown individuals). "Equity focused" or "equity oriented" refers to actions, activities, and approaches that are explicitly intended to integrate principles of equity and health equity into research and practices processes and outcomes.

Common biomedical, behavioral, and psychosocial frameworks, and the research and interventions they inform, tend to conceptualize health mainly as a property of individuals resulting personal choices and behaviors.[51,53] This conceptualization obscures the role of structural factors that constrain the health of marginalized people.[51,53] Approaches focused on individual behaviors are insufficient in preventing and controlling chronic diseases and can exacerbate inequities.[54-56] Additionally, marginalized groups have historically been excluded and continue to be underrepresented in research as participants and members of the scientific workforce. Consequently, their needs, priorities, and perspectives are largely absent from the evidence base for interventions targeting chronic diseases and associated risk factors.[57-59] Our understanding of health inequities is also hampered by lack of intersectional data collection and reporting. Health inequities are often reported by one or a small number of defining variables, such as race/ethnicity, income, or educational attainment, which obscures within-group heterogeneity and which subpopulations may be at greatest risk for developing disease or having adverse outcomes. It is important for the perspectives of marginalized groups to be better represented in surveillance of health inequities and efforts seeking to eliminate these.

Greater understanding of which interventions work best for whom and under what conditions to promote equity in chronic disease prevention and control is still needed.[60,61] Despite the availability of effective chronic disease prevention and control EBIs, not all groups benefit from these.[55,62] The "inverse prevention law" describes the phenomenon in which populations with the greatest need and risk benefit the least from public health interventions, while interventions are more available and successful among those with less severe need.[63,64] EBIs often do not reach populations with the greatest need, and implementation efforts may not address contextual barriers that perpetuate inequities (e.g., systemic racism, neighborhood

deprivation, limited availability of or access to resources) or leverage facilitators to support equitable implementation (e.g., existing community resources and resiliency factors).[65-67] As just one example, a large quality improvement initiative involving nearly 200 healthcare practices seeking to reduce hypertension control disparities improved overall hypertension control but actually increased inequities between Black and white patients because the latter had greater improvements.[68] This study had targeted recruitment in marginalized communities, however was informed by an individual behavior change theory (Self-Determination Theory), did not include a foundation in health equity research, and did not seek to address community, policy, or other environmental and societal barriers to hypertension control.[68] Studies such as this would benefit from a grounding in principles of health equity and greater consideration of non-clinical factors that can support or hinder health equity. For instance, this study could have used community needs assessments and historical literature to discern barriers to equitable primary care quality and access (e.g., residential segregation, historical and current medical mistreatment of nonwhite patients) and incorporated intervention components to ameliorate or reduce the deleterious impact of these.

As the evidence base for chronic disease prevention and control interventions grows, there is also a need to understand *how* to put these interventions in place and appropriately sustain them so that they can have their intended benefit. The field of dissemination and implementation science (hereafter referred to as "implementation science" or IS) seeks to close the gap between research and practice by studying methods and approaches to support the uptake, routine use, and sustainment of research findings and evidence-based interventions (EBIs) into routine practice.[69] Ultimately, the field's goal is to improve the quality and effectiveness of intervention delivery to, in turn, achieve improved health outcomes.[69]

Challenges and opportunities to advance equitable implementation science

Health equity is rapidly receiving increased attention in IS.[70,71] The field has the potential to advance health equity by improving the implementation and sustainment of EBIs delivered to marginalized populations and settings.[72] However, EBIs are too often delivered inequitably; without intentional consideration of equity, implementation efforts risk failing to advance health equity and inadvertently exacerbating inequities.[45,65] Interventions can generate inequities when they are more acceptable to, adopted more frequently, adhered to with greater fidelity, or are more effective in advantaged groups compared to those who are disproportionately burdened by a health condition or risk factors.[73,74]

Although health equity is often an implied goal in IS, the field's development did not until recently explicitly focus on equity.[71,75,76] Furthermore, specific, actionable guidance for integrating health equity into IS is currently sparse. What equity means in the context of IS is often not well defined. Equity is frequently added to frameworks or other IS tools and methods as a broad umbrella term without operationalizing what constitutes equity,[77] or terms have circular definitions (e.g., "equitable implementation" has equity in the definition rather than defining equity).[45] As implementation scientists work to increase the field's focus on health equity, it will be critical to integrate conceptual foundations and empirical work from health equity research into prominent theories, models, and frameworks (TMFs) in IS, the interventions we seek to implement, the strategies we use to support implementation and sustainment, and the measures we use to assess implementation determinants, processes, and outcomes.[75,78]

To integrate greater focus on health equity in IS, several gaps must be addressed.[70] First, most prevailing TMFs used in implementation research were not developed with a grounding in health equity and do not adequately conceptualize the multi-level factors that promote equity or

lead to inequities.[70,75,79,80] This hampers our ability to assess implementation contexts, identify equity relevant determinants (i.e., barriers and facilitators) to implementation, and situate determinants in their broader historical and current social and political contexts (e.g., recognition and understanding of Jim Crow laws to contextualize continued racial residential segregation).[81] If the structural drivers of inequities are not considered in the selection, adaptation, and uptake of interventions, implementation may perpetuate inequities rather than promote greater equity.[75] Although there are several recent health equity additions to implementation frameworks,[77,82] prominent conceptual guidance in the field continues to underspecify or omit equity-relevant constructs (e.g., processes of marginalization, community assets and resilience). Additionally, many frameworks are geared towards clinical settings.[70,71] The focus on clinical constructs and language, (e.g., "clinical encounter", patients) limit their applicability to non-clinical settings (e.g., neighborhoods) and implementation of population focused rather than individually focused interventions (e.g., clinic-based hypertension control for individual patients vs. community-based program for municipality-wide hypertension control). IS also has few high-quality measures to assess broader contextual factors, particularly social and structural determinants of health, compared to measures focused on the implementers and the settings in which implementation occurs.[83] Additionally, there is little focus on equity in available measures.[70,83]

Another challenge to the field is the lack of guidance on how to select, design, and tailor implementation strategies with an explicit focus on health equity. This is related to the first challenge, as it is recommended to match strategies to determinants. As commonly used frameworks are insufficient in guiding the identification and characterization equity-relevant determinants, selecting and designing strategies to adequately address these is difficult. Although there are broad suggestions to include equity in implementation strategy design,[45,70] there are few

resources available to guide the operationalization of equity in the selection of strategies, specification of strategy components, and identification of measurement targets and measurement of implementation processes and strategy effects on implementation outcomes. Rather than reinventing the wheel, the field should leverage existing knowledge from health equity researchers, critical race scholars, and other disciplines that have conducted equity oriented work for decades.[78]

One recent approach, the Adapting Strategies to Promote Implementation Reach and Equity (ASPIRE) framework from school mental health,[84] offers a valuable starting place for selecting and designing implementation strategies through an equity lens. ASPIRE outlines a three-step process for adapting equity explicit implementation strategies – identifying underlying assumptions about how the strategy works, identifying potential sources of disparities, and adapting the strategy to ensure equity is considered in the underlying assumptions.[84] To be actionable to users beyond the ASPIRE developers, greater detail on equity-oriented theoretical perspectives to guide the interrogation of strategies and their underlying assumptions would be helpful. An intersectional and critical race lens would be valuable in better understanding the drivers of observed inequities and how different groups are differentially affected. Finally, to promote high quality reporting and replicability, strategy components should be reported with sufficient specificity, per Proctor and colleagues.[85] Additionally, ASPIRE has not yet been applied to other health areas beyond mental health or in settings beyond schools; a more diverse array of examples for equity-focused strategy specification would be beneficial to the field.

Along with integrating a health equity focus into implementation strategies, greater emphasis on health equity needs to be incorporated into the interventions we implement.[86] Many interventions are developed by researchers who do not reflect the characteristics of the intended

recipients, and are often tested among predominantly white, relatively well-off participants compared to the wider populations at risk for or living with chronic conditions.[58,59,65,87] Interventions are usually tested in controlled research studies designed to enhance the internal validity of findings, but often do not account for the complexity of the routine practice settings and contexts in which the interventions will be implemented and delivered.[65,86] Interventions often need to be adapted to better address external validity, with explicit attention to the fit to the context and the needs and preferences of recipients.[88-90] There is also increased acknowledgement of the need for interventions that modify context in order to promote equitable access to resources and opportunities to achieve optimal health (e.g., policies to reduce childhood poverty, place-based approaches to improve neighborhood living conditions).[67]

There is a growing literature on the science of adaptations, many examples of interventions that have been adapted for marginalized groups through participatory approaches, and several IS frameworks to guide and track adaptation.[88-92] However, as with other types of frameworks in IS, frameworks to guide and assess adaptations to EBIs (e.g., Dynamic Sustainability Framework[93]) were not designed with an explicit focus on health equity. The expanded Framework for Reporting Adaptations and Modifications to Evidence-Based Interventions (FRAME) includes coding elements to capture multi-level contextual factors that influence adaptation or that adaptation seeks to address (e.g., existing laws, funding policies, social context, implementer or recipient race/ethnicity).[90] While equity may be implied with the inclusion of these factors, there is not explicit guidance on how to approach adaptation with the goal of promoting greater equity, or to assess equity-related impacts of adaptations. This is another area in which implementation science would benefit from learning from other fields (e.g., sociology, anthropology) to integrate more explicit focus on health equity (e.g., integration

of postcolonial theory to understand how colonialism contributes to health inequities experienced by people of color and potential solutions to these inequities).[79,92]

As Jones and colleagues suggest, health equity should be considered as a continuous process.[43] It is improbable complete health equity will be achieved, so it will always be a work in progress. The risk of treating health equity as an outcome that will be achieved when inequities are eliminated is that this could happen with worsening outcomes for some groups (e.g., increased COVID mortality among ideologically conservative white populations with low vaccine uptake) without improvements in outcomes among groups experiencing inequities, or without allocating resources according to need, redistributing power, supporting self-determination and autonomy, and co-creation of solutions with affected groups.

Thus, I envision **equitable implementation as the process of selecting, adapting, and promoting the uptake and sustained use of evidence-based interventions in a way that embraces and integrates principles of social justice, empowerment, self-determination, liberation, and community engagement and co-production** (with de-implementation as the reduction or removal of harmful practices in a manner that follows the same principles). The term "evidence" is informed by an evidence-based public health perspective, which recognizes other forms of evidence beyond investigator-driven studies, such as program evaluations, qualitative data from community members and other non-research groups and individuals, and other data on people's lived experiences.[1,86,94] Empowerment refers to social actions and processes that promote individuals' and community voice, ability, and capacity in having greater influence and ownership over their lives.[95] Self-determination is related to empowerment and refers to the fundamental human right to freely pursue economic, social, and cultural development. Liberation refers to freedom from oppression. Community engagement and co-

production indicates affected individuals and groups should be meaningfully involved in identifying priorities, decision making, and generation of evidence. The above definition or equitable implementation aligns with recent work by Metz et al. that describes values-driven implementation, which entails understanding and aligning implementation efforts with values, beliefs, desires of affected individuals and groups.[96]

Specific Aims

The overall goal of this dissertation is to contribute to advancing the integration of health equity into the field of IS. This dissertation pursues three specific aims, which correspond to three distinct projects:

Aim 1: Identify and characterize health equity theories, models, and frameworks that can be incorporated into implementation research. To achieve this aim, **study 1** involves a scoping review of health equity TMFs applied in empirical research in chronic disease prevention and control. (Chapter 2)

Aim 2: Develop a resource to guide the integration of health equity into the design and tailoring of implementation strategies. **Study 2** integrates literature from the study 1 scoping review, the candidate's doctoral area statement, and other literature sources, and involves iterative development, feedback, and refinement steps to arrive at a usable version of the resource. (Chapter 3)

Aim 3: Apply a health equity lens to assess adaptations made to an evidence-based chronic disease prevention intervention. Aim 3 is informed by literature from the first two aims, as well as guidance on intervention adaptation. **Study 3** takes place within the context of a trial to evaluate the implementation and effectiveness of Healthy Eating and Active Living Taught at Home (HEALTH) intervention delivered through the Parents as Teachers (PAT) home

visiting program. The goal of this work will be to discern what adaptations are made and their potential implications for equitable delivery and impact of HEALTH (i.e., potential to promote equity or increase inequities).

These three aims and their corresponding studies are linked by their intersecting focus on IS, health equity, and chronic disease prevention and control. This dissertation represents the current stage of the field of IS, in which scholars are simultaneously attempting to integrate an explicit focus in their conceptual guidance and methodological approaches from the onset of a study, as well as apply an equity lens to work already underway or completed to understand potential equity implications that can be learned from this work. Collectively, the studies in this dissertation address the following recommendations from Brownson et al. 2021 to advance health equity within IS: Study what is already happening; Integrate equity into models; Design and tailor implementation strategies; Engage organizations, internally and externally (specifically – evaluate existing programs policies regarding their equity impacts).[70] The final chapter of this dissertation (Chapter 5) discusses overall lessons learned, limitations, and opportunities for future research.

Chapter 2: Scoping review of health equity frameworks and models

Introduction

Despite advancements in interventions to modify health behaviors and outcomes, SDOH and structural causes of inequities, equity is not always a specific focus of health interventions or their evaluation.[97,98] There is a need for equity-oriented conceptual guidance to inform intervention development and adaptation, study design, measurement, and evaluation.[99] Visual representations offered in frameworks and models can clarify and distill key concepts and offer a simplified summary of complex phenomena, such as population health and drivers of health inequities.[100] Frameworks and models can help to shape research questions, identify key variables of interest and relationships between these, and guide the development and evaluation of interventions.[99,100] Interventions that are guided by TMFs may be more effective than interventions that lack theoretical grounding.[101]

There is little guidance available that distinguishes what makes a framework or model a "health equity framework." In a recent article, Kumanyika describes health equity frameworks as being predicated on health equity concepts and principles and indicates such frameworks amplify structural issues and SDOH.[102] She also indicates health equity frameworks offer a series of factors or questions that allow for deconstructing and reconstructing intervention components and contextual elements, providing tools for assessing programs and policies.[102] There are several narrative reviews and summaries of health equity-focused models and frameworks, which broadly describe the disciplines and settings in which these have been applied and how equity is operationalized in these. However, to date there has been no systematic synthesis of which of these have been applied in empirical studies in public heath,[49,100] particularly in chronic disease prevention and control, and how these have been utilized to guide research.

Conceptual guidance in IS is largely devoid of an explicit focus on health equity.[103-105] Although there are several new or revised frameworks that incorporate an equity lens,[77,82] these generally include equity as a single overarching construct and offer little guidance on identifying, defining and operationalizing equity-related determinants, processes or outcomes. Greater integration of health equity into IS and the field's conceptual guidance is still needed.[70,79] The National Cancer Institute's (NCI) Consortium for Cancer Implementation Science (CCIS) action group on health equity identified promoting an explicit focus on health equity in implementation TMFs as a key opportunity for the field and suggest conducting a scoping review on health equity frameworks that may have relevance for IS.[105]

Previous reviews of conceptual guidance in IS, for example a scoping review of de-implementation frameworks and models, indicate that many frameworks are proposed conceptually without empiric use, testing, and refinement over time.[104] A recent scoping review examined how equity-focused implementation TMFs were empirically applied and offers examples of how equity is operationalized in these.[106] This review is limited to TMFs within the field of IS applied to address ethnicity-related health inequities in healthcare settings.[106] Given the need to focus efforts beyond healthcare to promote health equity and the field's limited grounding in health equity, there are still opportunities to identify equity focused frameworks and models from public health and other disciplines to improve the availability and quality of equity-focused conceptual guidance in IS. This scoping review study seeks to address these gaps.

This dissertation reports findings from a subset of studies from a larger scoping review of health equity TMFs from chronic disease prevention and control research. This study seeks to address the following specific aim, guided by four research questions:

Aim 1: Identify and characterize health equity TMFs that can be incorporated into implementation research.

- Research Question 1: Which health equity TMFs have been applied in chronic disease prevention and control studies?
- Research Question 2: What are the characteristics of these health equity TMFs (e.g., what are the relationships between constructs, what socioecologic levels are included)?
- Research Question 3: How have these health equity TMFs been applied in empirical research (e.g., are they used to inform research aims, intervention development, measurement and analysis)?
- Research Question 4: What implications do these health equity TMFs have for IS?

Methods

Study 1 involved a scoping review of health equity TMFs that have been utilized in empirical research on chronic disease prevention and control. A scoping review, which follows many of the same procedures as a systematic review, was appropriate for this aim as it sought to clarify concepts in the literature, examine how research is conducted in a certain area, and identify opportunities for learning across fields.[107] This review followed established methods for conducting scoping reviews,[108-110] and reporting guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRIMSA-ScR),[111] supplemented by the PRISMA extension for equity-focused reviews (PRISMA-E).[112] The lead author (CWB) developed an in-depth procedures manual to guide this review, which was piloted and refined at each stage of this review. The review protocol is registered with Open Science Framework (OSF: https://doi.org/10.17605/OSF.IO/SFVE6) and was published in a peer reviewed article.[113]

Search strategy

A medical research librarian (BS) created search hedges containing terms related to 'frameworks and models', 'chronic diseases and risk factors' and 'health equity or social determinants of health'. The chronic diseases and associated risk/preventive factors are those defined by the US Centers for Disease Control and Prevention (CDC).[11,24] The librarian applied the final search strategy (see Appendix 2.1) to conduct systematic literature searches in four

bibliometric databases: PubMed (US National Library of Medicine), CINAHL+ (Cumulative Index to Nursing and Allied Health Literature), APA PsycInfo (EBSCO), and Embase. I entered records into EndNote reference management software for deduplication, then uploaded to the Covidence systematic review platform,[114] which automatically conducted an additional round of deduplication.

Inclusion and exclusion criteria

This review included peer-reviewed journal articles from any country, published in English between 2010-2021 (due to the increase in health equity-focused research during this time[70]). Any empirical study design was eligible, including quantitative, qualitative, and mixed methods approaches in intervention or observational studies. Non-empirical conceptual articles and non-peer reviewed literature were not included. Studies pertained to one or more relevant chronic diseases (e.g., cancer, diabetes, cardiovascular disease; see Appendix 2.2) or prevention topics (i.e., physical activity, food intake, tobacco use or secondhand smoke exposure, excess alcohol intake) at any point along the prevention and control continuum. Studies focused solely on other health topics (e.g., infectious disease, mental health) were ineligible.

As numerous terms can convey the concept of health equity, and terminology may vary over time and across contexts (for example, the evolution of Braveman's definitions of health equity, health disparities, inequalities, and inequties[46,115,116]), the inclusion criteria focused on intentionality around investigating health equity or related concepts. Equity-related intentionality was assessed in study aims (e.g., intervening to ameliorate health disparities among marginalized populations, testing causal relationships between SDOH and health outcomes), methods (e.g., use of participatory or engaged research methods), measurement targets (e.g., assessing constructs and variables related to discrimination, community resilience), or in other ways

described in Appendix 2.2. Phase 1 disparities studies,[117] i.e., studies that only described the presence of health disparities without seeking to identify causal factors contributing to observed inequities or intervening to reduce disparities and promote equity were not eligible. Studies conducted among marginalized populations without explicit attention towards equity (see Appendix 2.2) were ineligible.

The title and abstract screening did not include criteria regarding TMFs as this information was frequently absent from abstracts. To be eligible, full text articles had to include and clearly apply a health equity related TMF, defined in this study as a set of ideas, constructs, or variables arranged in a conceptual structure to guide or support the study of health equity or related concepts (e.g., discrimination, community capabilities and resilience). Articles using only a TMF unrelated to health equity were excluded (e.g., classic psychological theories focused on individual changes to cognitions). Brief mention of a TMF in passing was insufficient for eligibility (see Appendix 2.2); articles had to clearly indicate how a TMF was applied (e.g., description of how the TMF informed research questions or intervention design, constructs or variables from the TMF were measured in the study, TMF guided data analysis or interpretation of results).

Study selection

The screening team piloted and iteratively refined all procedures and screening criteria before independently screening. Four reviewers (CWB, AG, RT, TS) independently screened randomly selected sets of 20 records and met to generate consensus. I revised the screening procedures, tracked consensus decisions, and calculated interrater reliability (IRR) in each team pilot screening round. The team repeated pilot screening until satisfactory IRR was achieved in two sequential rounds, determined by assessing rater agreement on inclusion/exclusion, with

agreement on the appropriate exclusion "E code" applied during full text screening. The threshold for satisfactory IRR was a free-marginal multi-rater kappa ≥0.8, which is appropriate for free rating of exact agreement among more than two raters and when unordered categorical variables are used (i.e., the assignment of an exclusion code).[118] We then used a single-reviewer approach to screen remaining records. If a single reviewer could not determine eligibility, the screening team made a consensus decision. The team met every two weeks during title and abstract screening to review records flagged for discussion and conducted IRR checks following the same process used in the pilot to ensure satisfactory agreement was maintained.

After piloting and refining the full text screening procedures, the screening team (CWB, AG, RG, RT, SX, TS) conducted blinded dual independent screening such that all full text records were screened by two reviewers. For ineligible articles, reviewers hierarchically applied the most pertinent exclusion code (see Appendix 2.2), as Covidence did not allow for coding multiple exclusion reasons. Reviewer pairs used asynchronous notes in Covidence and Zoom consensus meetings to resolve disagreements, consulting the screening team as needed.

During full text screening, we observed inconsistencies in the distinctions between theories, models, and frameworks, likely due to the broad array of disciplines represented in the sample. Although this review originally intended to focus on models and frameworks that had visual representations of constructs (e.g., figure, image, table), we determined this was overly restrictive and may omit relevant conceptualizations of health equity. As such, we expanded our full text screening criteria to include theories in addition to models and frameworks and did not require these to have a visual representation. Furthermore, we acknowledged the complexity in operationalizing differences between a health equity TMF versus a TMF that was not explicitly

grounded in heath equity principles but could be applied in applied in an equity-relevant way. Thus, we were liberal in our inclusion of potentially eligible TMFs.

Upon completion of full text screening, I took a second pass, as employed in previous reviews,[119] to narrow the extraction sample. In this phase, meta-analyses and reviews were set aside for future analyses. In addition, based on our guiding conceptualization of health equity (described in chapter 1), we concluded that equity cannot be operationalized and addressed only at the person level (intra and/or interpersonal), although an individual level framework could be applied in an equity relevant manner (e.g., using a cognitive theory to develop an intervention to change practitioner race-based biases). Any TMFs that included only person-level factors and did not operationalize any concepts at least one higher (organization, community, system/societal, or policy) level were set aside for future analysis. During this second pass, I obtained full text PDFs, when accessible, for the cited references for each relevant TMF applied in the included empirical articles to supplement the extraction of TMF information. Additionally, I combined articles reporting results from the same study into a single extraction record in Covidence.

Data extraction

A standardized protocol guided extraction; this protocol defined and operationalized each extraction element, indicated whether this was a coded (i.e., fixed response) or free text item, and offered examples for each extraction element. The review team piloted and iteratively refined the extraction procedures on a randomly selected subset of seven full text records. Upon finalizing the extraction procedures, I built a standardized extraction template in Covidence. We employed a dual non-independent extraction approach in which a primary reviewer completed extraction and a second unblinded reviewer checked the primary extraction for accuracy and completeness.

Reviewer pairs used asynchronous notes and Zoom consensus meetings to generate agreement, consulting additional reviewers as needed.

This dissertation includes a selected subsample of studies included in the overall review. I conducted primary extraction of 20% (n=72) of the sample included in the overall review, based on committee guidance to maintain a feasible scope for the dissertation. I determined study eligibility for the dissertation subsample by first selecting all articles that used a broadly generalizable TMF, then randomly selected studies that used a somewhat generalizable TMF to fill in the remaining balance of articles needed to achieve the target sample size (n=72). As we could not locate existing guidance for characterizing TMF generalizability, I adapted guidance for determining generalizability from Allen and colleagues' review of health policy implementation measures.[83] In the current review, we determined a TMF to be broadly generalizable if the constructs were broad enough to be applied across different disease topics, settings, populations, and study designs with minimal (e.g., changing a diabetes outcome variable to a general chronic disease) to no modification. We considered a TMF somewhat generalizable if it could be applied across various topics or contexts with some modification to <50% of constructs or their definitions (e.g., removing disease-specific terms from construct definitions). We coded a TMF as specific if it could not be readily applied to a different topic (e.g., an intervention logic model, a population and disease specific TMF generated from qualitative data with low external validity).

Collating, summarizing, and reporting the results

I downloaded extraction data from Covidence into an Excel database for analysis. I used descriptive statistics to quantitatively summarize characteristics of the selected subsample (e.g., frequencies and proportions of types of study designs, countries and settings in which studies

were conducted, target population characteristics, health topics). I calculated quantitative summaries of the TMFs applied in the subsample of empirical records (e.g., total number of unique TMFs, total number of empirical uses of each TMF, and frequencies and proportions for the framework characteristics (e.g., number of new study-specific framework vs. number of existing TMFs). I used qualitative and quantitative methods to code and summarize open-ended text extraction items (e.g., counts of common constructs across TMFs, narrative summaries of themes related to TMF applications to IS). For studies with exemplar TMF applications (determined from having ≥4 types of applications within a study and reviewer subjective rating of the quality of the application in an open-ended item regarding TMF applicability IS), I developed narrative summaries describing the TMF application and compared applications of the same TMF across multiple studies.

Consultation

As recommended in conducting scoping reviews, our team engaged multiple types of individuals and groups throughout the review. The study team consulted external experts in the study conceptualization stage to identify guiding conceptual literature, solicit search terms, and elicit feedback on the review research questions. The smaller screening team regularly met with the broader study team to provide updates and gather input on the review procedures. My faculty mentor for this review (RT) and I also presented this review to the NCI Implementation Science Centers for Cancer Control (ISC3) Health Equity Task Force and the Collaborative for Anti-Racist Dissemination & Implementation Science (CARDIS) groups for feedback on the review procedures, including operationalizations of health equity TMFs.

Results

Yield

As shown in Figure 1, the final search yielded 63,364 records after deduplication. We reviewed 2,730 full text records for eligibility, of which we determined 465 were eligible for extraction. The most common exclusion reason was no TMF in the article (e.g., "model" term referred to a statistical model rather than conceptual guidance; N=1,551). In the second pass, we set aside 89 studies for future analysis. Twelve article pairs (24 total articles) reported results from a single study, so these articles were combined into a single extraction record, resulting in a total of 364 studies included for extraction in the overall review. This dissertation reports on a subset of 72 studies (as described above).

Study characteristics

Table 1 summarizes the characteristics of included studies. Over 2/3 of studies were conducted in the US (n=50, 69.4%), followed by Australia and Canada (each n=3, 4.2%). Nearly half of the studies were quantitative (n=33, 45.8%), while 27 were qualitative (37.5%) and 12 were mixed methods (16.7%). The most common type of study design was observational cross sectional (n=36, 50.0%), while only 6 studies (8.3%) used a randomized (n=2, 2.8%) or non-randomized (n=4, 5.6%) trial design to test or evaluate an intervention, 5 of which were protocols. Most studies took place over multiple types of settings, while only 10 studies (13.9%) took place in a single type; community locations (e.g., homes, religious organizations, community-based organizations) were the most common setting (n=56, 77.8%). Nearly half of the studies (n=33, 45.8%) focused on multiple prevention and control objectives; primary prevention (intervening before health effects occur) was the most frequent objective (n=31, 43.1%). Most studies (n=55, 76.4%) focused on one or more specific chronic diseases, of which cancer was most common (n=25, 34.7%), while 17 studies (23.6%) focused on prevention topics without a specific disease focus.

Figure 1

PRISMA Diagram

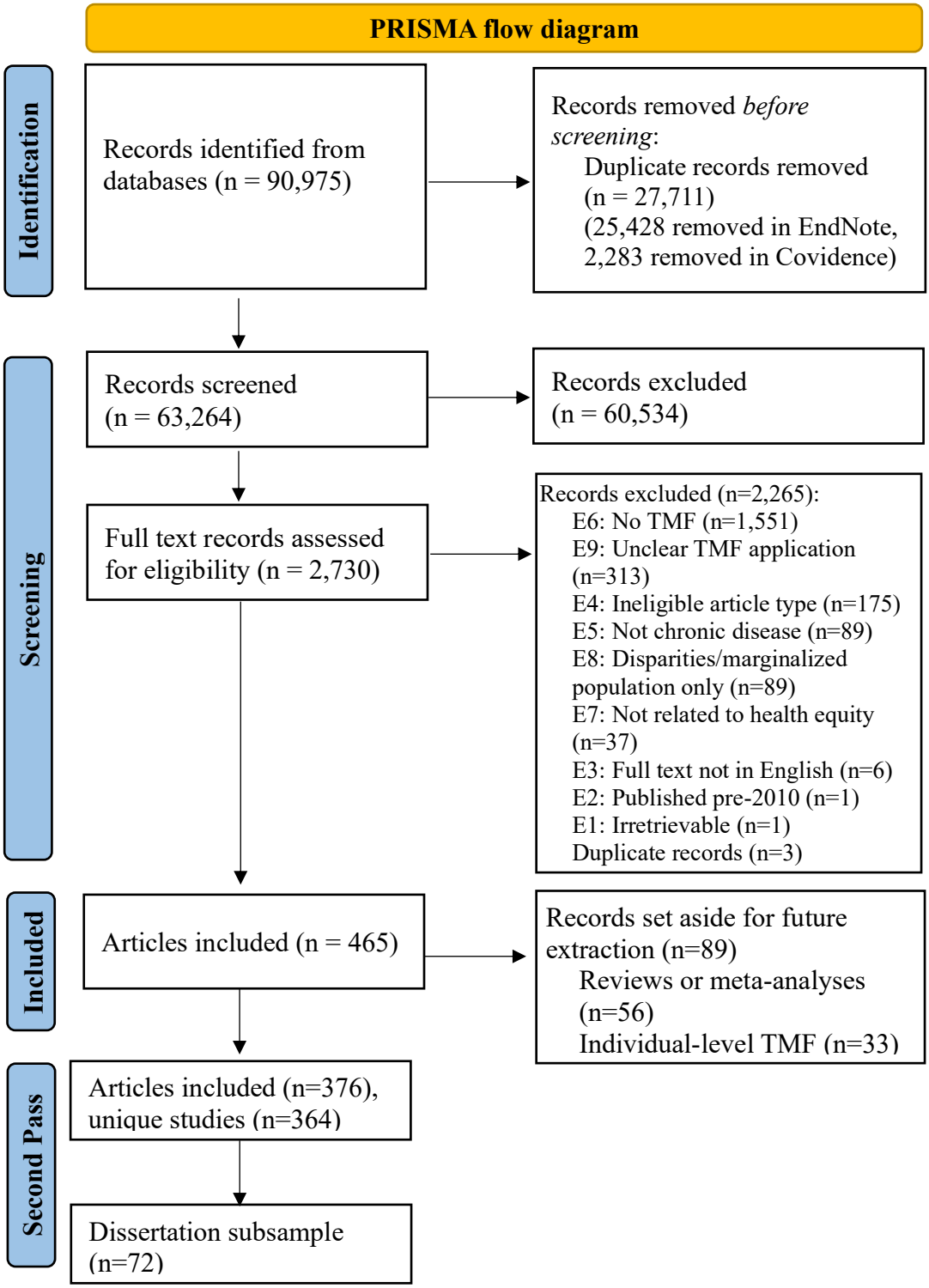


Table 1

Characteristics of included empirical studies (n=72)

Study	Country	Methodology	Design	Setting	Chronic Disease Topic	Control Spectrum	Marginalized or vulnerable population
Abbs 2021[120]	US	MM	Case study	Com	Diabetes	1° Prev	Black; Latinx; Low SES/ Limited resources; Urban; Youth
Abildso 2021[121]	US	Qual	Case study	Com; Govt	PA	1° Prev	Rural
Adams 2021[122]	US	Qual	Obs cross-sectional	Com	Cancer	Survivorship	Black; Rural; Older adults
Agarwal 2020[123]	US	Quant	Obs cross-sectional	Clinic	Diabetes	Surveillance	Black; Latinx; Low SES/ Limited resources; Youth
Alvarez 2021a[124]	US	Quant	Obs cross-sectional	Clinic	CVD	2°/3° Prev, Tx	Black; Latinx;
Alvarez 2021b[125]	US	Quant	Case study	Com; Govt	Cancer	1° Prev; Surveillance	Black; Latinx; Low SES/ Limited resources; Rural; Urban; Disadvantaged geography
Armour-Burton 2020[126]	US	Qual	Case study	Com; Remote	Cancer	2°/3° Prev, Tx	Black; Women
Arredondo 2015[127]	US	Quant	Protocol; Randomized trial	Com	PA; Cancer	1° Prev; 2°/3° Prev, Tx	Latinx; Women; Immigrant
Ayub 2020[128]	US	Qual	Obs cross-sectional	Com	Nutrition; PA	1° Prev; 2°/3° Prev, Tx	Black; Refugee
Azul 2021[129]	Portugal	MM	Obs cross-sectional	Com	Nutrition; PA	1° Prev; Surveillance	Rural
Beccia 2020[130]	US	Quant	Obs cross-sectional	Com	Nutrition	Surveillance	Latinx; Women
Blake-Lamb 2018[131]	US	Quant	Protocol; Non-randomized trial	Clinic; Remote	Obesity	1° Prev; 2°/3° Prev, Tx	Black; Latinx; Low SES/ Limited resources; Low-income; Limited language proficiency; Women; Mothers + Infants

Study	Country	Methodology	Design	Setting	Chronic Disease Topic	Control Spectrum	Marginalized or vulnerable population
Blosnich 2011[132]	US	Quant	Obs cross-sectional	Other	Tobacco	Surveillance	LGBTQ+; Youth
Bostean 2021[133]	US	Quant	Obs cross-sectional	Com	Alcohol; Tobacco	Surveillance	Asian; Latinx; Immigrant
Bowen 2016[134]	US	Quant	Obs cross-sectional	Com	Nutrition	1° Prev; Surveillance	Low SES/Limited resources; Urban
Braid 2021[135]	US	Qual	Obs cross-sectional	Com; Govt	Nutrition	1° Prev	Black; Latinx; Urban; Women
Brown 2018[136]	Botswana	Qual	Obs cross-sectional	Clinic	Cancer	2°/3° Prev, Tx	Disadvantaged geography
Cai 2021[137]	US	Quant	Obs cross-sectional	Clinic	Diabetes	2°/3° Prev, Tx	Black; Low SES/Limited resources; Low-income; Urban
Campesino 2012[138]	US	MM	Obs cross-sectional	Com	Cancer	2°/3° Prev, Tx; Survivorship	Black; Latinx; Women
Cardarelli 2020[139]	US	Qual	Obs cross-sectional	Com; Other	Nutrition; Obesity	1° Prev	Rural
Carrasquillo 2014[140]	US	Quant	Protocol; Randomized trial	Clinic; Com; Remote	Nutrition; PA; Diabetes; CVD	1° Prev; 2°/3° Prev, Tx	Latinx; Uninsured
Chen 2021[141]	US	Quant	Obs cross-sectional	Com	Alcohol; CVD; Obesity	Surveillance	Asian; Black; Latinx
Chin 2014[142]	US	Qual	Case study	Clinic; Com	Diabetes	2°/3° Prev, Tx	Black; Low SES/Limited resources; Urban; Disadvantaged geography
Chung 2021[143]	Australia	Qual	Obs cross-sectional	Govt	Obesity	1° Prev	Children
Clouston 2017[144]	US	Quant	Obs longitudinal	Com	Cancer	Surveillance	Black
Craig 2021[145]	Jamaica	Quant	Obs cross-sectional	Com	Chronic lung disease;	Surveillance	Disadvantaged geography

					Diabetes; CVD; Obesity; Stroke		
Study	**Country**	**Methodology**	**Design**	**Setting**	**Chronic Disease Topic**	**Control Spectrum**	**Marginalized or vulnerable population**
Darroch 2016[146,147]	Canada	Qual	Obs cross-sectional	Clinic; Com	PA; Diabetes; Obesity	1° Prev	Indigenous; Urban; Women
de Oliveira 2021[148]	Brazil	Quant	Obs cross-sectional	Clinic; Govt	Cancer	Surveillance	Women
de Silva 2017[149]	Sri Lanka	MM	Obs cross-sectional; Case study	Com; Govt	Chronic kidney disease	Surveillance	Low SES/Limited resources; Rural; Marginalized laborers
Dlugonski 2017[150]	US	MM	Obs cross-sectional	Com	PA	1° Prev	Black; Low-income; Women
Evans-Agnew 2018[151]	US	Qual	Case study	Com; Govt	Chronic lung disease	2°/3° Prev, Tx	Black; Urban; Youth
Gewalt 2019[152]	Germany	Qual	Case study	Other	Nutrition	1° Prev	Marginalized religious group; Limited language proficiency; Women; Refugee; Asylum seekers
Goodridge 2019[153]	Canada	Qual	Obs cross-sectional	Clinic; Com	Chronic lung disease	2°/3° Prev, Tx	Physical or mental disability; Low SES/Limited resources; Disadvantaged geography; Complex social needs
Gordon 2018[154]	US	MM	Protocol; Non-randomized trial	Clinic; Remote	Chronic kidney disease	2°/3° Prev, Tx	Latinx; Urban
Hankivsky 2016[155]	Ukraine	Qual	Obs cross-sectional	Com	Alcohol; Nutrition; PA; Tobacco	1° Prev	Rural; Urban
Hughes 2013[156]	US	MM	Case study	Clinic; Com; Public health	Chronic lung disease	1° Prev; 2°/3° Prev, Tx	Black; Latinx; Low-income; Urban
Karimi 2018[157]	Iran	Qual	Obs cross-sectional	Clinic; Com; Public health; Govt	Cancer	2°/3° Prev, Tx	Women

Study	Country	Methodology	Design	Setting	Chronic Disease Topic	Control Spectrum	Marginalized or vulnerable population
Krieger 2011[158]	US	Quant	Non-randomized trial	Clinic; Remote	Tobacco	1° Prev	Black; Low-income
Lukachko 2014[159]	US	Quant	Obs cross-sectional	Com; Govt	CVD	Surveillance	Black
Mayhand 2021[160]	US	Quant	Obs cross-sectional	Com	Cancer	2°/3° Prev, Tx	Low SES/Limited resources; Low-income; Low educational attainment; Uninsured; Urban; Disadvantaged geography; Older adults
McLoughlin 2020[161]	US	MM	Case study	Com	Nutrition	1° Prev	Urban; Youth
Oates 2017[162]	US	Quant	Obs cross-sectional	Clinic	Chronic lung disease	2°/3° Prev, Tx	NA
Ochieng 2021[163]	US	Qual	Case study	Com	Diabetes	2°/3° Prev, Tx	Black; Women
Olson 2020[164]	US	Qual	Case study	Com; Public health; Remote	Cancer	Surveillance	Disadvantaged geography
Pearson 2020[165]	Australia	MM	Case study	Clinic; Com	Alcohol; Nutrition; PA; Tobacco	1° Prev; 2°/3° Prev, Tx	Indigenous
Pinheiro 2020[166]	US	Quant	Obs longitudinal	Com; Remote	CVD	Surveillance; 2°/3° Prev, Tx	NA
Porcherie 2017[167]	France	MM	Protocol; Non-randomized trial; Case study		PA; Cancer	1° Prev	Urban
Quach 2012[168]	US	Qual	Obs cross-sectional	Com; Public health	Cancer	2°/3° Prev, Tx	Asian; Black; Latinx; Women
Ranjbar 2015[169]	Sweden	Qual	Case study	Clinic; Com	Chronic lung disease	2°/3° Prev, Tx; Survivorship	Physical or mental disability; Older adults

Study	Country	Methodology	Design	Setting	Chronic Disease Topic	Control Spectrum	Marginalized or vulnerable population
Ray 2017[170]	US	Quant	Obs cross-sectional	Com	PA	Surveillance	Black; Urban
Reshetnyak 2020[171]	US	Quant	Obs longitudinal	Com; Remote	Stroke	Surveillance	NA
Rottapel 2021[172]	US	Qual	Obs cross-sectional	Com	CVD	1° Prev	Black; Women
Rubin 2014[173]	US	Quant	Obs longitudinal	Com; Govt	Cancer	Surveillance	NA
Safford 2021[174]	US	Quant	Obs longitudinal	Com; Remote	CVD	Surveillance	NA
Saldana-Ruiz 2013[175]	US	Quant	Obs longitudinal	Com; Govt	Cancer	Surveillance	Low SES/Limited resources
Santamaria-Ulloa 2019[176]	Costa Rica	Quant	Obs longitudinal	Govt; Other: Registry data	Cancer	Surveillance	Low SES/Limited resources; Disadvantaged geography; Women
Sayani 2019[177]	Canada	Qual	Case study	Public health	Cancer	1° Prev; 2°/3° Prev, Tx; Survivorship	NA
Shariff-Marco 2013[178]	US	Quant	Obs cross-sectional	Com	Cancer	Surveillance; 2°/3° Prev, Tx	Older adults
Sharma 2020[179]	Nepal	Qual	Case study	Com; Public health; Govt	Alcohol; Tobacco	1° Prev	Disadvantaged geography
Shelton 2011a[180]	US	Quant	Obs cross-sectional	Com	PA	1° Prev	Black; Latinx; Low SES/ Limited resources; Low-income; Limited language proficiency; Urban; Women
Shelton 2011b[181]	US	Qual		Clinic; Com	Cancer	1° Prev; 2°/3° Prev, Tx	Black; Latinx; Low-income; Women

Smith 2021[182]	US	Quant	Obs cross-sectional	Com	Cancer; Diabetes; CVD; Stroke	Surveillance	Black; Women
Sommer 2011[183]	US	MM	Case study	Clinic; Com; Public health; Remote	Chronic lung disease	1° Prev; 2°/3° Prev, Tx	Black; Latinx; Low-income; Urban; Children & families
Tabaac 2019[184]	US	Quant	Obs cross-sectional	Com	Cancer	2°/3° Prev, Tx	LGBTQ+; Women
Tan 2019[185]	Singapore	Qual	Case study	Com	CVD	1° Prev; 2°/3° Prev, Tx	Low SES/Limited resources; Older adults
Teuscher 2015[186]	Netherlands	Qual	Case study	Com	Nutrition; PA; Diabetes	1° Prev	Middle Eastern/North African; Low SES/Limited resources; Low educational attainment; Urban; Disadvantaged geography
Thompson 2019[187]	US	Quant	Obs cross-sectional	Com	Cancer	Surveillance	Youth
Viens 2016[188]	Lesotho	Quant	Obs cross-sectional	Com; Public health; Govt	Cancer	Surveillance	Disadvantaged geography; Women
Ward 2018[189]	Australia	MM	Case study	Clinic; Public health		2°/3° Prev, Tx	NA
Westrick 2020[190]	US	Quant	Obs longitudinal	Com	Cancer	Surveillance	Women
Yeary 2011[191]	US	Qual	Case study	Com; Remote	Cancer	1° Prev; 2°/3° Prev, Tx	Black; Disadvantaged geography; Women
Zorbas 2021[192]	18 high income countries	Qual	Case study	Govt	Nutrition; Obesity	1° Prev	NA

Note: 1° Prev = Primary prevention; 2°/3° Prev, Tx = Secondary/Tertiary Prevention and Treatment; Com = Community; CVD = Cardiovascular Disease; Govt = Government; Mixed Methods = MM; NA = Not Applicable; Obs = Observational; PA = Physical Activity; Qual = Qualitative; Quant = Quantitative

Health equity TMFs

TMF characteristics

This review identified 52 unique health equity TMFs across 72 studies. Most TMFs (n=32, 61.5%) were broadly generalizable in their original form (either from the empiric study or cited source). About 1/3 of the TMFs (n=16, 30.8%) were somewhat generalizable, i.e., they could apply to other topics, populations, settings, or time periods with some modification. Four specific TMFs were used in conjunction with a generalizable TMF. Most TMFs (n=41; 78.8%) visually depicted relationships between constructs, while 11 TMFs (21.2%) arranged constructs in a table or described constructs in text. Of the TMFs that visually represented relationships between constructs, most indicated multiple types of relationships. Linear (e.g., directed arrows) and nested (e.g., concentric shapes) were the most common type of relationships depicted, both appeared in 34 TMFs (65.4%).

Although not always represented visually, all TMFs were multilevel. All but one of the TMFs represented societal or systems level constructs, (e.g., systemic racism, interactions across payors and hospitals in a healthcare system). The intrapersonal level appeared in 46 TMFs (88.5%), with many TMFs illustrating how structural and social determinants of health influence individual health outcomes (e.g., depicting how discrimination impacts cardiovascular health). The interpersonal and community levels were each represented in 45 TMFs (86.5%), acknowledging the influence of social networks (e.g., family, friends) and living environments (e.g., build and natural environment, local resource availability) on health. The organizational level was represented least frequently (n=33, 63.4%), though over half the TMFs included organizational constructs (e.g., the role of workplaces in health promotion, characteristics of healthcare organizations). Table 2 summarizes the TMF characteristics.

Table 2

Health Equity TMF characteristics (n=52)

				Socioecologic levels represented in the TMF					
TMF Name	**Citation year***	**Generalizability**	**Construct relationships**	**Intra**	**Inter**	**Org**	**Com**	**System/ Society**	**Policy**
AAAQ (Availability, Accessibility, Acceptability, & Quality) Framework[193]	1966	Broad	None shown		y	y		y	y
AACORN (African-American Collaborative Obesity Research Network) Model[194]	2007	Somewhat	Linear; Cyclical; Nested; Multilevel	y	y	y	y	y	y
Agency-Structure Theory[195]	1984	Somewhat	None shown	y	y		y	y	y
Analytic Framework to Evaluate the Effectiveness of Healthcare System Interventions to Increase Cultural Competence[196]	2003	Somewhat	Linear	y	y	y		y	
Biopsychosocial Model of Racism as a Stressor[197]	1999	Somewhat	Linear; Multilevel	y	y		y	y	
Collective Impact Model[198]	2012	Broad	None shown		y	y		y	
Collective Lifestyles Theory[199]	2001	Broad	None shown	y	y		y	y	
Community Capital Framework[200] (n=2)	2006	Broad	Nested; Complex	y	y	y	y	y	y
Conceptual Framework for Analysis of Multimorbidity and its Relationship with SDOH[145]	2021	Somewhat	Linear; Nested; Multilevel	y		y	y	y	y
Conceptual Framework of Access to Health Care[201]	2013	Broad	Linear; Multilevel	y	y	y	y	y	
Conceptual Framework of the Lived Experience of Intersectionality among African American Women with Breast Cancer[126]	2020	Specific	Linear; Nested; Multilevel	y	y			y	
Conceptual Model for Racial and Ethnic Disparities in Health Care[202] (n=2)	2007	Broad	Linear; Nested; Complex; Multilevel	y	y	y	y	y	y

TMF Name	Citation year*	Generalizability	Construct relationships	Intra	Inter	Org	Com	System/ Society	Policy
Conceptual Model of Discrimination & Binge Eating[130]	2020	Specific	Linear; Multilevel	y	y			y	
Conceptual Model of Health Capability[203]	2010	Broad	Nested; Multilevel	y	y	y	y	y	y
Contributors to Delay in Cancer Diagnosis Model[136]	2018	Specific	Linear; Cyclical; Nested; Multilevel	y	y	y	y	y	
Critical Race Theory[204-207] (n=3)	1989	Broad	None shown	y	y	y	y	y	y
Critical Social Theory[208]	2015	Broad	None shown	y			y	y	
Dahlgren & Whitehead Determinants of Health Model[209,210] (n=2)	1991	Broad	Nested; Multilevel	y	y	y	y	y	y
Ecosocial Theory[211-214] (n=6)	1994	Broad	Linear; Nested; Complex; Multilevel	y	y	y	y	y	y
Ethno-Cultural Gerontological Nursing Model[215]	2015	Somewhat	Nested; Multilevel	y	y		y	y	y
Evaluation of Environmental Policy and Systems Model[156]	2013	Somewhat	Linear; Cyclical; Nested; Complex; Multilevel			y	y	y	y
Expanded Evaluation and Measurement Framework for Assessing Health In All Policies (HIAP) Initiatives[216]	2014	Broad	Linear; Nested			y	y	y	y
Framework for Conceptualizing Equity in Health Care[217]	2011	Broad	Nested	y			y	y	
Fundamental Causes Theory (n=5)	1994	Broad	None shown	y	y		y	y	y
Getting to Equity Framework[218] (n=3)	2007	Somewhat	Nested; Multilevel	y	y	y	y	y	y
Health Equity Promotion Model[219]	2014	Somewhat	Linear; Nested; Multilevel	y	y		y	y	y
Health Lifestyle Theory[220]	1995	Broad	Linear	y	y			y	

TMF Name	Citation year*	Generalizability	Construct relationships	Intra	Inter	Org	Com	System/ Society	Policy
Healthy People 2020 SDOH Framework[221] (n=5)	2008	Broad	Other (interrelated, no directionality)	y	y	y	y	y	y
Inside-out Socioecologic Model of Policy and Environmental Change[222]	2015	Broad	Nested	y	y	y	y	y	y
Integrated Life Course and Aboriginal SDOH Model[223]	2009	Somewhat	Nested; Multilevel	y	y	y	y	y	y
Intersectionality Theory[87,205,224] (n=7)	1991	Broad	None shown	y	y		y	y	y
Institute of Medicine (IOM) Socioecologic Model[225]	2003	Broad	Nested; Multilevel	y	y		y	y	y
Jones 3-Level Framework of Racism[48]	2000	Broad	None shown	y	y		y	y	y
Kaiser Family Foundation SDOH Framework[226]	2019	Broad	None shown	y	y	y	y	y	
Model for Analysis of Population Health and Health Disparities[227] (n=2)	2008	Broad	Linear; Nested; Multilevel	y	y	y	y	y	y
Model for Incorporating Social Context in Health Behavior Interventions[228]	2003	Somewhat	Linear; Nested; Complex; Multilevel	y	y	y	y	y	y
Multilevel Influences on the Cancer Care Continuum Model[229]	2012	Somewhat	Linear; Nested; Multilevel	y	y	y	y	y	y
National Institute on Minority Health and Health Disparities (NIMHHD) Research Framework[230]	2019	Broad	Nested; Multilevel; Other: matrix	y	y	y	y	y	y
Postcolonial Feminist Theory[231,232]	2000	Broad	None shown	y	y		y	y	y
Ranjbar Participant-Focused and Human Rights-Based Evaluation of COPD Mobile Care Model[231]	2015	Specific	Nested		y	y		y	
Regional Asthma Management and Prevention Framework[233]	2011	Somewhat	Linear; Nested; Complex; Multilevel	y	y	y	y	y	y

TMF Name	Citation year*	Generalizability	Construct relationships	Intra	Inter	Org	Com	System/ Society	Policy
Socioecologic Model[234]	1988	Broad	Nested; Multilevel	y	y	y	y	y	y
Socioecologic Model of Type 2 Diabetes[235]	2013	Broad	Nested; Multilevel	y	y	y	y	y	y
Sharma 2020 Study SDOH Framework[179]	2020	Broad	Linear; Cyclical; Complex; Multilevel	y	y	y	y	y	y
Social Contextual Framework[228] (n=2)	2003	Broad	Linear; Nested; Multilevel	y	y	y	y	y	y
Society-Behavior-Biology Nexus Framework[236] (n=2)	2006	Broad	Linear; Nested; Complex; Multilevel	y	y	y	y	y	y
Structural Violence Theory[237]	1969	Broad	Linear; Nested; Multilevel		y		y	y	y
Synergies of Oppression Framework[238]	2011	Broad	Nested; Multilevel; Other: matrix	y	y		y	y	y
Tan 2019 Model of Patients' Perceptions on Individual's Conditions, and Perceived Social and Physical Environments[185]	2019	Somewhat	Nested; Multilevel	y	y	y	y	y	y
Theoretical Model of Environments and Health Outcomes[239]	2012	Somewhat	Nested	y			y		
Theoretical Model of the SDOH Related to Advanced Stage Diagnosis of Breast Cancer[148]	2021	Somewhat	Linear; Nested; Complex; Multilevel	y			y	y	y
WHO CSDH Framework[39] (n=14)	2010	Broad	Nested; Multilevel	y	y	y	y	y	y
Total frequency of TMF levels (out of n=52)				46	45	33	45	51	38

Note: (n=#) next to TMF name indicates number of uses in the sample, no (n=#) indicates a single-used TMF; Citation year indicates the earliest year of TMF publication from the source(s) cited in the empiric use article or the year of empiric use if no external source cited (e.g., article included intervention logic model developed for the study); Intra = intrapersonal; Inter = interpersonal; Org = organization; Com = Community

TMF applications

There were 94 instances of health equity TMF use across the 72 studies. Nearly all studies used an existing TMF, either in its original form or with study-specific adaptations; only three studies (4.2%) created a novel TMF that was not informed by an existing source. Of the 52 TMFs, 39 (75.0%) were applied in a single study, while 13 (25.0%) were applied in two or more studies. The most frequently used TMFs were the WHO Commission on Social Determinants of Health (CSDH) Framework, which appeared in 14 studies (19.4%), Intersectionality Theory (n=7, 9.7%), Krieger's Ecosocial Theory (n=6, 8.3%), Link & Phelan's Fundamental Causes Theory (n=5, 6.9%), and the Healthy People 2020 SDOH Framework (n=5, 6.9%). Most studies (n=54, 75.0%) used a single health equity TMF, while ¼ of studies (n=18) applied two or more health equity TMFs. We did not extract non health equity TMFs that were used in the studies.

The median number of application purposes per TMF use was 3 (see Table 3). There were only 4 instances (4.3%) in which a TMF was used for a single purpose in a study. Of the 94 TMF uses, applying a TMF to interpret or contextualize study findings (e.g., indicating the ways or extent to which results aligned with an existing TMF) was most common (n=83, 88.3%). Authors frequently used TMFs to inform study aims/research questions, and to select and measure variables (e.g., TMF constructs selected as variables assessed in surveys or interview guides); these application types each appeared 81 (86.2%) times. Just over 1/3 of the TMF applications (N=35, 37.2%) pertained to data analysis (e.g., TMF used to develop qualitative codebook, guided statistical analysis decisions). TMFs were used relatively infrequently (n=11, 11.7%) to inform the selection of study participants (e.g., sampling methods, recruitment activities). Of the studies that tested or evaluated an intervention, most indicated a TMF was used to inform the selection (n=8) or design/adaptation of the intervention (n=11).

Table 3

Health equity TMF applications (n=94 TMF uses across 72 studies)

		Type of TMF Application (y = yes, study used TMF used for this purpose)								
Study	**TMF**	**Inform aims**	**Select Int**	**Design/ Adapt Int**	**Sample/ recruit**	**Select, Measure Variables**	**Data Analysis**	**Interpret findings**	**Other**	**Total**
Abbs 2021[120]	Socioecologic Model of Type 2 Diabetes	y		y		y	y	y		5
Abildso 2021[121]	Community Capital Framework					y	y	y		3
Adams 2021[122]	Critical Race Theory	y			y	y	y	y	Design study	6
Agarwal 2020[123]	Healthy People 2020 SDOH Framework	y				y		y		3
Alvarez 2021a[124]	Kaiser Family Foundation SDOH Framework	y				y		y		3
Alvarez 2021b[125]	Intersectionality Theory	y				y	y	y		4
	Ecosocial Theory	y				y	y	y		4
Armour-Burton 2020[126]	Conceptual Framework of the Lived Experience of Intersectionality among African American Women with Breast Cancer					y		y	Framework developed from data	3
	Intersectionality Theory	y			y	y	y	y	Develop study framework	6
Arredondo 2015[127]	Model for Analysis of Population Health and Health Disparities	y	y	y		y			Inform int logic model	5
Ayub 2020[128]	Inside-out SEM of Policy and Environmental Change	y					y	y		3
Azul 2021[129]	Conceptual Model of Health Capability	y				y		y		3
Beccia 2020[130]	Conceptual Model of Discrimination & Binge Eating	y				y		y		3

	Fundamental Causes Theory	y				y		y	Develop study framework	4
	Intersectionality Theory	y				y		y	Develop study framework	4
Study	**TMF**	**Inform aims**	**Select Int**	**Design/ Adapt Int**	**Sample/ recruit**	**Select, Measure Variables**	**Data Analysis**	**Interpret findings**	**Other**	**Total**
Blake-Lamb 2018[131]	Collective Impact Model	y	y	y	y	y				5
	Society-Behavior-Biology Nexus Framework	y	y	y						3
Blosnich 2011[132]	Ecosocial Theory	y						y		2
Bostean 2021[133]	WHO CSDH Framework	y						y		2
Bowen 2016[134]	WHO CSDH Framework	y				y				2
Braid 2021[135]	Society-Behavior-Biology Nexus Framework					y		y		2
Brown 2018[136]	Contributors to Delay in Cancer Diagnosis Model							y	Model developed from data	2
	Model for Incorporating Social Context in Health Behavior Interventions	y				y		y		3
Cai 2021[137]	WHO CSDH Framework	y				y		y		3
Campesino 2012[138]	Critical Race Theory					y				1
Cardarelli 2020[139]	Getting to Equity Framework	y				y	y	y		4
Carrasquillo 2014[140]	Conceptual Model for Racial and Ethnic Disparities in Health Care		y	y						2
Chen 2021[141]	Intersectionality Theory					y	y	y		3

Study	TMF	Inform aims	Select Int	Design/ Adapt Int	Sample/ recruit	Select, Measure Variables	Data Analysis	Interpret findings	Other	Total
Chin 2014[142]	Conceptual Model for Racial and Ethnic Disparities in Health Care	y	y	y		y		y		5
Chung 2021[143]	Dahlgren & Whitehead Determinants of Health Model	y				y	y	y		4
Clouston 2017[144]	Fundamental Causes Theory	y				y		y		3
Craig 2021[145]	Conceptual Framework for Analysis of Multimorbidity and its Relationship with SDOH	y				y	y	y		4
	WHO CSDH Framework	y				y	y	y	Develop study framework	5
	Theoretical Model of Environments and Health Outcomes					y				1
Darroch 2016[146,147]	Postcolonial Feminist Theory	y				y	y	y		4
	Integrated Life Course and Aboriginal SDOH Model	y				y	y	y		4
de Oliveira 2021[148]	Theoretical Model of the SDOH Related to Advanced Stage Diagnosis of Breast Cancer					y	y	y		3
	WHO CSDH Framework	y				y		y	Develop study framework	4
de Silva 2017[149]	Structural Violence Theory	y			y	y		y		4
Dlugonski 2017[150]	Intersectionality Theory	y			y	y		y		4
Evans-Agnew 2018[151]	Ecosocial Theory	y				y	y	y		4
Gewalt 2019[152]	WHO CSDH Framework	y			y	y	y	y		5

Study	TMF	Inform aims	Select Int	Design/ Adapt Int	Sample/ recruit	Select, Measure Variables	Data Analysis	Interpret findings	Other	Total
Goodridge 2019[153]	Framework for Conceptualizing Equity in Health Care	y			y	y		y		4
Gordon 2018[154]	Analytic Framework to Evaluate the Effectiveness of Healthcare System Interventions to Increase Cultural Competence	y	y	y		y				4
Hankivsky 2016[155]	WHO CSDH Framework	y				y		y		3
Hughes 2013[156]	Regional Asthma Management and Prevention Framework	y	y	y		y		y		5
	Evaluation of Environmental Policy and Systems Model					y		y		2
Karimi 2018[157]	WHO CSDH Framework	y				y	y	y		4
Krieger 2011[158]	Ecosocial Theory	y			y	y		y		4
Lukachko 2014[159]	Ecosocial Theory	y				y		y		3
Mayhand 2021[160]	National Institute on Minority Health and Health Disparities (NIMHHD) Research Framework	y				y		y		3
McLoughlin 2020[161]	Getting to Equity Framework	y				y	y	y		4
Oates 2017[162]	Health Lifestyle Theory	y				y				2
Ochieng 2021[163]	Critical Social Theory	y					y	y		3
	Ethno-Cultural Gerontological Nursing Model	y						y		2
Olson 2020[164]	Model for Analysis of Population Health and Health Disparities					y	y	y		3
Pearson 2020[165]	WHO CSDH Framework	y				y	y	y		4

Study	TMF	Inform aims	Select Int	Design/ Adapt Int	Sample/ recruit	Select, Measure Variables	Data Analysis	Interpret findings	Other	Total
Pinheiro 2020[166]	Healthy People 2020 SDOH Framework	y				y		y		3
Porcherie 2017[167]	Expanded Evaluation and Measurement Framework for Assessing HIAP Initiatives	y		y		y		y		4
Quach 2012[168]	Jones 3-Level Framework of Racism	y					y	y		3
Ranjbar 2015[169]	Ranjibar Participant-Focused and Human Rights-Based Evaluation of COPD Mobile Care Model							y	Model developed from data	2
	AAAQ (Availability, Accessibility, Acceptability, & Quality) Framework	y				y	y	y	Develop study framework	5
Ray 2017[170]	Intersectionality Theory	y			y	y	y	y		5
Reshetnyak 2020[171]	Healthy People 2020 SDOH Framework	y				y		y		3
Rottapel 2021[172]	AACORN (African-American Collaborative Obesity Research Network) Model	y		y	y	y	y	y		6
	Critical Race (+ Community Capital) Theory	y				y		y		3
Rubin 2014[173]	Fundamental Causes Theory	y				y		y		3
Safford 2021[174]	Healthy People 2020 SDOH Framework	y				y		y		3
Saldana-Ruiz 2013[175]	Fundamental Causes Theory	y				y		y		3
Santamaria-Ulloa 2019[176]	WHO CSDH Framework	y				y		y		3
Sayani 2019[177]	Synergies of Oppression Framework	y				y	y	y		4
	Multilevel Influences on the Cancer Care Continuum Model	y				y	y	y		4

Study	TMF	Inform aims	Select Int	Design/ Adapt Int	Sample/ recruit	Select, Measure Variables	Data Analysis	Interpret findings	Other	Total
Shariff-Marco 2013[178]	WHO CSDH Framework	y				y		y		3
Sharma 2020[179]	Sharma 2020 Study SDOH Framework	y				y	y	y		4
	WHO CSDH Framework	y				y	y	y	Develop study framework	5
Shelton 2011a[180]	Social Contextual Framework	y				y		y		3
Shelton 2011b[181]	Social Contextual Framework	y			y	y	y	y		5
Smith 2021[182]	Intersectionality Theory	y				y		y		3
	Biopsychosocial Model of Racism as a Stressor	y				y		y		3
Sommer 2011[183]	IOM Socioecologic Model	y	y	y		y		y		5
Tabaac 2019[184]	Health Equity Promotion Model	y				y		y		3
Tan 2019[185]	Dahlgren & Whitehead Determinants of Health Model	y				y	y	y	Develop study framework	5
Tan 2019[185]	Tan 2019 Model of Patients' Perceptions on Individual's Conditions, and Perceived Social and Physical Environments	y				y		y		3
Teuscher 2015[186]	Collective Lifestyles Theory	y				y		y		3
Thompson 2019[187]	Healthy People 2020 SDOH Framework	y				y		y		3
Viens 2016[188]	Fundamental Causes Theory	y								1
	WHO CSDH Framework	y								1

Study	TMF	Inform aims	Select Int	Design/ Adapt Int	Sample/ recruit	Select, Measure Variables	Data Analysis	Interpret findings	Other	Total
Ward 2018[189]	Conceptual Framework of Access to Health Care	y				y		y		3
Westrick 2020[190]	Ecosocial Theory	y						y		2
Yeary 2011[191]	Socioecological Model	y				y		y		3
Zorbas 2021[192]	Getting to Equity Framework	y				y	y	y		4
	WHO CSDH Framework	y				y	y	y		4
	Agency-Structure Theory					y	y	y		3
Frequency of applications (out of 94)		81	8	11	11	81	35	83	13	

Notes: Total in the far right column refers to total number of use types within a study, total as the bottom row indicates frequency of application type across the 94 instances of TMF use in the sample. CSDH = Commission on Social Determinants of Health; HIAP = Health in All Policies; Int = Intervention; SDOH = Social Determinants of Health

Exemplar TMF applications

This section expands on the quantitative coding (see Table 3) of approaches to integrate a TMF into an empirical study and describes ways to convey how the TMF application informed the study. This section also highlights exemplar empirical applications of health equity TMFs. The narrative information in this section is briefly summarized in Table 4. This is not an exhaustive list of ways a health equity TMF could be applied an empirical study, rather this reflects themes that emerged from the current sample.

Table 4

Approaches to communicate the application of a health equity TMF

Type of TMF application	**Approaches to communicate TMF use**	**Article section**	**Modality**
Inform study aims, questions, hypotheses	• Summarize TMF constructs, propositions, characteristics; indicate how these inform study (e.g., conceptualize factors that contribute to health inequities) • Clearly state how the TMF is connected to the study aims, objectives, or questions • Specify TMF constructs tested in the study & the nature of hypothesized relationships between constructs (e.g., direction of association)	Background/ Introduction	Text (paragraph, list)
Select intervention	• Describe how key tenets, characteristics, or propositions from the TMF informed the selection of the intervention • Indicate how the TMF led to the decision to select one particular type of intervention over another	Background/ Introduction; Methods	Text (paragraph)
Design/Adapt Intervention	• Organize intervention components, activities by TMF level or domain • Specify which TMF constructs are incorporated into the intervention and how these are operationalized • Describe and provide specific examples of activities or processes from a TMF that are used to inform intervention adaptations	Methods, Supplemental Material	Text (paragraph, list); Table; Figure
Sample/recruit participants	• Summarize key TMF propositions related to the population of interest (e.g., how the TMF conceptualizes marginalization) • Describe how the TMF informs identification of the target population, characteristics of interest, or inclusion/exclusion criteria	Background/ Introduction; Methods	Text (paragraph); Figure

	• Indicate how the TMF informed sampling or recruitment methods (e.g., oversampling for certain characteristics for an understudied marginalized population) • Link the TMF to recruitment activities and approaches (e.g., recruiting from locations identified in the TMF) • Visually illustrate various participant types and roles (e.g., organizations and individuals across sectors)		
Select, measure variables	• List constructs/variables of interest and cite the source TMF • Organize key TMF constructs/variables and how they are defined and operationalized in the study • Map data collection items (e.g., survey items, interview questions) onto TMF constructs or domains • Provide a figure illustrating the TMF constructs/ variables assessed in the study • Describe how concepts or tenets from the TMF provide overall guidance for data collection (e.g., wording interview questions to have a strengths-based framing)	Methods; Supplemental Material	Text (paragraph, list); Table; Figure
Data Analysis	• Describe how the TMF informed the selection of the data analysis approach • Indicate how TMF is used to select codes and develop codebooks • Map qualitative data onto TMF domains/levels to organize themes • Describe how the TMF informed data groupings (e.g., create interactional comparison groups) • Specify how the TMF was used to build a statistical model or analysis approach • Illustrate TMF application to group data across sources or quantify qualitative data in mixed methods approaches (e.g., count SDOH code frequencies)	Methods; Supplemental Material	Text (paragraph, list); Table; Figure
Interpret & Report findings	• Develop a study-specific TMF figure or organize and report findings • Organize results aor discussion section headings by TMF level, domain, construct, or theme • Cite TMFs and describe connections between study findings and the TMF	Results; Discussion	Text (paragraph, list); Table; Figure

Inform study aims, research questions, or hypotheses

In exemplar applications, authors illustrated how the selected health equity TMF(s) informed their aims, research questions, or hypotheses in several ways. Article background sections introduced the TMF, summarized key constructs, propositions, or characteristics, and indicated how these informed the study. The most obvious use of a TMF informing study aims or research questions was an explicit statement connecting the TMF to the aims. For example, Abbs et al.[120] indicated in their introduction that communication interventions target individual-level barriers rather than structural factors (e.g., economic, political, and social systems that perpetuate differential risk exposures, such as access to high-quality foods) and indicated the multilevel SEM guides the conceptualization of type 2 diabetes as a "communal and social" issue rather than an "individual, biomedical problem." Abbs et al. stated one of their study objectives was to "explore whether their resultant spoken-word art [created by study participants] represents and communicates the SEM as it relates to [type 2 diabetes]."[120]

For studies that tested hypothesized relationships between constructs in the TMF, exemplar applications indicated which relationships their study tested and hypotheses about these. Craig et al.[145] developed a study-specific conceptual framework of SDOH and chronic disease multimorbidity based on the WHO CSDH framework,[39] and specified the hypothesized pathways their study tested to examine the association between SDOH (e.g., housing conditions, neighborhood environment, wealth quintile) and chronic disease multimorbidity.

Select, design, and adapt interventions

This review found several ways in which the use of health equity TMFs to select, design, or adapt an intervention was communicated in empirical articles. In exemplar applications, authors described the main tenets or characteristics of the TMF and how this led to the selection

of the intervention, including the specific intervention type or characteristics and why this was more suitable than alternative approaches. As described above, Abbs et al. indicated that communication interventions that target individual-level barriers did not sufficiently address causes of health inequities and indicated that multilevel approaches guided by the SEM that included framing around structural factors (e.g., discrimination) would be better suited for type 2 diabetes prevention among marginalized communities.[120] In an RCT protocol to design and test a multilevel cancer prevention intervention among Latinas, Arredondo et al. stated a key tenet of ecological models, including the cited Model for Analysis of Population Health and Health Disparities,[227] is that interventions should target multiple levels of influence rather than a single level to promote sustained behavior change.[127]

Authors used several approaches to indicate how the selected health equity TMF informed the design of their intervention, either visually or in text. Exemplar applications included organizing intervention activities by TMF domain or level, or indicating which TMF constructs or components were included in the intervention and how. For example, Arredondo et al. organized intervention components in the methods text and intervention figure according to socioecologic levels – individual (e.g., mailed education material), interpersonal (e.g., motivational interviewing), organization (e.g., churches allocated space for group classes), and environment (e.g., community-selected and led neighborhood improvement projects),[127] informed by levels and constructs from the Model for Analysis of Population Health and Health Disparities.[227] In their quasi-experimental evaluation protocol of the First 1000 Days maternal-child obesity prevention program, Blake-Lamb et al. provided a table that included the five components from the Collective Impact Model[198] and a study-specific description and program activities that aligned with each component.[131]

Descriptions of using health equity TMFs to guide the adaptation of an existing intervention were limited in this sample. One type of application was the use of a TMF to guide and illustrate activities or approaches used to adapt an existing intervention for improved cultural concordance and competence for a marginalized population. Gordon et al. adapted the Analytic Framework to Evaluate the Effectiveness of Healthcare System Interventions to Increase Cultural Competence[196] and used a figure and text to illustrate activities to adapt a kidney transplant program for Hispanic patients (e.g., programs to recruit/retain staff who reflect the cultural diversity of the community, linguistically and culturally appropriate health education materials) and evaluation of these activities.[154]

Identify, sample, and recruit study participants

Several studies illustrated how health equity TMFs informed the selection of study participants and activities to recruit these participants. Some authors described the tenets or principles of the TMFs that guided the selection of participants who represented specific marginalized identities. Dlugonski et al., incorporated Intersectionality Theory[87,205] to describe how multiple intersecting marginalized social identities (e.g., Black, single parent, female, low income) may impact health and the importance of examining these interactions, rather than a single aspect of identity, to understand within-group differences.[150] This intersectional premise guided the study inclusion criteria and purposive sampling of low-income Black single mothers who varied in terms of their age, educational attainment, employment status and other factors, described in detail in the introduction and methods.[150] Another exemplar connected the guiding TMF to sampling decisions and the rationale for these. Ray stated Intersectionality Theory[224] informed their decision to oversample Black women to focus more acutely on this understudied group.[170]

Authors also described how TMF principles were used to guide recruitment settings and activities among marginalized populations. For example, Adams acknowledged the historic discrimination and exclusion of African Americans in research and indicated Critical Race Theory[37,206] informed recruitment activities, such as recruitment in churches through trusted individuals.[122] TMFs could also be used to illustrate the different types of groups or individuals in a study and how they are related to one another. Chin et al. adapted the Conceptual Model for Racial and Ethnic Disparities in Health Care[202] to map intervention components, including the types of organizations and individuals (e.g., health department, patients) participating into their multisectoral health promotion initiative.[142]

Select and measure variables

Many studies illustrated how a health equity TMF informed the selection and measurement of constructs and variables in empirical studies. One of the simplest approaches was to provide the citation for the TMF source from which a variable was selected. For example, Pinheiro et al.[166] explicitly stated their study's "socially determined vulnerabilities" – education, economic stability, neighborhood/build environment, health and healthcare, and social and community were the five domains from the Healthy People 2020 SDOH framework.[221] Other studies went further by using TMFs to create measurement tables or figures, with some providing construct definitions, study-specific operationalizations, and/or data collection and measurement approaches. Some authors also provided visualizations of TMF constructs and how these were defined and measured in their study. In a qualitative study assessing multilevel factors influencing health behaviors among urban Black and Latina women, Shelton et al.[181] provided a figure of their adapted Social Contextual Framework[228] along with a table mapping sample interview questions onto framework constructs. In a quantitative example, Craig et al's[145]

methods section included a figure illustrating their adaptation to the WHO CSDH framework,[39] a table, and in-text narratives, each of which organized variables by framework domain and specified how these were operationalized in the study.

Less frequently, authors described how concepts or paradigms from a health equity TMF informed their overall measurement approach but did not identify specific constructs from the TMF measured in their study. For example, Rottapel et al. applied the African-American Collaborative Obesity Research Network (AACORN) model[194] and the combined Critical Race + Community Capital Theory[207] to develop the focus group guide used in a qualitative study related to cardiovascular health among African American women.[172] The authors articulated that these TMFs informed how community strengths, as a challenge to deficit perspectives, and the impact of racism were woven into focus group questions.

Analyze data

Depending on the methodology, authors applied health equity TMFs to data analysis a variety of ways. Authors used a combination of text narratives, tables, and figures to demonstrate how the TMF informed analyses. In qualitative analyses, authors applied health equity TMFs to select analysis approaches, inform overall guiding questions for analysis, identify codes, develop codebooks, and summarize themes. For example, Adams described the Critical Race Theory method of composite storytelling,[206] which uses a narrative analysis approach to construct counternarratives, and specified how this approach was appropriate for capturing marginalized perspectives often excluded in research (in this case, rural older Black male prostate cancer survivors).[240] Chung et al. provided a narrative summary and table that mapped guiding questions for coding and analysis and identified TMF constructs that were selected as codes applied to the data.[143] For example, the table identified “How have equity objectives and targets

been described in the policy?" as a guiding question for analysis and "equity in principle", "SDOH", and "priority populations" as codes informed by Dahlgren & Whitehead's Determinants of Health Model.[209] Abildso et al.[121] applied the Community Capital Framework[200] to code interview transcripts; they provide a narrative overview of the framework, a table summarizing the framework constructs, original and study-specific operational definitions, and describe how the framework-based codebook was applied. Evans-Agnew described mapping text from multiple qualitative data sources onto ecological levels within the Ecosocial Theory[241] and organized determinants of asthma management disparities from previous studies according to these levels to compare themes from their study with known determinants.[151]

In studies using quantitative methods, TMFs were applied to develop novel statistical modeling approaches, build statistical models to test hypothesized relationships, and inform data groupings for analyses. Alvarez and Evans[125] included descriptions of the Ecosocial[211,242] and Intersectionality[205,243] theories in their introduction, described in detail how these theories informed the development of their novel Eco-Intersectional Multilevel modeling approach, and compared their approach to other conventional and intersectional modeling approaches via text and figures. Beccia et al.[130] incorporated the Fundamental Causes[54] and Intersectionality[204] theories to develop a conceptual analytical model guiding their analysis of the associations between different forms of discrimination and binge eating behaviors among Latinas. Ray described how Intersectionality Theory[224] informed the construction of race and sex intersections to compare BMI within and across groups of Black women, Black men, white women, and white men with similar levels of education, income, and other sociodemographic factors.[170]

In mixed methods analyses, TMFs were mainly applied in data transformation (e.g., quantification of qualitative data), which authors articulated through text description, tables, and

figures. For example, Pearson et al.[165] applied the WHO CSDH Framework[39] to code SDOH-related activities from Aboriginal Community Controlled Health Organizations' annual report documents, organized activities with framework domains, and quantified the total number of each type of SDOH activity reported (e.g., number of health promotion activities that addressed sociopolitical contexts and socioeconomic position).

Report and Interpret findings

TMFs served as tools to organize, contextualize, and communicate study findings and interpret their connection with other literature. Many authors organized study findings into TMF levels or domains and depicted these groupings via text section headings, figures, or tables. For example, McLoughlin et al.[161] included a figure that grouped emergency school meal provision during COVID-19 by the four domains of the Getting to Equity Framework[218] and included a table that indicated the use and frequency of each activity enacted by large urban US school districts, also organized by Getting to Equity domains. Several authors used data to make study-specific adaptations to an existing health equity TMF or develop a new TMF to organize and report findings. For instance, Armour-Burton et al. used qualitative data to develop a novel conceptual framework of the lived experience of intersectionality among African American women with breast cancer and indicated how this data-informed model could be applied in other studies.[126] Some authors interpreted results through the lens of a health equity TMF and used the TMF to contextualize findings and make connections with the broader literature, described in text and sometimes organized by TMF level or theme. Darroch et al.,[146,147] organized results and discussion sections by themes from the Postcolonial Feminist Theory[231,232] and the Integrated Life Course and Aboriginal SDOH Model[223] and narratively described the ways in which findings aligned with, extended, or contradicted propositions from these TMFs.

Health Equity TMF applications to IS

Many of the TMFs identified in this review were coded as having potential implications for IS. Four major thematic areas emerged from the open-ended item capturing reviewer impressions of the TMF relevance to IS: determinants, processes, outcomes, and overall research activities. Some TMFs could serve multiple purposes for equity focused IS, while others would likely have utility for specific types of studies (e.g., policy D&I studies, implementation research in clinical settings). TMFs that crosscut implementation studies include Intersectionality and Critical Race theories,[205,243] Postcolonial Feminist Theory,[232] and the Synergies of Oppression Framework,[238] as well as some less generalizable TMFs (e.g., the AACORN Model[194]), provide a theoretical orientation to understanding systemic discrimination and oppression identities and can inform ethical, equitable research practices for studies involving marginalized populations, particularly people of color who hold multiple other marginalized identities.

About half of the 52 TMFs in this review contained constructs representing equity-relevant determinants. Generalizable TMFs such as the WHO CSDH framework,[39] Dahlgren & Whitehead's Determinants of Health Model,[209] Krieger's Ecosocial Theory,[242] National Institute on Minority Health and Health Disparities (NIMHHD) Research Framework,[230] Kaiser Family Foundation SDOH framework,[226] and variations of the SEM (e.g., Inside Out SEM of Policy and Environmental Change[222]) conceptualize a wide array of SDOH largely absent from prominent determinant frameworks in IS. Other somewhat generalizable TMFs can also help conceptualize multilevel equity relevant determinants and could be useful for specific implementation topics or more broadly applicable with minimal modification. For example, the Ethno-Cultural Gerontological Nursing Model[215] and SEM of Type 2 Diabetes[120] offer detailed conceptualizations of various SDOH and structural factors (e.g., discrimination) that lead to

health inequities; many of their constructs are broadly generalizable, with a few population or disease specific constructs amenable to adaptation to broaden their generalizability. Chin et al.[142] offer a study-specific operationalization of their previously published Conceptual Model for Racial and Ethnic Disparities in Health Care;[202] this example could inform identification of collaborators and policy, system, organization, and community leverage points for implementation efforts spanning clinical and community settings.

Several TMFs identified in this review could have utility for particular activities or processes in implementation studies. For example, the Analytic Framework Used to Evaluate the Effectiveness of Healthcare System Interventions to Increase Cultural Competence[196] could help guide cultural adaptations in clinical settings. The Collective Impact Model[198] organized five principles to guide partnered work across organizations and could inform collaboration activities to promote equitable implementation efforts. The Evaluation of Environmental Policy and Systems Model[156] and Expanded Evaluation and Measurement Framework for Assessing Health in All Polices Initiatives[216] both offer a useful overview of the policy process and could be valuable in policy implementation studies.

Many of the identified TMFs could be used to inform the operationalization of equity or related concepts in implementation outcomes, or to identify more distal service and health outcomes to target through improved EBI implementation. The Conceptual Framework of Access to Health Care[201] offers detailed definitions and examples differentiating between multiple aspects of access from a recipient and organization/provider perspective, which could aid in operationalizing implementation (e.g., appropriateness) and service (e.g., availability) outcomes. The Framework for Conceptualizing Equity in Health Care[217] also conceptualizes equity as it related to healthcare accessibility, availability, and acceptability, and includes several

SDOH that affect patient abilities to engage in care, which could be useful in identifying both implementation determinants and outcomes.

Discussion

This scoping review seeks to address a gap in the IS literature by identifying and summarizing health equity TMFs that have been applied in empirical chronic disease research and exploring their potential relevance for IS. Our team conducted title and abstract screening of over 63,000 records and reviewed 2,730 full text articles for eligibility. This study reports findings on a subset of the overall review's extraction sample. Across 72 studies, I located 52 unique health equity TMFs, applied in 94 instances; 25% of studies applied multiple TMFs. TMFs included a wide array of concepts and constructs related to equity that reflected multiple socioecologic levels, and most were broadly generalizable to different health topics, populations, and settings with minimal to no modification. One noted limitation of many TMFs in this review is a lack of intersectional attributes that could be subject to marginalization (e.g., race, gender, socioeconomic status) and resultant disparate health outcomes. These attributes were often applied as discrete variables or constructs, with some notable exceptions of studies that applied Intersectionality or Critical Race Theory.[122,125,150,170] Bowleg notes the challenges with these theories as they are not a traditional TMF with operationalized constructs.[87] However, this review highlights ways in which existing health equity TMFs can be updated and modified, indicating they are amenable to revisions to make explicit how attributes of identity intersect, interact with, and are the product of social structures.

TMFs that conceptualize health as a result of personal choices at the individual level obscure the structural causes (e.g., public policies) shaping the conditions that influence individual and population health.[53] This review highlights the conceptual complexity in defining

and operationalizing health equity in empirical research. There is relatively little guidance available to determine what qualifies as a health equity TMF. Guided by conceptualizations of structural factors as the fundamental cause of inequities,[39,51,54] this review contends that a health equity TMF must be conceptualized beyond the person level. All TMFs in this review reflected multiple levels; nearly all TMFs represented four or more of the six levels coded in this review. The organization level was represented least frequently in this sample, although still present in over half of the TMFs. This may have implications for which TMFs may be most relevant to IS and the extent of their utility, given the importance of organizations in implementation research and practice (e.g., as settings of intervention delivery, as units of group assignment or analysis for multisite studies).[244,245]

Although TMFs conceptualized multiple levels of influence beyond individuals, empirical applications varied in the extent to which the societal, systems, or policy levels were acknowledged and operationalized. While there were notable examples of studies that sought to identify structural factors (e.g., structural racism, exclusion from employment, public policies) as fundamental causes of health inequities or leverage points to promote equity,[120,143,149,159,161] studies often operationalized these structural factors at the individual level (e.g., individual insurance status, cultural barriers to applying for insurance, rather than assessing or acknowledging policies that set income, immigration, and other eligibility requirements[128,137]). This presents missed opportunities to identify important drivers of health inequities and factors to target with interventions to promote greater equity.[55] When applying a health equity TMF, authors should also look to the theoretical and empirical literature to identify approaches to operationalizing structural and SDOH beyond the person level.[98,99,214,246] Equity-focused studies would also benefit from selecting TMFs in collaboration with partners. Although we did not code

co-selection as a specific activity in data extraction, this did not appear in the free text response option to code other TMF applications beyond the fixed response options (see Appendix 2.3). Only one article, a community-based participatory research study examining rural community environments for health promotion, described discussing the theoretical background guiding the study with community partners.[129] This highlights an important collaboration and co-learning opportunities that are absent from research activities, or at least are underreported in peer reviewed articles.

Previous reviews of health equity TMFs in public health have sometimes taken non-systematic narrative summary approaches, not explicitly focused on empirical applications, and equity-focused IS TMF reviews have been limited in scope (e.g., equity-focused TMF applications of IS TMFs to study to ethnicity related disparities in healthcare settings).[49,100,106] This study extends findings from previous equity focused TMF reviews by collating health equity TMFs across an array of fields, disciplines, and settings through systematic rather than narrative methods and detailing the ways in which these were empirically applied. This review offers a summary of approaches to use a health equity TMF to inform research and how to explicitly communicate these applications so that others can learn from these and more readily compare findings across applications of the same TMF. Many of the best practices identified in this review (see Table 4) can also apply more broadly to TMF use in IS and other fields. For example, making explicit how the TMF informs study aims or hypotheses can help authors and audiences evaluate the relevance of the TMF to their study; as noted in IS, TMF selection is often haphazard,[247] so connecting TMF constructs and propositions to research questions could help improve selection of appropriate TMFs.[248] The application of a multilevel health equity TMF (e.g., Ecosocial Theory, WHO CSDH Framework) and appropriately operationalizing

constructs at the organization, community, systems/societal, or policy levels represented in the TMF could improve the selection, design, and adaptation of interventions to incorporate or address factors beyond individuals known to influence health.[55,56] This review noted examples of how authors adapted or applied a health equity TMF to develop an intervention logic model that noted the levels of activities and actors involved,[127,131,142] which could inform similar approaches in equity focused IS projects.[248]

Although this review can help to extend the conceptualization of health equity and related concepts and offers examples and suggestions for empirically applying health equity TMFs, there are several limitations to note. To achieve a manageable scope, this review limits to English language articles published in 2010 or later (given the uptick in equity-focused search terms during this decade[70]), and searches of bibliometric databases indexing peer reviewed articles biases the sample towards academic products produced by English-speaking scholars from well-resourced institutions or countries. Further, the exclusion of non-empirical and non-peer reviewed sources may omit TMFs described in conceptual articles, books, and other sources, although these were included for data extraction when cited by empirical articles. It is the intent of this review to identify health equity TMFs used in chronic disease prevention and control, thus, TMFs in other areas of health are beyond the scope of this review and could be explored and compared in future work. Further analyses are needed to collate, map, and compare constructs and their definitions; previous TMF reviews acknowledge the complexity of this process,[249] thus further collaboration and consultation with academic and non-academic health equity experts is warranted. In depth thematic and concept analyses could explore the extent to which equity is operationalized as a process or outcome, which dimensions of equity are included, and whether we can synthesize a core set of equity related constructs.[70]

This review collated an array of equity related TMFs that could be applied in combination with or used to adapt existing IS TMFs. Findings can inform improved reporting of TMF applications in empirical studies and can facilitate cross disciplinary learnings about SDOH and health equity. The detailed protocol for this review can aid other researchers in conducting similar health equity TMF reviews in other health areas or could inform a broader, more comprehensive systematic review. Learnings from this subset of studies extracted from a larger ongoing review can help refine data extraction and synthesis approaches to ensure the data and how they are synthesized allow our team to adequately answer the research questions we sought to pursue in this review. Findings from this review will be integrated with a review of health equity applications of IS frameworks to inform the health equity expansion of the dissemination and implementation models webtool.[250] The empirically informed recommendations and examples derived from this review will offer new equity focused content, actionable guidance, and exemplar case studies that can inform equity-focused implementation research activities.

Chapter 3: Development and user-testing of a resource to guide selection and design of equity-focused implementation strategies

Introduction

Implementation strategies are the scaffolding used to support the uptake and routine, sustained use of an EBI. Though current evidence is somewhat mixed, implementation strategy effectiveness is likely improved by matching strategies to determinants.[251-255] Identifying determinants of (in)equity and applying an equity lens to strategy design may improve the equity impact of resulting implementation outcomes, and ultimately service and health outcomes.[45,65,72,256] The recently published ASPIRE framework described earlier offers a foundation for adapting implementation strategies through an equity lens.[84] However, it is still unclear which strategies can be used in which contexts to address equity-relevant determinants, or how strategies should be tailored to promote equitable implementation in chronic disease prevention and control, and ultimately, improvements in equitable health outcomes.

There are several challenges that should be addressed to make strides towards equitable implementation. First, outer setting determinants (including patient/intervention recipient, community, and structural factors) are often understudied in IS. Determinants frameworks rarely consider health equity, or include equity as a general umbrella term rather than specifying equity-relevant constructs.[79,257-259] Second, recommendations for implementation strategy selection, tailoring, and specification, while useful, do not offer specific, actionable guidance on designing for equity impact (e.g., more equitable implementation processes, improved reach, fidelity, or sustainment among marginalized populations and settings).[85,251-253,260,261] Detailed reporting of strategy components, or key ingredients, is essential for replication and for generating understanding of what components are needed to activate the causal processes through which implementation strategies operate (i.e., their mechanisms).[85,262] Third, although EBI

implementation may improve health equity and reduce inequities, equity impact is not articulated in implementation outcomes.[92,263] Baumann and Cabassa offer a valuable call to the field to operationalize equity in implementation outcomes,[92] however they do not provide updated conceptualizations of what these equity focused outcomes would entail. Many conceptualizations of equitable implementation are focused only on reach (i.e., getting interventions to populations who would benefit from them). However, equitable implementation needs to go further than this outcome (e.g., perceived appropriateness of an intervention among a marginalized population, equitable sustainment across high and low resource settings).

Health equity is often conceptualized as a reduction in health disparities. While reducing and ultimately eliminating health disparities is required to achieve health equity, these two are not synonymous; disparities could be eliminated by worsening outcomes among a more advantaged group without improvements for marginalized groups. Health equity is a complex, multifaceted concept that is difficult to measure, and operationalizing the measurement of health equity can be fraught.[40,99,264] For example, Fortuna et al. concluded their hypertension control study resulted in "reductions in some targeted disparities" based on overall improvements in hypertension control among Black participants, their outcomes show a two-percentage point larger gap between Black and white participants, indicating an increase in inequities between these groups.[68] Thus authors described their study as community-engaged, but did not detail how community members were involved in the study, other than as targets of data collection and surveillance, with clinic-based intervention (e.g., blood pressure monitoring), informed by community-level data provided by health departments.[68]

Health equity is not just an outcome, it is a process, which involves meaningful engagement of affected individuals and groups, allocation of resources according to need, power

sharing in development of programs and policies, and recognition and ongoing efforts to address historic and contemporary injustices and the structures that cause or perpetuate inequities.[43] Without explicit focus on health equity, we may fail to identify equity-relevant determinants and adequately select and tailor strategies to address these, we may not equitably improve outcomes, and we risk drawing inaccurate conclusions about impacts on health inequities.[75,265] This dissertation seeks to advance efforts to integrate health equity into implementation research, and focuses specifically on implementation strategies as this subject has seen relatively less equity-focused development in IS compared to efforts to integrate equity into determinants and outcomes TMFs. This study expands upon existing guidance for selecting, designing, and specifying implementation strategies to integrate a more explicit focus on heath equity. This second study pursued the following aim:

Aim 2: Develop a resource to guide the integration of health equity into the design and tailoring of implementation strategies. The study activities were guided by the following sub-aims:

Aim 2a: Create an initial prototype of the health equity implementation strategies resource. This involved synthesizing health equity and implementation science literature and informal consultation of IS experts to generate content for the resource.

Aim 2b: Iteratively test and refine the resource. This involved preliminary user testing to solicit feedback on the resource and recommendations for its refinement.

The outcome of this project is a revised version of the resource that will be further tested and refined in a larger-scale study (see discussion section).

Methods

Resource Inputs

Several inputs informed the preliminary version of the equity-focused implementation strategies resource, including published literature, informal conversations with IS experts experienced in conducting equity-focused research, and formal consultation.

Literature synthesis. I located relevant health equity and implementation literature from IS, public health, and social sciences (e.g., sociology, medical anthropology) through bibliometrics searches of relevant databases (e.g., PubMed, Embase) and crowdsourcing (e.g., recommendations from dissertation committee members, informal conversations with IS experts, literature and resources shared via email listservs and professional social media platforms). The specific types of inputs included:

- The candidate's doctoral area statement, focused on health equity, implementation science, and obesity-related chronic disease prevention
- The Aim 1 health equity TMFs scoping review
- Washington University IS course syllabi
- Equity-focused IS resources and repositories (e.g., the Institute for Implementation Science Scholars readings, Columbia University's IS resource hub, NCI's ISC3 Health Equity Task Force)

I collated literature informing the content of this resource guide through a non-systematic literature synthesis. I used EndNote reference management software to organize the literature into groups by topic (e.g., implementation strategy selection, design, and specification methods, health equity terms and definitions, health equity TMFs, conceptual literature for integrating health equity into IS).

Expert consultation. Informal consultation from implementation scientists with health equity expertise informed the overall conceptualization of this resource. I identified experts

through IS existing network (see Table 5) events, including local and national research group meetings, conferences, and training events. In these informal consultations, I described the resource concept (e.g., purpose, intended audience, content, structure) and testing and refinement approach. I solicited high level feedback (e.g., general reactions about the relevance and utility of the resource) and requested recommendations for content (e.g., health equity literature, existing health equity in IS resources). Experts either sent resources via email or I took notes to record recommendations.

Formal consultation took place through the 2022 Washington University D&I bootcamp, a one-day event with multiple one-on-one 30-minute consultations. For these consultations, I provided a one-page summary of the project and a verbal "elevator pitch" to three consultants with expertise in health equity, user-centered design, and IS methods. During these sessions, consultants provided verbal feedback on the project proposal related to user-centered design and testing methods (e.g., narrowing the intended recipients, recommended literature to inform the user testing methods) and the type of content to include (e.g., conceptual articles, methodological narrative reviews).

Initial resource development

I used the inputs described above to populate content for the initial draft of the resource, created as a Word document (see Appendix 3.1 for initial resource document draft, Appendix 3.3 for revised version). I organized content into the following sections:

1. Introduction: brief overview of the resource guide's purpose, intended users, and organization of content

2. Health equity concepts and resources: table of terms and definitions related to health equity and equitable implementation, brief bibliography of health equity literature, links to existing health equity focused IS resources
3. Equity-focused implementation strategies: brief overview of implementation strategy selection, tailoring, and specification literature, equity-focused strategy brainstorming activity
4. Case examples: example applications of the brainstorming activity, user tips
5. References: complete list of citations used in the document

The key component of this resource is a brainstorming activity, which provides a set of equity-focused prompts organized by the implementation strategy dimensions articulated in Proctor et al.'s strategy specification recommendations.[85] The rationale for organizing the brainstorming prompts by the Proctor et al. strategy components (i.e., actor, action, action target, temporality, dose, implementation outcome affected, and justification) was to ensure strategy outputs from the brainstorming activity align with established recommendations in the IS literature and were sufficiently detailed for replicability. I developed prompts within each strategy component based on recommendations from health equity IS literature, conceptual and empirical equity literature from public health and social sciences, and informal conversations with implementation scientists conducting equity-focused research.

In reviewing guiding literature and conceptualizing the content for this resource, I developed several prompts that were likely necessary to consider prior to designing or tailoring an implementation strategy and did not fall within a single specification component. This led me to expand the brainstorming activity into two parts – part one included overarching questions related to equity and health equity, and part two included the table of strategy-specific prompts. I

also added several new components not included in the Proctor et al. strategy specification recommendations and revised the definitions of several existing strategy dimensions (see Appendices 3.1 and 3.3)

Resource guide testing and refinement

I used a concurrent mixed methods approach that incorporated pragmatic user-centered design methods to conduct user testing and elicit usability data and feedback on the resource prototype.[266-268] The Washington University Institutional Review Board approved this as an exempt study (#202310076).

Sampling and recruitment

Following principles of user-centered design, I narrowed to a particular type of user for the initial development and testing of the resource.[269,270] The intended users were early to mid-career researchers with a foundational understanding of IS (i.e., familiarity with IS methods, terminology, and TMFs) who have relatively novice or intermediate knowledge of health equity principles. The rationale for gearing the resource toward this type of user was to ensure the resource's approachability and usability for varying levels of experience and expertise. Starting with users with sufficient knowledge to engage with the content but lower levels of experience helped ensure the content would be appropriate for non-experts. More advanced implementation scientists with health equity expertise would likely be better prepared to engage with this type of resource and may not identify issues that more novice users could experience. This initial version was not explicitly focused on practitioners who may be less well versed in IS language and methods.

I used a non-random, purposive sampling approach to achieve representation of an array of disciplines (e.g., public health, medicine), demographic characteristics, and research

experiences (e.g., collaboration with community organizations, use of participatory methods). Participants were eligible if they were doctoral level (e.g., PhD, MD, DrPH) early to mid-career researchers at US-based institutions (academic or non-academic) who conducted research focused on IS, health equity, and chronic disease. I did not include non-US researchers due to IRB limitations and difficulty obtaining lists of non-US scholars (particularly in low- and middle-income countries), and did not recruit close collaborators to minimize risk of bias. I used public information from online sources (e.g., faculty webpages, Google Scholar profiles) to determine eligibility. I defined early to mid-career as ≤10 years of experience following receipt of doctoral level degree. I determined IS experience based on participation in a formal IS training program (e.g., IS2, RISE; see Table 5), role as PI, co-investigator) on an IS study, and/or peer reviewed IS publications. I determined chronic disease and health equity interest based on publications and online researcher profiles (e.g., keywords, narrative summary on faculty webpages). I documented summary information about eligible researchers, including name, email address, institution, job title, research interest key words, and recruitment source (from those listed in Table 5).

Table 5

IS Networks

Washington University (WU)	**External collaborators**
Prevention Research Center	Collaborative for Anti-Racist D&I Science (CARDIS)
WU ISC3	Society for Implementation Research & Collaboration (SIRC)
WUNDIR	NCI ISC3 Health Equity Task Force
Institute for IS Scholars (IS2) training program	NCI Consortium for Cancer Implementation Science
	Research in IS for Equity (RISE) training program

The target sample size for this study was 8-10 participants. This sample size was appropriate for a formative user-testing approach, as the goal at this stage was to identify major flaws rather than fine tuning, which is conducted in later stage testing.[266,270] It was expected this

sample size would be sufficient to identify major issues with the resource that needed correction (i.e., thematic saturation).[271] I sent recruitment emails to eligible participants; emails described the study goals and indicated participation would entail asynchronous review of the draft resource Word document, a one-hour Zoom interview, and brief survey. Upon receiving a response confirming interest, I assigned participants ID numbers and scheduled interviews.

Data Collection and Measures

Building upon cognitive walkthrough and think-aloud methods,[266,272,273] I engaged participants in semi-structured interviews and a cognitive walkthrough exercise to assess the usability of the resource for target users and solicit feedback and recommendations to inform resource refinement. I emailed the resource Word document to participants at least 48 hours prior to the scheduled interview. This email contained brief information about what to expect during the interview, including that participants would be asked to think about an implementation strategy from their own work.

Interviews took place in a one-hour session conducted via Zoom. I developed a semi-structured interview guide to structure the user-testing sessions (see Appendix 3.2). The sessions were organized into three parts. The session started with a semi-structured interview which asked participants to describe how health equity appears in their implementation research, challenges to integrating health equity into implementation research and specifically implementation strategies, and needs and preferences for resources to guide equity focused-implementation strategy design and specification. In the second part, I used a think-aloud protocol to have participants verbalize their thoughts and reactions to the resource. I displayed the resource document via Zoom screen share; for each resource section (see methods section B above) I instructed participants to verbalize their thoughts and reactions as they reviewed the document

and probed for additional detail. The third section asked participants to apply the resource's equity-focused brainstorming prompts to an implementation strategy from their own work to tailor it. Live feedback and testing of the prompts sought to gather real-time feedback, a benefit of a think aloud protocol versus asynchronous written comments.[272] At the end of the session, participants completed a brief survey which contained three demographic items and a ten-item Likert scale measure, adapted from Lyon et al.,[266] to assess the usability of the resource guide, administered via Zoom poll (see Appendix 3.2). I provided a $50 incentive for participation.

Data Analysis

With participant permission, I recorded interviews via HIPAA-compliant Zoom. I used a rapid qualitative content analysis methods to analyze the qualitative data.[274-276] Given the interactive nature of the feedback sessions, and goal of rapidly incorporating input into the resource refinement, I coded the recordings directly using a matrix coding approach successfully employed in previous user testing and implementation studies.[273,274] I generated an a priori code list based on the interview questions and user testing probes, and inductively added codes that emerged from the interview recording. I independently coded recordings using a structured template to summarize key themes and user suggestions. I used this coding matrix to generate summaries of user preferences, challenges, and recommendations, supported by illustrative quotes. I analyzed quantitative survey data using Excel. I used guidance from Lyon et al.,[266] to recode items (i.e., reverse score negative-valence items, convert individual item scores from a 1-5 to 0-4 scale, multiply the raw score total by 2.5 to convert overall rating to a 0-100 scale) and calculate summary scores (see Appendix 3.2). I generated descriptive statistics (mean, range) to summarize the usability ratings. I looked for convergence and divergence across the quantitative

and qualitative data and used qualitative data to contextualize and explain quantitative results.[268] I created a joint display to summarize the qualitative and quantitative findings together.

Resource Refinement

I incorporated participant feedback to revise the resource document throughout the testing period. This iterative rapid refinement throughout the data collection period enabled me to solicit feedback on specific changes. I used track change edits and a summary table to track updates. Following data collection and analysis, I revised the resource document to arrive at the final version resulting from this study (see Appendix 3.3).

Results

Sample characteristics

I assembled a list of 20 eligible researchers and selected 14 for the initial round of recruitment. Nine researchers agreed to participate; one declined due to travel during the data collection period and four did not respond. One participant became ill during the data collection period and was unable to participate in the interview; this participant provided written responses to interview questions and comments and tracked change edits on the resource document. Eight participants completed the user testing interviews and survey. As stated above, small sample sizes are appropriate for early-stage user testing to identify major issues with a product prototype (i.e., preliminary content for the equity focused implementation strategies resource).

All participants (N=9; see Table 6) identified as cis-gender women. Three participants identified as white, two identified as Black, two identified as Asian, and two selected multiple racial and ethnic identities (encompassing Hispanic/Latina, Black, and American Indian/Alaska Native). Seven participants were faculty at an academic institution, and two were researchers in an integrated health system. Participants had an average of 4.9 years' experience after their most

recent doctoral level degree (range 1-10 years). Most participants held PhD or DrPH degrees in public health or a related field (e.g., global health, community health, behavioral sciences). Four participants held clinical degrees (medicine (MD), occupational therapy (OT), physical therapy (PT), registered dietitian (RD); two participants had dual clinical and public health degrees. Participant research interests, obtained online and in interview questions, spanned an array of health topics, populations, and settings. Health topics included cancer, diabetes, obesity, health promotion (physical activity and nutrition), and maternal child health. Participants conducted research in a variety of settings in rural, urban, and suburban areas, for example primary care clinics, hospitals, state health departments, early childcare and other community settings.

Table 6

Participant characteristics (N=9)

Characteristic	**Frequency**
Gender	
Female	9
Race/Ethnicity	
Asian	2
Black	2
Multiple	2
White	3
Years Post-Degree (Mean)	4.9
1-4	5
5-10	4
Degree field	
Public health	5
Clinical (e.g., MD, OD, PT, RD)	2
Dual Clinical-Public Health	2
Role	
Assistant Prof.	6
Investigator	2
Post Doc	1
Organization Type	
Academic	7
Health system	2

Qualitative themes on health equity-focused implementation research

The goal of the semi-structured interview portion of the user testing sessions was to understand how implementation researchers conceptualized health equity in their research. Data from this portion of the interview provided context beyond demographic questions and online profiles to characterize the participant sample. This interview section also elicited participant perspectives on gaps and needs in equity focused implementation research, both in their own work and the broader field. This included specific types of resources, materials, trainings, and other types of support to promote an equity focused implementation research agenda.

How health equity is operationalized in implementation research. Participants described several ways in which they conceptualized and operationalized health equity in their research. Populations targeted by EBI implementation (e.g., rural and high poverty communities, patients with complex social needs, low-income and un/underinsured patients, marginalized racial/ethnic groups) and settings for implementation activities (e.g., community health centers, federally qualified health centers) were the two most prominent ways participants described how equity showed up in their research. Participants described various partnership and engagement activities, including consulting with "stakeholder advisory boards" to guide research practices, gathering practitioner input on their needs and priorities to select interventions, and co-writing grants with collaborators (e.g., clinical practitioners, health department staff). One researcher offered an example of how they bring IS methods to partners in community health centers, stating they tell partners, *"What you're doing right now is the implementation mapping process… Let me tell you what the labels are for what you're doing. Because this may feel like just sort of throwing ideas and stuff out there, but… these are actually strategies that we can develop and*

put into place and measure… in a systematic way." P03 This participant indicated they've "*written... grants together*" with partners to obtain funding from multiple sources.

Most participants described addressing SDOH in their implementation research, such as designing and adapting patient and community member-facing recruitment, health education, and medical information materials for recipients with low literacy, or implementing universal or targeted (e.g., cancer patients) social risk screening and assistance programs in healthcare settings to connect patients to resources to address social needs (e.g., housing, transportation, food assistance). To a lesser extent across the sample, participants also described considerations of structural factors (e.g., systemic racism, historic and current injustice). One researcher shared, *"all of my work focuses on marginalized populations… the Black community, the Latino community and low-income community"* and reflected,

> *Health equity comes into play when thinking about the availability and accessibility of resources that impact primarily social needs... the resulting outcomes of the larger array of social determinants of health... those social risks that impact health behaviors and health outcomes. I also see equity... in terms of communication and trust. More so in mistrust. I think about it in terms of… the systemic determinants and structural determinants, and structural racism that has been historically with its claws into the relationship that communities of color have with the medical community, and by some extension of that with the academic research community as well. I keep those things in mind from the very beginning, from the planning stage... in sustainability... in implementation. Just throughout everything that because a lot of it is so deeply rooted in in past events and it leads into current events as well... The impact of social injustice and racial injustice, it's not just a political thing, it becomes a health-related thing... that's*

how equity shows up in my work and the direction I take in how I plan my intervention, how I examine their effects. And, how I tweak them to make them something that is not only packageable for the partners that we work with, but also something that is sustainable and starts to move the needle away from the negative impacts health inequity has. P08

Several participants indicated their doctoral training focused on equity and related concepts (e.g., community engagement, structural racism), which led an equity-oriented lens being their "default", as opposed to something they needed to add. Other participants whose formal education did not focus explicitly on equity acknowledged the learning curve to integrating this focus into their research. Even for researchers whose work is directly related to equity, several participants noted this is not always clearly articulated in how it ties into implementation. As one participant conveyed, *"I think a lot of the work that we do is rooted in disparities… we know it has a health disparities, health equity lens, right? So, we're looking at that stuff. But I don't know that we necessarily articulate exactly what we're doing [in implementation research] to address inequities in a way that's explicit." P03*

Challenges to integrating equity into implementation strategies & research. Participants articulated various challenges, gaps, and opportunities for conducting equity-focused implementation research, ranging from broad issues to specific struggles. Similar to the sentiment shared above regarding lack of explicit articulation of equity in implementation research, another participant reflected that when they came to the field of IS, "*the thing that felt missing… was the equity lens… There's just like an underlying assumption that by like doing implementation science, you automatically get to equity. And I think that's like really not it." P02*
Several participants expressed that assumptions and beliefs about equity in the IS field broadly

and among colleagues were both a challenge and an opportunity to clarify the goals and importance of equity work.

Funding and funder priorities were among the most common challenges discussed. Several participants noted tension and "*giant misalignment"* between funder priorities, requirements and timelines, and immediate needs and priorities of communities and collaborators. One researcher noted, *"funders tend to have their specific agenda, which may not be in line with the priorities of populations of research interest. Funds also are for short-term projects. Projects and partnerships with communities are very temporary which erodes community trust and buy-in" P06.* Other researchers added that traditional research paradigms and what was expected in funding proposals further hampered their efforts to conduct equity focused partnered implementation research. One participant stated when *"working with non-researchers, or trying to do equity focused work, the timelines rarely line up with grant funding"* and expressed the nature of soft money research environments requires *"figuring out how to navigate what will get me funded 2 years from now with what are my partners or the populations I'm working with are needing right now, I don't really want to wait around. Also fitting within a traditional research paradigm of like aims and power." P02.* Other funding challenges related to insurance eligibility, payor requirements and reimbursement rates, and bureaucratic hurdles to compensating non-research collaborators. Several participants expressed these funding and other *"structural barriers seem so insurmountable… we can identify implementation strategies within that context and be able to function within that context delivering evidence-based interventions. But it makes me kind of bang my head against the wall when I think... 'if we only had some funding for this, or if... health insurance was easier to enroll in'" P01.*

Resource needs and uses. Most participants indicated a need for concrete guidance for operationalizing equity, in implementation research and specifically related to implementation strategies. Although the questions about general needs were not framed to connect needs to the resource guide being tested, nearly all participants indicated this resource addressed some of the gaps or needs they experienced. One participant stated, a need for *"Some concrete guidance on how to incorporate health equity into implementation science"* and added *"like the resource guide, that kind of maps out things that we've learned piecemeal... it's just helpful to have this in one place that you can look towards and say, 'okay, from the beginning of your research project or conceptualization of your research project, these are the things that I need to be thinking about.' I feel like things like that. It's a helpful guide and has some application examples." P09* Several participants indicated the need for concrete, actionable resources to guide their own work, but to also communicate with and teach others. One participant reflected people not "*look at equity with the same lens… you see things a little bit differently. You have to… teach… folks to think in that way… having tools that are really concrete and interactive and actionable helps me to communicate to other people and work with other people."* P02

Several participants noted training programs helped them advance their equity focused implementation research. Trainings included equity focused IS programs, methodological trainings (e.g., Community-Based Participatory Research, Participatory Action Research), and workshops on specific topics (e.g., intersectionality). Some participants expressed desire for ongoing collaborative supports, such as workgroups or communities of practice, with a couple participants acknowledging awareness and involvement in national equity focused IS networks.

Mixed methods user testing findings

Participant ratings on the 10-item usability scale (possible range 0-100) ranged 72-100, with an average overall score of 82.4 (Table 7). Lyon et al.[266] do not provide cutoff scores for the scale, but indicated in their empirical application of the measure that a score of 82.5 falls within the "excellent" range (top quartile of scores) and a score of 71.3 was at the lower end of the "acceptable" range. Based on this, the equity-focused strategies resource had acceptable to excellent usability. Participants scored the resource highest on consistency (item 6) and lowest on likelihood most people would quickly learn to use the resource (item 7). Qualitative themes suggested that challenges to learning to use the resource stemmed from the complex nature of health equity and the myriad possibilities for operationalizing equity in research. As one participant noted, "*anti-racism… social justice… intersectionality and those kinds of more broad questions or topics… are important and are part of [health equity], but they can stand alone… it can get complex for folks sometimes." P03* Several participants also discussed potential challenges about applying the brainstorming activity to multi-component strategies, such as "*practice facilitation… there are so many different components to it, so you know it will be messy… but I don't know that [the resource] needs to change or that would change how I would use it." P02* All but one participant rated the resource as easy to use (item 3). Qualitative data indicate all participants had a positive perception of the resource and noted it addressed an important area of need in the field of IS. One participant expressed, *"This [resource] does a good job at creating something that is digestible for a researcher at any stage, super expert to… entry level or intermediate. So, I think is something that I would find very useful" P08.*

Participants noted several potential uses or purposes for the resource guide. Most users indicated the guide, particularly the prompts, would be useful as a planning tool at the start of a project. Several others indicated the brainstorming activity would also be beneficial to apply in

an ongoing study to identify opportunities to tailor existing strategies for greater impact on equity, or to apply retrospectively to a completed project to reflect on lessons learned and opportunities to improve the integration of equity in future efforts. One participant anticipated they would use the resource "*certainly in planning phases early on… Also, if things aren't going well, this [brainstorming activity] could be a really great tool to lay it all out and think about all these different types of strategy components." P02* Around half of the participants indicated the resource could be used as an educational tool for students, practitioners, health systems operational partners, newcomers to IS, and other audiences. All users confirmed this type of brainstorming activity would need to be approached in a team, with some participants indicating this could be done entirely with a team or to gather team input after a single user added their input to the resource guide document. One participant reflected that the resource, *"hammers in the point of only the group you're working with is going to be able… to help you identify… the strategies"* and stated of partnership, "*it's important that it's there, because I think we [researchers] so often run our little hamster wheel… not addressing that systemic policy issue." P05*

Although participants were enthusiastic about the tool and felt it would add value to their and others' research, they also noted several challenges with applying this tool. Users who felt newer to health equity research expressed that they did not feel like they had the requisite knowledge and information to complete the brainstorming activity and would need other inputs, including greater familiarity with health equity literature, data, and collaborator and recipient priorities and preferences. Several participants indicated they lacked confidence in deciding between tradeoffs or options that may be reflected in the outputs from the brainstorming activity. One participant shared they felt, *"decision paralysis like, What do I do? And what's the*

consequence if I decide to go the other way?... if I recognize that maybe this isn't the most equity focused component, but I have these other components… do we know which components could be more equitable? That's where I struggle" P04.

Table 7

Mixed methods synthesis of usability ratings

Usability Scale Item	**Mean (range)**	**Qualitative themes**	**Exemplar Quotes**
Overall Score	82.4 (72-100)	+ guiding terms & definitions clarify distinction between related concepts + strategy figure and organizing by specification components clarified "pieces" of strategies + concrete example reduced uncertainty about how to approach brainstorming + user tips and reflections improved understanding of how to approach brainstorming - unclear intended user - some terms, instructions needed further clarification - users with less health equity training need more background info to feel confident using resource - time consuming, need multiple sessions to complete brainstorming activity - need other inputs (e.g., data, team discussion) to complete - difficult to decide between tradeoffs, need guidance on which strategy elements to prioritize and how	*Very nice document… can be a valuable resource not only for implementation scientists but also conventional clinical researchers. P06* *Breaking down everyday terms… highlighting some differences and associations between them, I like that [the resource] did this. P08* *[The resource] did a really good job of distilling... making all of this information relevant… the amount of content… seems pretty acceptable. I liked it so I think others might, as well. P01* *I really like the [brainstorming] table... this is a great example of the how and helping people get to the how. P02* *This [activity] is a little hard… maybe this is just my lack of knowledge of empirical, theoretical, practice. P04* *We have to use end user perspectives in order to…do the work… being able to elicit or assign weight to the trade-offs... would be really helpful. P01*
1. Would like to use frequently	3.6 (3-4)		
2. Unnecessarily complex	3.5 (3-4)		
3. Easy to use	2.9 (0-4)		
4. Need technical support to use	3.1 (2-4)		
5. Components well integrated	3.5 (3-4)		
6. Too much inconsistency	3.8 (3-4)		
7. People would learn to use quickly	2.8 (2-4)		
8. Cumbersome to use	3.6 (3-4)		
9. Felt confident using	3.1 (2-4)		
10. Need to learn a lot before using	3.0 (1-4)		

Note: Items paraphrased; individual item scores converted to 0-4 scale, higher scores indicate more favorable rating; see Appendix 3.2 for complete item wording and scoring information.

Resource Refinement

Based on interviews (N=8) and asynchronous document review from one participant and three expert mentors, I identified numerous immediate actions for the resource guide revision, as well as items for future consideration (see Table 8).

Table 8

Resource revision decisions

	Content revision	**Format revision**	**Future considerations (no change made)**
Overall			Make into a living resource that can be updated, refined over time; Hyperlink between different sections; Extend to other users beyond implementation researchers (e.g., implementation practitioners, researchers from other fields); Use call out boxes to break up dense text; Consider how this resource relates to various methods for selecting and designing implementation strategies (e.g., Implementation Mapping)
Introduction		Break up large chunks of text	
Section 1: Terms & definitions	Add inequities; revised equitable implementation (*based on dissertation work, not necessarily user recommendation)	Bold/emphasize equity as a process	Add structural racism; Add cultural competency vs. cultural humility; Add a column with examples of how these terms are operationalized; Consider "core" terms in Table 1, supplemental glossary of additional terms
Section 1: Health equity literature & IS resources	Include brief description of each article add positionality & reflexivity papers; Add University of Colorado Stakeholder Engagement Navigator; Clarify types of resources included, where people can find common health equity IS papers	Include article hyperlinks	Indicate which papers are written by non-white authors; Add resources on marginalized populations (how to define who is marginalized, who is most vulnerable within marginalized communities; guidance for finding, connecting and engaging with marginalized communities; approaches for prioritizing, centering marginalized perspectives; More information on measurement of equity indicators; add resources on mechanisms, or consider how the guide might integrate with available mechanisms resources; Add 3rd edition of D&I book
Section 2: strategy information	Liked figure, definitely keep; Revise final paragraph of strategies overview to clarify community and recipient involvement in selecting implementation strategies; Make explanation of strategy components more explicit;		Revise figure to incorporate new strategy specification components (modality, service and health outcomes, measurement); Consider how to encourage users to consider mechanisms - through prompts or as a standalone component;

	Add a couple of references for strategy selection & design method articles		Add more detail about content & differences between implementation strategy taxonomies
Section 2: instructions & user tips	Add user tip that activity may take multiple sessions; Add user tip that brainstorming can be all at once, modular, or stepwise Add user tip around checking to see whether & how research team has diverse representation, identify ways to include more diverse members, preferably who identify with communities of research interest; Add user tip to "define your groups" - what characteristics are subject to marginalization, be explicit; Add user tip on using this as a reflexive exercise over multiple time points; Add user tip around generating team norms, values that promote psychological safety	Move positionality from user tips to overall instructions	
Section 2: brainstorming part 1	Integrate examples of structural racism into prompts; Give examples of equity-relevant determinants; Add what has been done before, what worked/didn't work to first prompt; Add who might be left out to who is impacted prompt	Reorder prompts so that assumptions & key events are first	Include greater emphasis on tracking & measuring equity metrics Add "What equity-focused indicators and metrics will be included to measure progress? How will you ensure adequate power to make inference regarding effects on equity."
Section 2: brainstorming part 2	Integrate examples of structural racism into prompts; Reiterate use of taxonomies in naming strategies; Add considerations about reimbursement of community members/non-researcher partners; Refine measurement prompts on equity-focused indicators and metrics to measure progress; Add question about match between actor & population of interest; Add accessible language to modality prompt; Clarify what is meant by an existing vs. new implementation strategy Add ""delivery approach"" to clarify what is meant by modality"		
Section 3: use example	Add space for intervention info (e.g., EBI, target population, setting) Add language & English proficiency to modality responses & strategy component revision		Narrative summary of who used, when, and how, especially how users decided on priorities and tradeoffs

Discussion

This project sought to fill a gap in IS by creating a new resource that can guide the consideration of equity in the design, tailoring, and specification of implementation strategies. I tested a preliminary version of this resource with a sample of US-based implementation researchers who were diverse in terms of their racial/ethnic identities, geographic location, disciplinary backgrounds, and settings and populations with whom they conduct research. This resource expands upon previous work, such as the ASPIRE framework[84] and the ISC3 Health Equity Toolkit[277] by focusing specifically on integrating equity within implementation strategies and offering a comprehensive set of brainstorming prompts organized by implementation strategy design elements (e.g., actor, action, action target) to allow for detailed reporting per existing recommendations.[85] This resource guide could be used in conjunction with these existing tools, and possibly integrated within other existing toolkits or resources. Next steps for this work include meeting with the developers of existing IS resources to determine how these resources could be used in conjunction with or integrated with one another.

Overall, participants had positive perceptions of the resource and indicated it addressed a need within the field of IS. Participants suggested several ways this resource could be used, including as educational material, a prospective planning tool, and a concurrent and retrospective reflection and tracking tool. Participants provided feedback on components they liked or found useful, including the health equity terms and definitions, implementation strategy specification figure, user tips, table of brainstorming prompts, and an example application of the brainstorming prompts. Users offered high-level and specific feedback on revisions, including additional literature and resources to add, suggestions for clarifying and simplifying wording, and prompts to include in the brainstorming activity. Participants also offered reflections on how

they might use the resource guide, providing content for user-generated tips and reflections. Although the participant sample included researchers whose main health interests are chronic disease related, and the current training strategy case example is in the context of cancer control, the resource guide is designed to be generalizable across implementation contexts and topics. The content is source from a broad array of health and social science disciplines and uses generalizable rather than setting, population or disease-specific language (with the exception of the use case example).

The resource guide can be paired with existing approaches for selecting and designing implementation strategies, including implementation mapping, concept mapping, or group model building.[251,278,279] For example, the first task of implementation mapping involved conducting an implementation needs assessment.[278] The health-equity related literature from the resource's bibliography includes measures and frameworks that could be applied to assess equity relevant determinants (e.g., community assets, public policies that could be leveraged to provide funding and resources, existing discriminatory structures or practices in the implementing setting that require dismantling to promote equitable implementation processes and intervention delivery). The second task of implementation mapping involves identifying change objectives and implementation outcomes. The strategy brainstorming prompts could help users ensure equity is a central focus of these objectives as outcomes (e.g., ensuring objectives align with the priorities of marginalized implementers and intervention recipients). In implementation mapping task 3, the brainstorming activity can guide users in operationalizing equity in the selected implementation strategies (e.g., power sharing with community partners, integrating accountability structures to ensure resource sharing according to need).

Participants offered reflections on their experiences conducting equity-focused implementation research. Themes regarding challenges and needs for equity focused IS align with gaps and opportunities highlighted in the IS literature. Participants acknowledged equity is often implied in implementation research in the populations and settings for whom we attempt to implement EBIs and the distal outcomes we seek to influence with implementation (e.g., reduce inequities experienced by marginalized populations), however the equity focused actions and goals we pursue are often not explicit.[75,76] Participants noted a need for applied examples of how to integrate equity into implementation research,[84] as currently there is more conceptual literature than empirical examples. Participants also expressed a need for other specific types of resources and trainings, including guidance on identifying, recruiting, and engaging with diverse populations, equity-focused measures, and guidance on how to make decisions when tradeoffs are required (e.g., deciding which design option to use for an implementation strategy). This resource collates existing materials from public health, IS, and other disciplines that can help address these needs, though further development of these materials is needed.[70,86,280]

This study focused on preliminary testing to gather input from participants who represented the intended user – early career implementation researchers with foundational IS knowledge who have varying degrees of experience in IS and health equity. Many of the suggestions were integrated into the final version of the resource. Changes that were not integrated were tracked as future opportunities. Reasons for not integrating user feedback included formatting changes that would be implemented in future versions (the primary focus of testing was the resource content), recommendations were beyond the scope of this implementation strategies focused resource (e.g., content related to measurement, specific research approaches such as Community Based Participatory Research), inconsistency in

recommendations across participants, or changes may warrant further consultation with research and practice experts. There is a need to balance comprehensiveness and detail with simplicity and pragmatism in order to make tools such as this resource guide usable.[281] Further work is needed to determine the optimal ways to balance participant preferences for information and parsimony in this resource. For example, users suggested terms to add to the health equity terms and definitions table; these could be integrated into a more comprehensive glossary and added as a supplement to this resource, rather than amassing an unwieldy list within the section one table.

Although this study sought to generate case examples of how users applied the brainstorming prompts from a strategy in their own work, the user testing interviews provided insufficient opportunity to generate use case examples due to time constraints. Participants acknowledged the complex, multifaceted nature of integrating equity into implementation strategy design choices and noted the need for team collaboration and consideration of various inputs (e.g., local data, existing literature, team discussion) to meaningfully engage in this activity. Further work is needed to generate user examples and should incorporate team-based applications of this resource rather than an individual researcher's perspective. This first version of the resource is researcher focused, which may limit its relevance and utility for implementation practitioners. For example, practitioners may need more introduction to IS language, as found in a previous study of implementation strategy tracking.[282] Future testing should also elicit feedback from different kinds of users (e.g., researchers, practitioners, community partners) doing work in other health-related areas beyond chronic disease to understand the extent to which this resource is applicable to a broad array of users, or how this can be refined for improved usability for different user groups.

This project generated an initial prototype of a resource that integrates learnings from health equity, public health, social sciences, and IS literature. The revised resource version is not a final, publishable product. Instead, more robust testing and revision in applied cases is warranted. Several participants indicated a desire to use the resource in ongoing partnered implementation research. This offers an opportunity to pilot test the resource as a planning and tracking guide to determine how transdisciplinary research teams and non-academic collaborators approach the brainstorming activity and how the resulting strategies are integrated into implementation projects. These applied examples are likely to identify challenges to engaging with the resource content and interactive brainstorming activity and user suggestions for improved usability.[270] Future testing should engage researchers in other health areas beyond chronic disease (e.g., mental health, infectious disease), as well as various implementation settings (e.g., clinical, community) and focal interventions (e.g., individual behavior change, multilevel policy, systems, and environment interventions). Given participant emphasis on the need for applied examples to look to for guidance, development of a variety of robust use cases and user tips will be essential to arrive at a usable, useful product.

The resource guide offers a starting place for researchers and their teams to intentionally integrate health equity into their implementation strategies. Although appropriate for this type of preliminary user testing,[266] this resource was tested among a small sample and findings may not be generalizable. Next steps in the development of this resource include seeking feedback from other experts (research and non-research) and pilot testing this resource within interdisciplinary teams conducting equity focused implementation research. The long-term goal of this work is to make this guide an open access, interactive web-based resource that can be updated over time as new literature and empirical examples become available.

Chapter 4: Assessing adaptations made to the HEALTH intervention and their equity implications

Introduction

Of the US subpopulations at risk of developing obesity and obesity-related chronic diseases, women in early adulthood are particularly susceptible to unhealthy weight gain, especially Black and Latina women and women from low socioeconomic backgrounds.[16,32] Unhealthy weight gain during pregnancy can have adverse consequences for moms and children past the pregnancy and postpartum period.[16,33] The Diabetes Prevention Program (DPP) is an EBI that can help reduce unhealthy weight gain and promote healthy behaviors to reduce the risk of developing type 2 diabetes.[283,284] To address some of the challenges to engaging with the DPP (e.g., required number of in-person sessions, cultural relevance, language of materials), numerous adaptations have been made to tailor the DPP to particular audiences.[285]

Bringing interventions to participants helps to overcome challenges to accessing health promotion programs. One such approach is the Healthy Eating and Active Living Taught at Home (HEALTH) intervention, which integrates content from the DPP into the Parents as Teachers home visiting program.[286] Parents As Teachers (PAT) provides home visiting services to families with young children and is an effective way to reach women who may otherwise not be able to participate in health promotion interventions.[287] A trial is underway to assess the implementation of HEALTH within PAT and to evaluate the effectiveness of HEALTH in promoting healthy behaviors and weight among mothers with overweight or obesity.[287]

As with many EBIs, it is likely that HEALTH is modified by the parent educators or PAT sites delivering the intervention. These modifications could potentially enhance or dampen the intervention's fit with recipient or implementer needs. Learning from changes made to HEALTH and how it is delivered can help the intervention developers make adaptations to the intervention

that could improve its alignment with PAT programming or recipient needs and preferences. As Alvidrez and colleagues note, many adaptations are researcher driven; it is less common to characterize and evaluate adaptations of EBIs made in the field by community organizations and practitioners.[288] The benefits or detrimental effects of such ad hoc modifications are often unknown, and present an important opportunity for learning from ongoing practice.[288] Specific attention to health equity should be paid to identifying and assessing adaptations to determine if they are made in a way that promotes equity or if they may inadvertently exacerbate inequities.

This study adds to the parent R01 trial (PI: Dr. Tabak) by applying a health equity lens to explore adaptations made to HEALTH by parent educators and considering potential implications for health equity (i.e., assessing the potential of adaptations to promote equitable delivery and outcomes or the potential of adaptations to hinder health equity). This qualitative study addresses the following aim:

Aim 3: Apply a health equity lens to assess adaptations made to an evidence-based chronic disease prevention intervention (HEALTH).

Methods

This descriptive qualitative study integrates with the parent R01's implementation evaluation and adds to it by incorporating a health equity lens to assessing adaptations made to HEALTH. The use of the phrase "equity lens" is intentional, as the parent R01 is an example of research in which a focus on equity is implicit (e.g., embedding HEALTH within an established home visiting program removes access barriers associated with out of home settings, delivery to participants in a language other than English (Spanish)), but did not base the study protocol or goals on conceptual guidance and methods from the health equity literature (personal communication with PI Tabak). The application of an "equity lens" allows us to elicit learnings

from the study with equity in mind, specifically looking towards potential equity implications of the HEALTH intervention and how it is delivered. This study was approved by the Washington University Institutional Review Board (IRB # 201810157).

HEALTH Intervention and parent R01 study

HEALTH in an EBI that integrates physical activity and healthy eating content from the DPP into the PAT curriculum. The HEALTH research team developed the HEALTH intervention and the parent educator training in partnership with PAT.[287] PAT is a community-based organization with affiliate sites across the US that offers services to promote family wellbeing and healthy child development for parents and caregivers from the prenatal period through kindergarten.[289,290] Home visiting professionals (Parent Educators) deliver educational curriculum and resources to parents focused on parent-child interactions, development-centered parenting, and family wellbeing.

The foundational PAT curriculum includes general health information (e.g., accident prevention), but does not cover obesity-related lifestyle changes for mothers of young children and families.[286] HEALTH expands the standard PAT curriculum to address eating behaviors (e.g., caloric intake, sugar sweetened beverage intake, healthy meal planning, food cues) and physical activity (e.g., integrating physical activity, problem solving barriers to being active, activity goal setting).[286] The HEALTH curriculum is delivered in conjunction with the standard PAT curriculum over 24 months. HEALTH includes eight core topics intended to be delivered in each home visit over the first four to six months of the program, as well as a menu of 15 maintenance topics to be delivered at least monthly during the remainder of the intervention.[287] HEALTH includes parent educator facing materials (e.g., information sheets with talking points and instructions, materials for delivering hands-on activities) and educational handouts for moms,

available in English and Spanish. Although PAT has fidelity and quality standards for the foundational curriculum, the PAT program and the HEALTH intervention are inherently dynamic and flexible so that they can be tailored to meet individual family needs.[289] For example, parent educators are encouraged to align topic selection with family needs and preferences and can tailor the order in which topics are delivered. This is a unique aspect of PAT and HEALTH, compared to manualized EBIs with more stringent fidelity criteria (e.g., Parent Management Training - the Oregon Model (PMTO®),[291] Cognitive Processing Therapy (CPT)[292]).

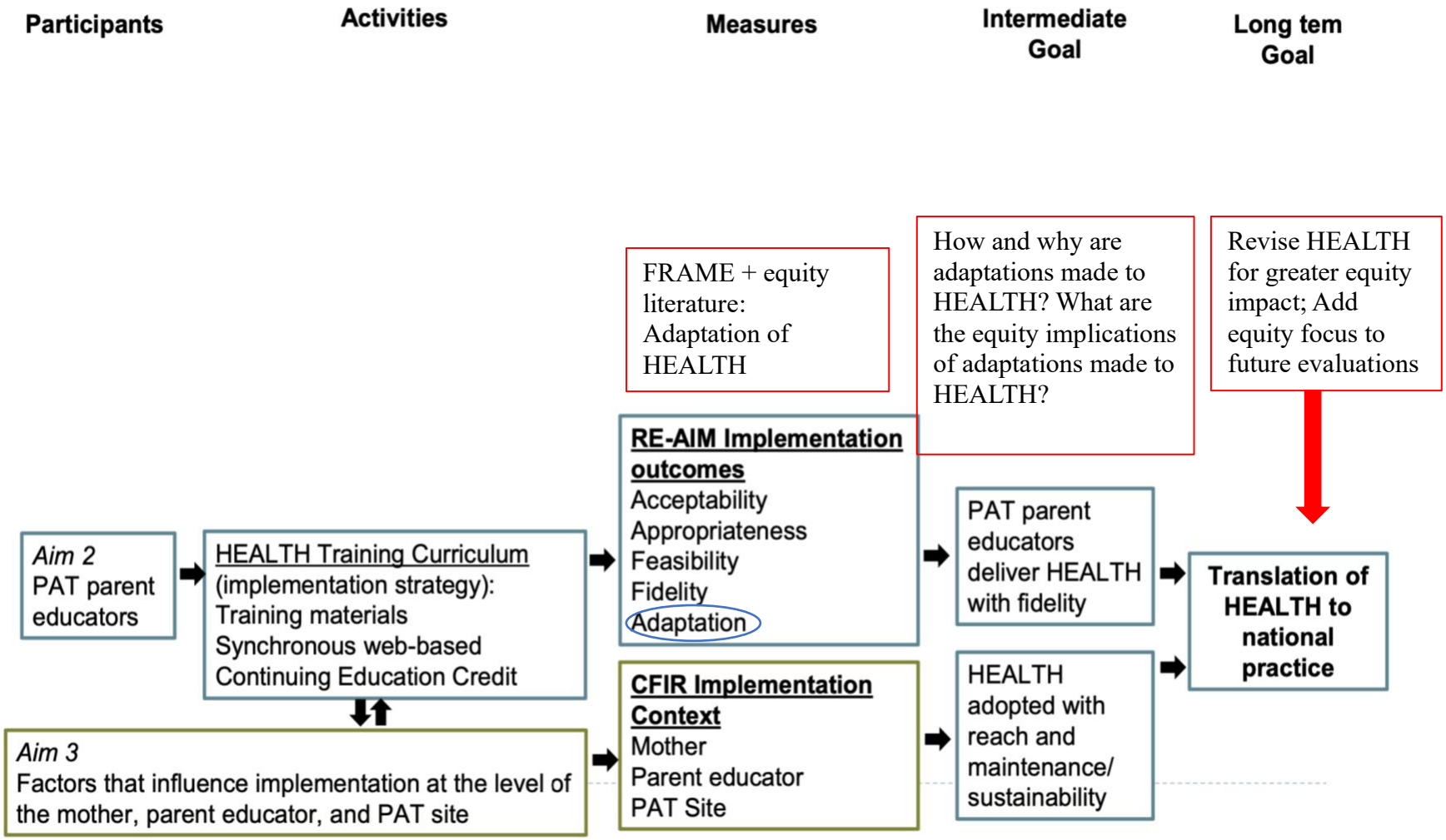
The parent R01 is a hybrid implementation-effectiveness pragmatic cluster randomized controlled trial. PAT sites were randomized to standard PAT (control; k=14) or PAT with HEALH (intervention; k=14). Parent educators from intervention sites were trained to deliver HEALTH to mothers with overweight or obesity. The protocol for this study was developed in 2017 and the project period began in 2018, thus the guiding implementation literature available at that time. The parent R01 applied the 2009 version of the Consolidated Framework for Implementation Research (CFIR)[293] to assess implementation determinants; The Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) Framework to guide assessment of effectiveness and implementation outcomes, including acceptability, appropriateness, feasibility, and fidelity;[287] and 2013 Framework for Reporting Adaptations and Modifications to Evidence-Based Interventions (FRAME),[294] to guide the assessment of adaptations.

Exploratory descriptive qualitative study

The current qualitative study enhances Aim 2 of the parent R01 by adding an explicit focus on SDOH as determinants related to HEALTH's delivery and adaptation, and exploring potential equity implications of enacted or recommended adaptations to HEALTH (see Figure 2 below).

Figure 2

HEALTH Trial logic model with equity-focused adaptation assessment added



Note: Figure adapted from Tabak et al., 2019 HEALTH protocol article.[287] Red outlined boxes and arrows indicate added elements.

Adaptations are defined broadly in this study and are inclusive of any tailoring or adjustments made to participant and family needs (e.g., condensing or reordering sessions) or modifications to the content or context of curriculum delivery (e.g., integrating content not in the HEALTH curriculum, conducting visits outside the participant home).

Sampling and recruitment

PAT parent educators who delivered the HEALTH intervention and who were still at their PAT site during data collection were eligible to participate in interviews. I identified parent educators through the R01's parent educator survey data and visit records (i.e., recorded completion of HEALTH visits with intervention participants). This qualitative study used a data-informed, non-random, purposive sampling to achieve variation in parent educator demographic characteristics (e.g., race/ethnicity, years of experience), individual-level determinants (e.g., high vs. low intent to implement HEALTH, attitudes towards HEALTH), and site characteristics and number of sites represented (e.g., geographic location, site-level motivation to implement HEALTH). I generated a list of parent educator study ID numbers, which a parent R01 study team member matched to identifying information. After confirming the parent educator was still at their PAT site at the time of recruitment, the HEALTH team member sent up to three recruitment emails to eligible parent educators. Upon expressing interest in participation, I emailed parent educators a study information sheet (formal written consent was already obtained in the parent R01 study, thus was not required for interviews) and documented parent educator enrollment in the qualitative interview study. The parent R01 provided a $30 gift card for interview participation.

Data Collection and Measures

I used data from the parent R01 parent educator survey to inform recruitment and characterize the interview sample. Demographic information included parent educator age, race/ethnicity, level of education, and years working at a parent educator and years at their current site. Implementation measures included a 4-item scale based on CFIR assessing parent education awareness of HEALTH, a 4-item scale based on RE-AIM assessing HEALTH's perceived appeal (a measure of acceptability) among parent educators, a 3-item scale based on CFIR assessing parent educator intent to use HEALTH with families, all of which were scored on a 1-4 Likert scale with higher scores indicating more favorable ratings. As a site level indicator, I included a single item based on RE-AIM that assessed parent educator perceptions of their site's motivation to implement HEALTH, scored on a 1-7 scale with 7 indicating highest motivation.

I collected data via semi-structured interviews with parent educators. The target sample size was 15 (approximately 10% of parent educators in the baseline dataset) as this was expected to be sufficient in achieving saturation for major types of adaptations made to the content or delivery of the HEALTH curriculum (e.g., reordering sections, adding culturally relevant examples, virtual vs. in person delivery modalities), resulting in sufficient data saturation.[271]

The original interview guide was informed by the Consolidated Framework for Implementation Research and [293] RE-AIM[295] as these frameworks were selected by the R01 study team to inform measurement and analyses. I collaborated with the R01 PI and several study team members to refine the interview guide and build out the questions regarding adaptations using the updated 2019 version of FRAME.[90] Although all interviews were conducted in English, two Spanish-speaking parent R01 team members translated the interview guide into Spanish in the event participating parent educators preferred Spanish. I conducted

interviews via Zoom; interviews were 35-65 minutes in duration. Although SDOH-specific prompts were not added to the final interview guide, I probed during interviews to elicit parent educator perspectives on mom and family SDOH and how this influenced how they delivered HEALTH and participant engagement in HEALTH. For example, asking if the parent educator felt the need to pair HEALTH with external content or resources to meet the needs of low-income families, families experiencing food insecurity, or low literacy or limited English proficiency participants. I reviewed the audio recording of the interviews alongside the automated Zoom transcript to clean the transcripts for accuracy (e.g., correct terms).

Data Analysis

I led coding and analysis of the interview data, with assistance from a doctoral research assistant (AP). This study used a directed content analysis approach in which I developed a priori codes using constructs from existing frameworks and inductively added and refined codes as themes emerged from the interview data.[296,297] I developed an initial codebook based on existing frameworks (CFIR,[298] FRAME,[90] SDOH frameworks[8,226]) and piloted the codebook with the research assistant, and R01 PI on two randomly selected transcripts. The team met to revise the codebook and generate consensus.

I used constructs from the Healthy People 2030[8] and Kaiser Family Foundation SDOH[226] frameworks to expand the CFIR outer setting constructs to code SDOH (e.g., food security, local food environments, neighborhood safety, participant education, literacy, and language proficiency). Guided by the SDOH frameworks,[8,226] literature informing the conceptualization of health equity in this dissertation (see chapter 1),[39,43,46,47,53] and equity-related brainstorming prompts (e.g., consideration of unintended consequences) from the equity focused implementation strategy resource described in chapter 3, I expanded FRAME to include

additional equity-related constructs. Appendix 4.2 illustrates modifications to FRAME (addition of new SDOH and equity constructs) and how it was operationalized to code adaptations (study-specific operationalizations of construct definitions, constructs not used in coding). Several revisions to the FRAME codebook (e.g., addition of "unplanned" to characterize if an adaptation was planned, crisis or emergent situation as a recipient-level reason for adaptation) appear in the version in the recently published 3rd edition of the Dissemination and Implementation Research in Health book, which was not available at the time of coding.

Upon finalizing the codebook, the research assistant and I independently coded transcripts using NVivo (version 14); we met regularly to compare coding and generate consensus. To conduct more detailed coding adaptations according to the equity-expanded FRAME (Appendix 4.2), I pulled code reports from NVivo for all enacted and suggested adaptations. I also created code matrices in NVivo to examine co-occurring SDOH and adaptation codes. I used an Excel coding form, organized by the equity-expanded FRAME, to characterize enacted and suggested adaptations and reviewed this coding with the R01 PI. The potential equity implications of the adaptations (i.e., potential to promote or diminish equity, unlikely to impact equity) emerged directly from participants (e.g., stated goal of adaptation was to promote equitable engagement across quality of neighborhood environments) or were coder ratings (i.e., subjective assessment of potential positive and negative unintended consequences). To understand the frequency of adaptations, the most common types of adaptations, and the proportion of adaptations made to address participant and family SDOH compared to other reasons (e.g., parent educator preferences, pragmatic needs), I chose to transform qualitative data into quantitative data.[299] This will allow for comparisons to adaptation data from parent educator surveys and future mixed methods analyses (see discussion section).

I used Stata to analyze the demographic data from the parent educator survey prior to interviews to inform the identification of parent educators for maximum variation sampling. To summarize the characteristics of the interview participants, I re-ran analyses of the interview participant data. I generated summary statistics (frequencies, proportions, means, ranges). To inform the sampling approach and assess the extent to which our sampling approach achieved variation on variables of interest (described above), I calculated means for continuous variables and created categorical variables to report varying levels (e.g., determine low vs. moderate. vs. high favorability on implementation scales). When scales were reported to two decimal places (e.g., .25, .67) in the survey dataset, I preserved this structure to allow for accurate scale groupings (rather than rounding to one significant digit). Given the small sample size for the interview dataset, it was not appropriate to calculate standard deviations for continuous variables or to conduct any significance testing within this sample.

Results

Sample characteristics

We recruited 30 parent educators across 11 sites. One email was undeliverable and 15 parent educators did not respond. Fourteen parent educators from 9 sites participated in interviews. Table 9 summarizes the characteristics of participating parent educators. All parent educators were women, whose average age was 48.6 (range 31-70). Three parent educators identified as Black and 11 identified as white, 2 of whom identified as Hispanic/Latina. Participants had an average of 10.5 years of experience working as a parent educator at the time of the interview (median = 6.5 years, range = 3-24). Most parent educators earned a bachelor's degree or higher. Most parent educators rated having at least moderate awareness of HEALTH (mean = 2.9) and rated HEALTH as having moderate to high appeal (mean = 3.4). There was

little variation in the site motivation to implement HEALTH (mean = 6.6, range 6-7). The nine sites represented in the sample were geographically diverse though fewer sites in Northeastern and Western states were represented than Midwest and Southern sites.

Table 9

Participant characteristics (N=14)

Characteristic	**Frequency (%) or Mean (range)**
Gender	
Female	14 (100%)
Age (Mean)	48.6 (31-70)
Race/Ethnicity	
Black	3 (21.4%)
Hispanic/Latina White	2 (14.3%)
White	9 (64.3%)
Years as parent educator	10.5 (3-24)
<10	8 (57.1%)
11-20	3 (21.4%)
>20	3 (21.4%)
Level of Education	
Some college	3 (21.4%)
Bachelor's degree	9 (64.3%)
Graduate degree	2 (14.3%)
Geographic region	
Midwest	4 (28.6%)
Northeast	2 (14.3%)
South	6 (42.8%)
West	2 (14.3%)
Awareness of HEALTH (1-4 scale)	2.9 (2.25-3.25)
Low (<2.5)	2 (14.3%)
Moderate (2.5-3)	8 (57.1%)
High (>3)	4 (28.6%)
HEALTH's Appeal	3.4 (2-4)
Low (<2.5)	2 (14.3%)
Moderate (2.5-3)	3 (21.4%)
High (>3)	9 (64.3%)
Intent to use HEALTH	3.3 (2-4)
Low (<2.67)	1 (7.2%)
Moderate (2.67-3)	6 (42.8%)
High (>3)	7 (50.0%)
Site motivation to implement HEALTH	6.6 (6-7)

Adaptations made to HEALTH

Parent Educators reported a total of 19 different types of adaptations to HEALTH (Table 10). The most common types of content adaptations were selecting topics based on participant preferences (i.e., reordering modules), condensing/shortening the delivery of HEALTH (e.g., brief overview with minimal discussion, provide handout without discussion), integrating related content from external sources (e.g., healthy recipes from CDC webpages or local extension offices), and repeating content (e.g., activities, reviewing information) periodically throughout the intervention period. Conducting video or phone visits was the most common type of context (format and setting) modification; this was mostly due to COVID-19, though parent educators noted other reasons, such as their own chronic health conditions or families' housing situations. Several parent educators also described incorporating walks into home visits (e.g., around the perimeter of the participant's home, at a nearby park) and conducting visits at a location outside the participant's home (e.g., at a library, another family member's home).

Most adaptations were likely fidelity consistent; only three were likely fidelity inconsistent. Fidelity inconsistent modifications were reported less frequently and were more obvious to discern than the extent of alignment with fidelity for adaptations rated as likely fidelity consistent. A few parent educators indicated they did not use the activities from the HEALTH curriculum, often as a systematic, conscious choice rather than an ad hoc adjustment due to competing demands or emergent family needs. There were several instances in which parent educators addressed topics not in the HEALTH curriculum (e.g., recommend avoiding certain food dyes because the parent educator believed these cause ADHD, recommend moms eat more protein). One parent educator indicated other staff discontinued delivering HEALTH

because they were uncomfortable with discussing weight due to their perceptions of their own body and health status.

Most adaptations were made to increase the intervention's fit with recipients and to improve recipient satisfaction. The rationale for these changes often involved the professional judgment of parent educators (i.e., recognizing family needs and preferences) and perceptions of HEALTH (e.g., extent to which parent educators felt HEALTH content was relevant to the participating mom or family). Nearly all adaptations were related to participating mom and family SDOH. Parent educators described many kinds of emergent needs such as a parent becoming sick or injured and being unable to work, divorce and household instability, housing insecurity, etc. As one parent educator indicated, if a mom "*was in the midst of a crisis, or really needed to talk about something else… I would still provide them with the handouts, but not necessarily go over them… if they got kicked out of their house and they needed to talk about shelters or jobs or whatever, that was more important in that situation for me to discuss than saying, 'Oh, by the way, we need to talk about [HEALTH]'" 27.09.* Most parent educators pointed to persistent social needs (e.g., food insecurity, limited transportation, neighborhood safety, lack of social support, limited literacy) as reasons for adjusting how they delivered HEALTH. As an example, one parent educator recounted her experience working with a mom who lived in a rural area who *"didn't have a car and they didn't have access to as many things… I found myself looking for places that she could go walking with a baby and a stroller. That's hard when you can't do it in your neighborhood, and… you have to join the Y… I talked about the parks and safety of the parks, and I would just share the ones that I thought were nice and things like that" 23.09.*

Table 10

Adaptations made to HEALTH

Adaptation Description	Change planned	Who Decided	Level of delivery	Content mod	Context mod	Goal	Reason	Potential Equity Implications	Exemplar Quote
Rated as Likely Fidelity Consistent (N=16)									
8- Select topics based on participant preference	Planned/ Reactive	Individual PE; Recipient	Individual	Reorder modules	NA	Improve fit w/ recipient; Improve satisfaction; Address cultural factors	P: PE judgment, Perception of int R: Preference, Existing knowledge, motivation & readiness, Access to resources, Cultural norm	(+) meet moms where they're at regarding interest, preferences; better meet family needs; communicates prioritization of & responsiveness to family needs	*I did switch some [topics]. I did a couple times... jump ahead a little bit... because that's the question they were asking me... I didn't think I was actually supposed to do that... But... I don't really want to say to someone, 'okay, that's our seventeenth business, so you have to wait.' 21.01*
8- Video or phone visits	Planned/ Reactive Planned/ Proactive	Site Leaders; Individual PE; Recipient	Individual; Site; Individual PE	NA	Format; Setting	Improve feasibility; Increase reach; Increase retention	S: Large scale event O: Service structure; Location/ accessibility; Neighborhood environment P: Preference R: Access to resources, Prefer, Crisis, Housing	(+) engage & retain families & staff who may be unable to engage in in-person visits (e.g., due to COVID-19, PE or family health, family housing situation, etc.) (-) if moms don't have reliable remote options (e.g., working phone, internet enabled device), if quality of program delivery differs by modality	*Virtual visits might consist of being on the phone… versus video. Video conference, you can share screen with the activity on there and go through... I... mail out the handout... [it takes] additional prep time... I think it's important that there they have the materials with them... this is more beneficial for both parties...if they have the information on the curriculum in front of them. 37.01*
7- Condensed delivery of HEALTH (e.g., brief overview with	Planned/ Reactive Un-planned	Individual PE; Recipient	Individual	Shorten/ condense	NA	Improve fit w/ recipient; Address cultural factors;	O: Time, Competing demand	(+) if condensing allows time to address other priorities or emergent needs, increase retention	*One family, they don't eat out... it's not in their culture… the topics of like eating out and how to eat out... didn't feel relevant... I*

minimal discussion)						Improve feasibility	P: PE judgment, Perception of int, Preference R: Cultural norm, Existing knowledge, crisis	(-) if PE condenses due to inaccurate judgment of family need, gatekeeps info delivered	*would... not deliver all of the information because it wasn't pertinent to them. 27.09*
7- Integrate related content from external sources (e.g., info from CDC, community organization)	Planned/ Reactive Planned/ Proactive	Individual PE; Recipient; PE Team	Individual	Integrating other content	NA	Improve fit w/ recipient; Address cultural factors	O: Mission P: PE Judgment, Perception of int, Previous training & skills, Cultural norms, competency R: Access to resources, Cultural norms, Comorbidity, Income/finances Food security	(+) improve the fit of content (e.g., recipes, PA options) w/ dietary needs, health conditions, availability and affordability of healthy foods, cultural norms, age, etc.	*Finding new recipes that are something that she would like, something that was quick. Something that was... healthy for... diabetes, but also something that was healthy for her and her baby… we found like quick snacks from Dollar Tree... she incorporated some things that her doctor... or nutritionist... recommended. 32.04*
7- Repeat content (e.g., information, activity)	Planned/ Reactive Planned/ Proactive	Individual PE; Recipient	Individual	Repeat element/ module	NA	Increase satisfaction; Improve fit w/ recipient; Improve effectiveness	P: PE judgment, Perception of int R: Cognitive capacity, Existing knowledge, motivation & readiness, Prefer	(+) meet moms where they're at to improve retention or comprehension of info that may be complex, was delivered at a time when mom could not be fully engaged, or is a priority for mom	*There were some where I would just repeat the same activity… [if] it seems uncomfortable or just not that simple, then we would review it the next time… as parents... we're so busy, it's so stressful at times, so repetition and reminders and refreshers are always good. 11.03*
5- Incorporate walks into visits	Planned/ Reactive	Individual PE; Recipient	Individual	NA	Setting	Increase satisfaction; Improve effectiveness	O: Neighborhood environment	(+) increase PA for moms who may otherwise have limited opportunity to be active	*It depends.. if I'm in… a very nice neighborhood with access to a lot of things, there's no fear, you know,*

							P: PE judgment, Perception of int R: Access to resources, Social support, Preference, Motivation	(e.g., due to lack of childcare) (-) walking visits not feasible or safe for all moms (e.g., rurality, access to parks, unsafe neighborhood); alternative activities needed for equitable PA promotion	*walking down the street. Whereas there are other families that… I don't think that we would be as comfortable walking around. 27.09*
5- Spread topic over multiple concurrent visits	Planned/ Reactive	Individual PE; Recipient	Individual; Cohort	Break up content over multiple sessions	NA	Increase satisfaction; Improve fit w/ recipient; Improve feasibility	O: Time, Competing demand P: PE judgment, Perception of int, Preference R: Cognitive capacity, Existing knowledge, motivation & readiness, Preference	(+) if spreading makes info easier to comprehend, or if allows time to address other priorities or emergent needs	*Certain [topics], not just because they took a little more in-depth knowledge, but the parents enjoyed it so much or wanted to really grasp what's going on… for example, healthy snacks… they could actually get things from their cabinets, and you can kinda go over reading things... it kept them more engaged. Like, 'I'm not gonna have to do this in a certain amount of time. Or like it's okay if... I need to think on this, or I need to come back to this.' I think it opens the door to really make the information stick or solidify the information. 37.01*
Adaptation Description	**Change planned**	**Who Decided**	**Level of delivery**	**Content mod**	**Context mod**	**Goal**	**Reason**	**Potential Equity Implications**	**Exemplar Quote**
5- Tailor framing of HEALTH (e.g.,	Planned/ Reactive	Individual PE; Recipient	Individual	Tailor/ tweak/ refine	NA	Improve fit w/ recipient;	P: PE Judgment, Perception of int, Previous training & skills, Cultural	(+) improve engagement if framing makes HEALTH more approachable, relevant	*We looked at... what could happen beyond this program. A lot of times... teens or young adults, they look at*

importance of content) to participant						Address cultural factors	norms, competency R: Cognitive capacity, Literacy & education level, Existing knowledge, motivation & readiness	to certain groups (e.g., young moms, various cultural identities)	*what happens today. And so a lot of times they are emotional learners... this particular participant, I was letting her know that I had all confidence that she could achieve... we would incorporate, you know, little captions or reactions to different things that that may have happened. 32.04*
3- Engage with participants outside of visit (e.g., text, Facebook)	Planned/ Reactive Planned/ Proactive	Individual PE; Recipient	Individual	Loosen structure	Format Setting	Increase retention; Increase satisfaction; Improve fit w/ recipient	O: Social context P: PE Judgment, Perception of int, Previous training & skills, Cultural norms, competency R: Preference, Existing knowledge, motivation & readiness	(+) if engaging w/ mom via preferred communication platform outside of visit enhances perceived support, motivation, responsiveness to participant needs (-) if option is not made available to all moms; may add burden to PEs (e.g., unpaid time outside visit)	*I know when Mom was not eating breakfast, so we were saying 'here's my breakfast, Here's my breakfast.' You know, I had several people oh just sending each other pictures of their breakfast. 21.01*
3- Provide food or other resources to participants	Planned/ Reactive	Individual PE; PE team; Site leaders	Individual; Target int group	Integrating other content	NA	Increase satisfaction	S: Large scale event O: Mission, Social context, Neighborhood environment P: PE Judgment R: Crisis, Food security, Other: dietary needs	(+) support food security of families (e.g., during COVID-19 pandemic, families who have limited access to fresh produce)	*During COVID we were providing different food... there's a lot of different resources in the last couple of years for that type of thing. So just helping with that nutrition piece. 25.07*

Adaptation Description	Change planned	Who Decided	Level of delivery	Content mod	Context mod	Goal	Reason	Potential Equity Implications	Exemplar Quote
3- Skip HEALTH entirely during a visit	Un-Planned Planned/ Reactive	Individual PE; Recipient	Individual	Drift followed by a return to protocol	NA	Increase retention; Improve fit w/ recipient; Improve feasibility	O: Competing demand, Time, Mission P: PE Judgment, Perception of int R: Crisis, Preference	(+) if pausing HEALTH to address emergent needs promotes retention of families w/ social needs, allows for delivery when mom is better able to engage & retain info (-) if PE condenses due to inaccurate judgment of family need, PE lack of interest gatekeeps info delivered	*I would kind of go between [standard PAT] curriculum and go to [HEALTH] just because... I didn't want my parents to feel like I was harping on fitness, or food, or weight, or anything like that. And I felt like sometimes if I would slide it a different topic in there, not that I didn't follow up with them on what we had done before, but that would help them not lose interest in this portion of my visits. 23.06*
2- Conduct visits in a location other than home	Planned/ Reactive	Individual PE; Recipient	Individual	NA	Setting	Increase reach; Increase retention	O: Neighborhood environment R: Access to resources, Housing, Crisis	(+) conducting visits in safe, accessible location helps retain moms experiencing housing instability	*I have a mom… if she's not comfortable to meet in her area… we'll meet at her mom's house with the kids. 37.10*
2- Extend session length to deliver HEALTH content	Planned/ Reactive	Individual PE; Recipient	Individual	Lengthen/ extend	NA	Improve feasibility	P: PE judgment, Perception of int R: Cognitive capacity, Existing knowledge, motivation & readiness, Preference	(+) meet mom preferences or learning needs (-) if extending results in PE burden (e.g., uncompensated time), or if PAT topic in another area that meets family need & preference is omitted	*Sometimes it [HEALTH topic] stretches across other domains of the curriculum, especially if it has an activity attached. You might just... do a whole HEALTH curriculum day... Like the Coca Cola, measuring the sugar in the Coca Cola... activity. 37.01*
2- Make goals incremental rather than all or nothing	Planned/ Reactive	Individual PE; Recipient;	Individual	Tailor/ tweak/ refine	NA	Increase satisfaction; Improve fit w/ recipient	P: PE judgment, Perception of int	(+) meet moms where they're at regarding motivation & readiness to change; small	*"[Moms] would be... like, 'I really don't like water. Is it okay to... drink 0 sugar juices or 0 sugar sodas?'*

		HEALTH team					R: Existing knowledge, motivation & readiness, Preference	changes may be more acceptable, achievable, sustainable	*And I remember... thinking, 'Oh, I'm sure there's a balance to this…' you know, little by little. So yes, 0 sugar is better than their 4 sodas that they're drinking right now... That was like a little learning curve for me, because I wanted to say, 'No, just do water.' ...The flexibility.. was nice for them to have that permission... that they don't have to go from 0 to 10 or from 10 to 0." 11.03*
2- Moms shared HEALTH info with other family members	Un-Planned	Recipient	Individual	NA	Pop-ulation	Increase reach; Improve fit w/ recipient	R: Existing knowledge, motivation & readiness, Preference, Social support	(+) enhance family support of participating moms; increase reach of evidence-based info to other family members	*We had a couple of dads join in. They're mostly getting the information from their wives, but they're using it. 21.01*
2- Change wording to explain topic differently	Un-Planned	Individual PE; Other: interpreter	Individual	Loosen structure	NA	Improve fit w/ recipient; Address cultural factors	P: Previous training & skills R: First/spoken language, Cultural norms, Cognitive capacity	(+) improve clarity of content for moms from various cultural or linguistic backgrounds for whom original wording may have limited familiarity	*Sometimes I just had to summarize, or I had to try and explain it differently for [mom] to understand. So that was more like... a language... sort of thing... sometimes she may not have understood. So I tried to explain a different way. Sometimes there's a word they don't understand... When I would have a live interpreter, she would sometimes pull her phone like... 'in Ecuador, this is*

									how we say it. But in Mexico this is how they say it.' 25.03
Rated as Likely Fidelity Inconsistent (N=3)									
Adaptation Description	**Change planned**	**Who Decided**	**Level of delivery**	**Content mod**	**Context mod**	**Goal**	**Reason**	**Potential Equity Implications**	**Exemplar Quote**
3- Did not use HEALTH activity	Planned/ Proactive Un-Planned	Individual PE	Individual; Cohort	Remove core component	NA	Improve feasibility; Improve fit w/ recipient	O: Time, Competing demand P: PE judgment, Preference R: Crisis	(+) if removing activity allows time to address other priorities or emergent needs, increase retention (-) if PE condenses due to inaccurate judgment of family need, PE lack of interest gatekeeps info delivered	*We have not used any of the activities... I have described... that sugar one... She [mom] was flabbergasted... I think that really was like, not that it necessarily helped, but it was a wakeup call. 43.03*
3- Discuss topics not in curriculum (e.g., food dyes & ADHD, protein intake)	Planned/ Reactive Un-Planned	Individual PE	Individual	Integrating other content	NA	Improve fit w/ recipients	P: Previous training & skills, PE judgment, Perception of int R: Comorbidity, Other: dietary needs	Unknown	*I also just kind of make my own stuff up... I worked as a nutritionist, so… let's look at what you tracked for your food. And I had one mom. She and I were doing a race on protein... cause she just doesn't eat enough protein when you look at someone's diet and they're not eating protein you have to try to help them... 21.01*
1- Parent educators discontinued HEALTH	Un-Planned	Individual PE	Individual PE	Drift from protocol without returning	NA	NR	P: Perception of int	(-) if moms who were interested in/ would benefit from HEALTH did not have opportunity to receive int, or had int cut short	*I think some [parent educators] yes, overcame [discomfort discussing weight]. And then I think some kind of just stopped a little and just didn't continue on with the program. 11.03*

Note: Number before the description in the first column indicates frequency; Int = intervention; Mod = modification; PA = physical activity; PE = parent educator; Prefer = preference ; In "Rationale" – S = Sociopolitical level; O = Organization/setting level; P = Provider (Parent Educator); R = Recipient; Equity Implication: (+) = potential to promote equity; (-) = potential to decrease equity/exacerbate inequities

Most adaptations that were likely fidelity consistent were rated as potentially having positive equity impacts. Adaptation decisions made to better fit family needs and preferences could help to address emergent needs (e.g., helping a family find housing, identifying local food pantries) or align HEALTH with ongoing social needs (e.g., sharing healthy recipes that utilize foods provided by food pantries, provide visits in a safe, accessible location). These adaptations could also help improve comprehension and retention of HEALTH's content (e.g., by simplifying content to reduce complexity for participants with low literacy or educational attainment) and make goals more approachable and achievable by meeting participants at their current starting place and promoting incremental change (e.g., aiming to cut back rather than eliminate sugar sweetened beverages, build in small amounts of daily at home movement and play).

Fidelity inconsistent modifications driven more so by parent educator preferences or constraints (e.g., cutting back or eliminating HEALTH content to save time, avoid discomfort of discussing weight) were more likely to have potential negative impacts on equity. Such changes could prevent moms and families from receiving information that could benefit them (e.g., parent educator perceptions about mom's existing knowledge or need to prioritize another topic could inadvertently gatekeep information provided). As one parent educator noted, *"a lot of the families… already understand the importance of health and nutrition… it's not the first time they're hearing this…"* but later acknowledged that misconceptions about health information are common. The parent educator recalled she *"had to do a lot of disproving these myths. Like, green tea is really healthy for you…' they were giving green tea to the baby…because they thought it was healthy and I had to say, 'there's so much sugar in that.'" 27.09*

Parent educator suggestions for future adaptations

Parent educators suggested seven unique types of future modifications to HEALTH, all of which were intended to address SDOH (Table 11). Some were more general adaptations, such as having multiple versions of handouts per topic that can be selected based on participants' existing knowledge or education and literacy level. Several parent educators suggested adding more handout content, including recipes and tips/suggestions (e.g., recipes for specific dietary needs such as vegan or gluten free, tips for purchasing healthy foods on a limited budget). Some parent educators also expressed interest in having additional interactive activities they could use with participants, particularly to fit within constraints or to help overcome SDOH-related barriers to healthy behaviors (e.g., grow your own produce at home, no cost fitness activities that moms and children can do in their homes). Parent educators were also interested in delivering HEALTH in a group rather than to individual parents to enhance social support, facilitate peer learning, and to allow HEALTH to be made available to a broader audience.

Several parent educators noted the importance of flexibility in choosing HEALTH topics based on participant needs and interest, rather than having to follow a specific sequence. This was one of the most common enacted changes, but some parent educators indicated they believed they had to follow a particular order so did not reorder topics. All suggestions had potential positive equity impacts (e.g., increasing accessibility and reach of HEALTH to groups not currently able to receive the intervention, such as non-English or Spanish speakers, improving materials to accommodate lower literacy levels), though these also had potential negative impacts without steps to ensure equitable accessibility and reach. Besides adjusting the order of curriculum delivery, all proposed changes would need to be decided upon and enacted by the intervention co-developers, which include decision makers within PAT National Center and the HEALTH research team.

Table 11

Suggested modifications to HEALTH

Adaptation Description	Change planned	Who Decides	Level of delivery	Content mod	Context mod	Goal	Reason	Potential Equity Implications	Exemplar Quote
4- Add more activities (e.g., at home physical activity, grow your own home garden)	Planned/ Proactive	HEALTH team; PAT national	Target Int Group	Add element; Integrate other content	NA	Increase satisfaction; Improve fit w/ recipient; Improve effectiveness	O: Neighborhood Environment P: Perception of Int, Previous training & skills R: Access to resources, Food security, Income/finances	(+) enhance healthy eating & PA options for families w/ resource limitations (e.g., lack of availability of safe or spaces for PA, limited access to fresh produce)	*If you live in a low- income apartment you're not gonna have a garden, you know. I've had some [usual PAT] parents... We made some lettuce bowls where it's just your potting soil with a little bit of compost in it, and then you just plant lettuce on it, and you keep it growing, and there's your salad because you just cut the tops off and it regrows. 21.01*
4- Allow for reordering topics based on participant need/ interest	Planned/ Reactive	Individual PE; Recipient	Individual	Reorder modules	NA	Improve fit w/ recipient; Increase satisfaction	O: Mission P: PE judgment, Perception of int R: Preference, Existing knowledge, motivation & readiness, Crisis	(+) meet moms where they're at regarding interest, preferences; better meet family needs; communicates prioritization of & responsiveness to family needs	*The flexibility [to reorder topics], for sure. Because not everyone might impact the same, you know. It might not be relatable... For instance... this family is very, very fit, but struggle with more of the eating portion... you know, it's so just focusing on something that the family needs in that area. 25.07*
4- Integrate more content into handouts (e.g., recipes, tips)	Planned/ Proactive	HEALTH team; PAT national	Target Int Group	Add element; Integrate other content	NA	Increase satisfaction; Improve fit w/ recipient;	P: Perception of int, Preference R: Access to resources, Existing knowledge,	(+) enhance relevance, availability of info that better meets participant needs &	*I would say ...recipes... some suggestions, I think that helps them. Like on the grocery shopping, or the food shopping. Just*

						Improve effectiveness	motivation & readiness, Cultural norms, Other: dietary needs	preferences (e.g., dietary needs, cultural relevance of foods, affordable options)	*some specific suggestions. I think things that they could look at and print and then take it with them and actually use that information. 23.06*
Adaptation Description	**Change planned**	**Who Decides**	**Level of delivery**	**Content mod**	**Context mod**	**Goal**	**Reason**	**Potential Equity Implications**	**Exemplar Quote**
4- Offer HEALTH in a group delivery model	Planned/ Proactive	HEALTH team; PAT national	Cohort	Shorten/ condense; Integrate parts of HEALTH into another program	Format	Increase reach; Improve fit w/ recipient	S: Societal norms O: Mission, Service structure P: Perception of int R: Social support, cultural norms, Preference	(+) increase reach of HEALTH; enhance social support for families participating in HEALTH (-) if group is more accessible to certain individuals (e.g., those with transportation to get to community center)	*One thing that would be nice... make this more... open... like a group connection within HEALTH. Like if there can be one that is laid out for like a 5-week session, or something like that, where we could incorporate and give that universal access opportunity for the community to come in and hear about the curriculum." 25.07*
2- Create multiple versions of handouts with varying simplicity, depth of information	Planned/ Proactive	HEALTH team; PAT national	Cohort	Add element; tailor/tweak/ refine	NA	Improve fit w/ recipient	P: Perception of int, PE judgment R: Existing knowledge, motivation & readiness, literacy & education level, Cognitive capacity	(+) meet participants where they're at, build on existing knowledge; improve comprehensibility for participants w/ low literacy or educational attainment	*In our [PAT] curriculum we have 2 different sets of handouts. We have one that is the normal set of handouts. But then we have another handout the same information, but it is formatted much easier for say a parent that was maybe limited in reading... It would share the same information, but maybe not be as wordy. It's more simple... That that would be my only suggestion is*

									maybe have an alternate easier to read. 23.06
2- Offer HEALTH handouts electronically (via app or website)	Planned/ Proactive	HEALTH team; PAT national	Target Int Group	NA	Format	Increase satisfaction; Improve fit w/ recipient; Improve feasibility	S: Societal norms O: Available resources P: Preference, PE judgment R: Preference; Access to resources; Cognitive capacity	(+) enhance accessibility of HEALTH info, material, ease of use (-) if paper handouts are no longer available to participants who don't have electronic access	*I just think if there could have been an app. You know, I think that we're such in that age now that I don't know if the papers the handout part was maybe a little too much, because we had to take our [parent educator] handouts, too. 23.04*
1- Translate HEALTH into other languages	Planned/ Proactive	HEALTH team; PAT national	Cohort	Tailor/ tweak/ refine; Other: translate content	Population	Increase reach; Improve fit w/ recipient; Address cultural factors	S: Societal norms O: Mission P: PE judgment, Cultural norms, competency R: First/ spoken language; Cultural norms; Cognitive capacity	(+) improve reach, fit for families who speak languages other than English or Spanish and have limited English proficiency	*Do you offer any other languages?... Mandarin Chinese... Burmese or Cambodian? I think we've had some of... those families… our Parents as Teachers program has now came out with like 8 different, more languages. 23.04*

Note: Int = intervention; Mod = modification; PA = physical activity; PE = parent educator;
In "Rationale" – S = Sociopolitical level; O = Organization/setting level; P = Provider (Parent Educator); R = Recipient
Equity Implication: (+) = potential to enhance/promote equity; (-) = potential to decrease equity/exacerbate inequities

Discussion

This study applied an equity focused expansion of FRAME to assess adaptations parent educators made to the HEALTH intervention and the potential equity implications of these adaptations. Parent educator interviews elicited 19 unique types of enacted adaptations and seven suggested future modifications to HEALTH. Most enacted and suggested adaptations were likely fidelity consistent and were made or recommended to better meet the needs of moms and families receiving HEALTH, with particular emphasis on SDOH. Most adjustments made to HEALTH's delivery were in response to emergent or ongoing parent and family needs and preferences. Parent educators described numerous circumstances that required responsive flexibility, such as a parent losing their job, divorce, family medical emergencies, housing instability, food insecurity, among other needs. This is consistent with findings from previous studies of PAT and other child and family interventions, which noted that practitioners could rarely follow manualized interventions without interruption due to more urgent client needs.[300] A review of adaptations made to child and family interventions found similar types of adaptations, including condensing, skipping, or removing intervention elements, or integrating other resources to meet client needs.[300]

One important finding is that although HEALTH is intended to be flexible,[286,287] some parent educators believed they had to deliver HEALTH in a specific sequence rather than tailor to participant needs and preferences. Several parent educators described only adjusting order, pacing, or depth of curriculum delivery in response to urgent needs and sticking to a specific topic order even if they felt other HEALTH topics were more relevant to families at the time. This has important implications for HEALTH's training, as well as how intervention developers may choose to define and prioritize indicators of fidelity. Future trainings can emphasize that

HEALTH can and should be tailored to family needs and preferences. In addition, trainings should prepare parent educators to solicit participant interests and engage in collaborative decision making to guide intervention delivery in a way that minimizes potential negative consequences, such as decisions made based on parent educator implicit biases or inaccurate assumptions of family needs.[102,301]

Although fidelity criteria for HEALTH have yet to be developed, PAT and HEALTH could offer a unique perspective on what constitutes fidelity and the interrelationships between adaptation and fidelity. Compared to PAT (foundational and with HEALTH embedded), which is inherently flexible, many EBIs informing conceptualizations of fidelity and adaptation are manualized, structured, and have relatively stringent fidelity criteria.[291,292,302,303] To be clear, this is not inherently problematic and in many cases adherence to a protocolized treatment is necessary for effectiveness and recipient safety. However, this rigidity is not warranted for all types of interventions and, as in the case of HEALTH, could be detrimental to this type of flexible intervention. For example, a previous review of adaptations to child and family interventions concluded practitioners value relationships with clients over fidelity to intervention components.[300] In the case of PAT and HEALTH, building and maintaining quality relationships between families and parent educators and tailoring the intervention to family priorities are integral parts of the intervention and could be key indicators of fidelity to the intended delivery, rather than in opposition to fidelity. Future collaborative work among HEALTH's developers, PAT National Center, parent educators, and families could help to determine indicators of fidelity that balance alignment with the intended flexible program delivery and adherence to the HEALTH curriculum content.

Most adaptations could potentially have positive impacts on health equity, though some may have detrimental implications. In many instances, one type of adaptation could have both positive and negative impacts on equitable delivery of HEALTH, and ultimately equitable implementation and health outcomes. In assessing equity implications, it is important to be clear in how equity is operationalized, including how it is defined and at what level (e.g., an individual recipient, recipients with a site, recipients across multiple sites).[102,304,305] For example, if considering individual participants, some actions may promote equity for individuals if HEALTH is delivered in a way that meets their needs. However, if considering all clients served by a site or across a group of sites, adaptations that benefit some participants may not be a viable option for others. For example, walking visits can benefit moms and families that have access to safe places for walking (e.g., parks, neighborhoods with sidewalks and traffic abatement infrastructure). However, families who live in rural, resource limited, or unsafe neighborhoods may not have the opportunity to incorporate walking into visits. As noted in suggested adaptations (Table 12), equity can be promoted for these families if other alternatives are incorporated (e.g., stretching, moving in place in the visit delivering setting).

It is important to note several limitations of how equity implications were assessed in this study. There is not an available objective rating system or guidance for assessing the direction or magnitude of potential equity impacts of tailoring and adapting an intervention such as HEALTH. Ratings of potential equity implications are preliminary and although some emerged from the interview data, others are based on subjective researcher assessment. Additional work is needed to further delineate potential equity implications. Additionally, it is possible that a single type of change may not make a measurable impact on equitable outcomes, or may depend on what the target outcome is (e.g., satisfaction to various intersections of program participants,

retention of participants with complex social needs, improved health behaviors or physiological outcomes equitably across participant groups). This exploratory study raises points of consideration to integrate or assess in future implementation and evaluation activities. Future work is needed to operationalize equity in implementation processes and outcomes and participant health outcomes and to track and measure these. Discerning equity related impacts will likely require triangulation across multiple data sources.

Despite these limitations, this qualitative study contributes to the broader IS and adaptation literature by providing an example of how an existing IS framework (FRAME) can be paired with and augmented by health equity literature, and adds to growing literature that seeks to characterize the implications of adaptations related to promoting health equity. The current expansion of FRAME builds upon the 2019 version of this adaptation framework,[90] and extends previous SDOH-focused applications,[306] by integrating an item to explicitly consider potential equity implications of adaptations. Several SDOH constructs (e.g., neighborhood environment, income) could be added to FRAME's reasons for adaptation. The equity implications item requires future conceptual development and refinement. For example, rather than a general "equity implications" item, these could be further specified into types of equity implications or more precise language about what aspect of equity is augmented or threatened (e.g., adaptation leverages existing strengths and assets, aligns with recipient values, adaptation contributes to existing resource constraints). The FRAME developers have continued to refine this framework over time,[90,294,307] and there are likely opportunities to collaborate with developers and users to expand equity-focused components of the framework or to offer guidance and examples for pairing this with SDOH and health equity TMFs.

This study uses a data-driven sampling approach to identify participants that vary in terms of their personal characteristics, perceptions of HEALTH, and site characteristics represented. A potential limitation of this study is the small sample size, which, while appropriate for a qualitative study, may not reflect all adaptations made to the intervention. Findings from this study can be integrated with quantitative survey data on parent educator adaptations made to HEALTH, available in mid-2024. Learnings from this study have the potential to improve the HEALTH curriculum's fit with recipient and implementer needs and preferences and the intervention's impact on equitable outcomes. Next steps for this work include sharing findings with PAT partners and using data to inform ongoing and future research activities, including comparing findings with parent educator interviews from a study testing HEALTH among pregnant mothers.

Chapter 5: Implications and Future Directions

This dissertation triangulates three projects that contribute conceptual (Aim 1 health equity TMFs), methodological (Aim 2 resource to guide health equity integration into implementation strategies), and empirical (Aim 3 qualitative assessment of equity implications of HEALTH adaptations) findings to advance health equity's integration into the field of implementation science. While the field is increasing its focus on equity and taking steps to build an explicit equity focus into IS tools and methods,[45,67,70,77,79,82,84,277] this dissertation identified several gaps and opportunities to advance the field's efforts.

Research, practice, and policy implications

Health equity in theories, models, and frameworks

Because the unequal distribution of power, money, and resources in society is shaped by structural forces, including public policies, laws, governing bodies, multinational and global financial institutions, societal norms and values, among others, health equity must be multilevel in its conceptualities.[51,53] Differences in health and resource distribution are not random, rather are grounded in systemic, structured discrimination based on race, ethnicity, gender, sex, social class, socioeconomic position, physical and mental ability, and other attributes and intersections of these.[53] Health equity cannot be conceptualized and articulated at the person-level alone, as this obscures the structural forces that marginalize people and must be intervened upon to more equitably distribute resources according to need and reduce inequities. The review of health equity TMFs found that studies often examine individual-level SDOH while not discussing the structural causes of inequities, omitting key pieces of the conceptual guidance from which they draw.[39,128,137] Studies sometimes mischaracterize systemic harms as individual problems (e.g., patient attitudes of mistrust) rather than critically examining the underlying causes (e.g., provide

biases, historical and current mistreatment of certain groups) and do not always engage the appropriate groups to gather perspectives and data to draw these conclusions (e.g., provider perspectives of patient experiences).[153] Theories of intersectionality and marginalization can inform the conceptualization of how structural forces (e.g., systemic racism, classism) differentially affect groups who occupy multiple socialized identities that afford relative privilege or disempowerment, rather than treating groups who share a common trait (e.g., sex, race) as homogenous, and can guide the identification and selection of marginalized perspectives who are underrepresented in research.[87,205,224,308] To inform strengths-based perspectives and approaches, researchers can leverage TMFs such as the Community Capital Framework which delineates several types assets and resources,[200,207] the Collective Impact Model proposing five steps for partnered collaboration,[198] or the Inside-out SEM of policy and environmental change offering a strength-based version of the socioecologic model to depict multi-level opportunities for health promotion.[222]

There is a need to integrate health equity TMFs into IS.[70,79,92] While bidirectional learning between health equity and implementation researchers can leverage the strengths and address limitations of the respective fields,[309] we should also be cautious as a field to not overstate the benefit of IS on health equity research. For example, Chinman et al., suggest using a IS framework such as CFIR to design phase 2 disparities studies (seeking to identify causes of inequities) could reveal factors beyond patients and providers to that contribute to inequities or can be leveraged to enhance equity.[76] However, many TMFs in IS were developed with a clinical lens in higher resource settings and often underspecify broader contextual factors (e.g., systemic racism, public policies, social movements) that lead to inequities or promote equity.[280,298] In comparison, many of the health equity TMFs identified through the aim 1 scoping review offer a

more comprehensive catalog of SDOH, societal factors, and structural drivers of resource distribution and inequity that affect contexts in and outside of healthcare (e.g., WHO CSDH Framework, Ecosocial Theory).[39,213] Implementation researchers may wish to combine IS and health equity TMFs, or use the latter to refine the former for a greater comprehensive and detailed focus on equity. The aim 3 study using SDOH frameworks offers one such example.[8,90,226] The use of SDOH frameworks extended the conceptualization of implementation determinants (e.g., family support as facilitators of mom engagement in HEALTH) and as reasons for adapting the EBI (e.g., adding general or local information to better address participant food security while promoting heathy eating). Examples pairing of health equity and IS TMFs can illustrate to other implementation researchers how they might approach this in their own work. This extends conceptual suggestions,[70,92] moving the field forward from what to do to how to do what is recommended.

This dissertation can inform future work to develop guidance around selecting a health equity TMF and how to apply it in a study. The scoping review summary of health equity TMF applications and approaches for reporting empirical applications could be used to expand existing equity-focused reporting guidelines such as the equity extension of CONSORT for reporting equity in randomized trials or the PRISMA-E extension for equity-focused systematic reviews.[112,310] In IS, there is a growing recognition that a careful, critical approach to theorizing is needed, rather than applying an off the shelf model or framework.[311,312] The aim 1 review offers examples of how existing TMFs have been adapted for use in a specific study and discussion of decisions made about how to use these.[121,126,145] The aim 3 qualitative study illustrates how a TMF, in this case the equity focused revision to FRAME, can be applied as a way to engage in theorizing by prompting identification of potential positive and negative

impacts adaptations may have on equity. The aim 2 brainstorming activity can serve as a tool to prompt theorizing, or hypothesis generation, about the ways equity can be operationalized through various elements of an implementation strategy (i.e., the actor, the action, action target, etc.) As health equity is complex and multifaceted, it will be important for implementation researchers to make explicit the conceptual perspectives informing how they define and operationalize equity, and to consider the strengths and limitations of these perspectives.[51,53,79] When reporting details about how and why a health equity TMF was chosen, how this TMF informed the study, and how the TMF was operationalized in the study. Authors can overcome space constraints in journal articles by including supplemental online tables, figures, or technical documents.

Integrating equity into implementation strategies

As stated in chapter 1, health equity can be considered both a process and an outcome. When considering how equity is operationalized in the context of implementation, it can appear in numerous ways and can be multilayered. For example, equitable implementation processes could be operationalized as power sharing between researchers and non-academic collaborators such that all parties have equal decision-making authority in what gets implemented and how, or as the use of actions that advance social justice (e.g., activism, financial contributions). It can also be a meta concept that encapsulates these and other operationalizations of ways to engage in translating evidence (research or evaluation derived data, personal experiences) into practice to lead to greater equity in service delivery and ultimately health outcomes. The various ways of slicing equity make it a complex topic to communicate when discussing equitable implementation. There is a need for discourse of equity as a broad concept, and at the same time our discussion of equity and how it appears in implementation research and practice needs to be

specific so that we can understand exactly how we are and are not integrating equity into our work. There is no simple or objective solution to how to best do this, but it is important to acknowledge this complexity and the limitations of how we communicate about equity. In this section, I attempt to articulate the meaning of broader terms such as equitable implementation processes and outcomes through examples.

There is a need to evaluate whether and how various implementation strategies are effective at promoting equity and reducing inequities. For example, this could include assessing which strategies are most appropriate or feasible in resource limited settings, which strategies might be most acceptable for among marginalized groups and settings, which strategies are most effective in improving equitable EBI reach, and discerning the causal mechanisms through which strategies promote equity when creating change.[105] There are relatively few implementation strategies that have been tested for their effectiveness in reducing inequities.[76] It remains unclear the extent to which implementation strategies from compilations such as ERIC[313] can be tailored to promote more equitable implementation processes (e.g., greater involvement of marginalized EBI recipients in enacting the strategy) and outcomes (e.g., improved EBI sustainment in low resource settings). In other words, we do not know how far current commonly used strategies will get us, and at what point or under what conditions we need entirely new strategies to move the needle towards improvements in implementation, service, and ultimately health outcomes for marginalized populations. Many implementation strategies in current compilations focus at the individual or team level or on a discrete setting of implementation, such as a clinic.[313,314]

Future efforts in IS should identify existing or design new strategies that focus on broader contextual factors, systems, and policies that drive inequities or can be leveraged to create conditions to promote equity.[45,315] Implementation researchers can build from the health equity

TMF scoping review and the equity-focused strategy resource in this dissertation to enhance guidance and develop concrete examples on how to identify equity-related determinants and for selecting and designing strategies to target these determinants. The brainstorming activity in aim 2 can be paired with existing tools for tracking implementation strategies to determine the extent to which equity focused processes and strategy components are enacted as intended and to monitor for unintended consequences (especially those that may present an equity threat).[282,307,316]

As equity is conceptualized both as a process and an outcome,[43] it is possible that a different type of guidance or different resource content than that presented in aim 2 is needed to create and guide more equitable implementation processes for those involved in implementation versus how to promote more equitable implementation, service, and ultimately health outcomes. This is related to the point above related to uncertainty about how far certain strategies can get us. The current resource is intended to guide users in considering various ways in which equity might be articulated in the design of implementation strategy components. For example, power sharing across actors representing roles at different levels of social and professional hierarchies, fair reimbursement of actors enacting an implementation strategy, use of modalities that accommodate different abilities and needs (e.g., accessible language for limited literacy levels, visual or audio aids for hearing impairments). The brainstorming activity could promote more equitable implementation processes for those involved in implementation efforts. However, it is possible the current resource content is not sufficient to yield strategies that lead to greater equity in implementation outcomes (e.g., improved EBI appropriateness for marginalized populations, feasibility in low resource settings).[92] Ideally more equitable implementation processes would lead to more equitable implementation outcomes (e.g., a strategy designed with the needs and

preferences of marginalized groups from the beginning may improve implementation outcomes of importance for these groups) However, this notion needs to be tested, through head-to-head comparison of equity focused vs. standard strategies or through testing different versions of equity focused strategy designs (e.g., tradeoffs between various options for operationalizing equity in strategy components).[75]

It also remains to be determined if mechanisms (causal processes through which strategies operate to bring about change) are different for equity focused vs. standard strategies. As one hypothetical example, a strategy that shares decision making power among actors from various levels of professional hierarchies (e.g., a highly specialized practitioner, a mid-level administrator, an entry-level staff person) rather than only a highly specialized expert may increase a sense of belonging or feeling valued across roles in an organization.[317] This sense of belonging could improve team cohesion,[317] and ultimately improve the feasibility of implementing an EBI in a resource limited setting. The same strategy that is enacted by a technical expert may not work in the same way to foster this sense of belonging or inclusion, but instead could streamline decision making, freeing up team member capacity to implement the EBI. As the field continues to develop evidence for implementation strategies and test causal pathways, equity-oriented theorizing should be a central part of this process. This perspective is necessary for identifying as evaluating potential tradeoffs and can help determine which design choices offer the best "bang for our buck" to promote greater equity in implementation. The equity focused brainstorming activity from aim 2 offers a tool to help implementation researchers in articulating potential design choices to test.

Empirical orientation towards equity

A key premise of this dissertation is that equity-focused work occurs on a spectrum regarding the centrality and depth of equity. Concepts and actions related to equity (e.g., autonomy, fairness, centering marginalized perspectives) may be a central foundation from the onset guiding implementation research or lens that is retrospectively applied to evaluate potential equity implications.[52] Applying an equity lens is a way to critically examine research and practice efforts to determine potential implications for equity related outcomes (e.g., reach among marginalized populations, decreased inequities in health outcomes), to identify opportunities to change course to make ongoing efforts more equity promoting (e.g., prioritizing needs of marginalized populations rather than researcher interests), or to examine positive and negative unintended consequences that promote or hinder equity. Equity may not have been a consideration from the onset or was an implied goal rather than an explicit, intentional, central focus. There are still opportunities to learn from what's already happening to potentially change course or improve future efforts.[86] While critical appraisal and learning from what's already been done and can inform future equity-centered efforts, there are cautions against promoting use of an equity lens, as this implies equity is a layer or perspective that can be added or removed (much like sunglasses can be taken on or off), rather than a central component of research and practice efforts.[51,53,318] Above all – we need to cement our commitment to equity as a field, and not have it become a surface level buzz word that polishes and drapes misguided, superficial efforts to address equity – avoid being health equity tourists and diluting the evidence base and using up finite resources that diminishes the efforts of individuals (including researchers, practitioners, community leaders, and activists) who have been doing the heavy lifting for years.[5,53]

Limitations and future directions

While this dissertation was intended to be responsive to calls for greater focus on equity and recommended actions for integrating health equity into implementation science, there are important limitations to note. First, this dissertation is an academic product that does not directly engage non-academic collaborators as co-creators of knowledge. This work was guided by peer reviewed literature that elevates academic scholarship and is often missing perspectives of practitioners, including grassroots activists and community-based organizations enacting change. Findings from aims 2 and 3 of this review are based on small sample sizes and qualitative data, which may limit the generalizability of learnings from these studies.

Next steps building from aim 1 will include developing use case summaries from exemplar health equity TMF applications located through this review. Although we did not extract information related to IS TMFs, we noted in free text coding studies that paired health equity and IS TMFs. These will offer especially helpful applied examples that can inform how other implementation researchers might pair TMFs. These examples will add to existing use cases on the D&I models webtool.[250] I can also build upon Table 4 to develop guidance for applying a TMF in an empirical study and articulating the TMF uses in peer reviewed articles or other dissemination products. Current recommendations on using implementation frameworks focus on uses across implementation processes (e.g., develop implementation logic models, identify determinants, select implementation strategies, specify implementation outcomes),[248,250] rather than applying a TMF to specific research activities that can align with crosscut these processes (e.g., select and measure variables can apply to implementation determinants or outcomes). Recommendations from the aim 1 review would extend existing recommendations and offer applied examples across contexts, rather than limiting to one project or framework (e.g., the Exploration, Preparation, Implementation, Sustainment (EPIS) framework in Moullin

and colleagues' recommendations article[248]). The applied examples and empirically informed recommendations from this review could inform development of training materials for implementation researchers, including "how to" guides, short courses, workshops, or student activities in IS classes.

As indicated in chapter 3, the equity-focused implementation strategy resource is a preliminary version I intend to carry forward in future testing. The user-testing in aim was limited to a small sample of individual researchers in a one-hour session that did not provide the necessary conditions to fully engage with the content and develop user case examples illustrating how the brainstorming activity can inform the design of equity focused implementation strategies. I plan to write a career development proposal (K12) to partner with other implementation scientists conducting participatory or community engaged implementation research to test the resource guide in applied, team-based contexts. This testing will involve mixed methods approaches to solicit feedback on the resource from a broader array of users, observe how interdisciplinary teams use the resource, and elicit examples of equity focused implementation strategies. This testing will also explore more deeply some of the challenges to designed equity focused strategies mentioned by participants in aim 2, including how teams can approach deciding between various design options and evaluating the implications of these design choices. Findings from future user testing will inform further refinements to the resource, which can then be applied in a larger-scale study (e.g., R01) to inform the design and effectiveness testing of implementation strategies designed using this resource. This strategy resource could be one piece of a suite of resources and methods that ultimately helps implementation researchers optimize implementation strategies for greater equity impact.

Findings from aim 3 contribute to the community-based implementation literature, which is often underrepresented in IS compared to clinic-based research.[66] This study provides an example of applying an equity lens to assess adaptations to an EBI developed in collaboration with researchers and practice partners (PAT National Center) and integrated within an existing home-based delivery model. This study offers a unique contribution to the adaptation literature given many adaptation studies in the IS literature uses of FRAME are in clinical contexts with more structured EBIs,[90,306,319] rather than a flexible, community-based intervention such as HEALTH. The aim 3 study also has implications for practice, both for HEALTH and other EBIs. Next steps for this work include creating practitioner focused products (e.g., infographic, brief non-technical summaries) to share findings with PAT National Center and intervention sites delivering HEALTH. These products can share learnings about adaptation approaches that other sites can use (e.g., examples of local and online sources to obtain reliable information and resource to use to supplement the HEALTH curriculum). Findings from aim 3 can also support practice and data informed decision making among the HEALTH developers and PAT National Center regarding refinements to the curriculum, its integration into the standard PAT curriculum, and strategies for implementing and sustaining HEALTH within PAT. In particular, findings point to the need to emphasize tailoring HEALTH to meet family needs in the parent educator training. Results could also inform additional strategies to ensure HEALTH is delivered as intended (e.g., refresher trainings, session debriefs, ongoing supervision).

Although this dissertation work was mainly focused on research focused products and advancing a greater focus on health equity within the field IS, findings may have some implications for public policy and "small p" institutional policies. Shah and colleagues found that employees in public health agencies had low awareness of Health in All Policies and generally

felt their agency should have little involvement in social policies in areas beyond health (e.g., education, economy, transportation).[320] Several health equity TMFs and empirical applications from the aim 1 scoping review could be used to illustrate the importance of Health in All Policies initiatives and how to engage in policy evaluation to assess implementation and population health outcomes. For example, Hughes et al. applied the Evaluation of Environmental Policy and Systems Model, along with an program-specific logic model to assess activities and outcomes from a multisectoral intervention to improve asthma prevention and control outcomes with low income, urban communities of color.[156] Future work to create TMF use cases from the scoping review can include policy related examples to inform equity-focused policy implementation research. Additionally, a participant from aim 2 requested to share the equity-focused strategies resource with a colleague working with policymakers to develop equity-centered prenatal screening policies, noting the resource could help inform strategies to promote equitable access to screening (personal communication). This indicates the potential utility of this resource to policy development and implementation and opens up avenues for future testing with policy implementation researchers and policymakers and multiple levels of government. The expertise of individuals working in health and social policy will be instrumental in ensuring the utility and usability of products and future work stemming from this dissertation for policy and practice audiences.

Conclusions

The exercise of conceptualizing and carrying out this dissertation work allows me to develop the knowledge base that will be essential for carrying out community-engaged, partnered research in a careful manner that (hopefully) does not exacerbate harms, and will enable me to build long-term collaborations and provide the toolkit for me to offer my skills as a

researcher to build capacity in communities to leverage research evidence to improve the health and social conditions for their communities. Thus, this dissertation is not a complete product, but rather a first step into a career dedicated to advancing equitable implementation research and practice. I intend to build from this work by critically examining the extent to which equity is operationalized in research (empirical studies in aim 1) and identify missed opportunities and lessons learned for integrating equity principles (community engagement, empowerment, self-determination). I plan to apply for funding to pilot test the aim 2 resource guide among teams conducting community engaged and participatory implementation research to assess how teams apply this resource and what the added value is of integrating the brainstorming activity into research. This can inform long term studies to develop and test equity enhanced implementation strategies versus standard versions of the same strategies. I intend to expand findings from aim 3 with survey data on implementations, and plan to report findings to the HEALTH team and PAT so that learnings can inform future refinements to HEALTH and supporting implementation strategies.

This dissertation contributes to is in several ways. In chapter 1, I offer a guiding definition of equitable implementation that builds upon existing applications and further articulates how equity is conceptualized, avoiding current limitations in the literature of circular definitions. The health equity TMFs identified in chapter 2 can inform revisions to existing IS TMFs or pairing health equity and IS TMFs to capitalize on the strengths and compensate for the limitations of each. The resource presented in chapter 3 extends current guidance and recommendations in the implementation literature for integrating an explicit focus on health equity into implementation strategies. The application of an equity-focused revision to FRAME to assess adaptations made to HEALTH can inform refinements to the EBI and its

implementation, and also adds an empirical example of combining elements from health equity and IS TMFs. Through these three aims, current findings and future work building from this dissertation respond to the need to advance equity in IS.

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Appendix A: Chapter 2 (Aim 1) Appendix materials

Appendix 2.1: Health Equity Frameworks Scoping Review Search Strategy

Limiters: PY = 2010-current; human studies only/no animal; English language; abstract available; journal article only

Action	Terms
1	("Health Policy"[MeSH Major Topic] OR "Concept Formation"[MeSH Terms] or "models, theoretical"[MeSH Terms]) with limiters
2	(framework*[Title/Abstract] OR concept*[Title/Abstract] OR pathway[Title/Abstract] OR approach* [Title/Abstract] OR constructs[Title/Abstract] OR blueprint[Title/Abstract] OR model* [Title/Abstract]) OR (framework*[Text Word] OR concept*[Text Word] OR pathway[Text Word] OR approach*[Text Word] OR constructs[Text Word] OR blueprint[Text Word] OR model*[Text Word]) with limiters
3	1 or 2
4	("Social Determinants of Health"[MeSH Terms] OR "Health Status Disparities"[MeSH Terms] OR "Health Status"[MeSH Terms]) with limiters
5	("health equit*"[Title/Abstract] OR "health equalit*"[Title/Abstract] OR "health inequit*" [Title/Abstract] OR "health inequalit*"[Title/Abstract] OR "health disparit*"[Title/Abstract] OR "justice"[Title/Abstract]) OR ("health equit*"[Text Word] OR "health equalit*"[Text Word] OR "health inequit*"[Text Word] OR "health inequalit*"[Text Word] OR "health disparit*"[Text Word] OR "justice"[Text Word]) with limiters
6	(racism[Title/Abstract] OR discrimination[Title/Abstract] OR "sdoh"[Title/Abstract] OR segregation [Title/Abstract] OR colonialization[Title/Abstract] OR "critical race"[Title/Abstract]) OR (racism[Text Word] OR discrimination[Text Word] OR "sdoh"[Text Word] OR segregation[Text Word] OR colonialization[Text Word] OR "critical race"[Text Word]) with limiters
7	Or/4-6
8	3 AND 7
9	("Chronic Disease"[Mesh] OR "Chronic Disease Indicators"[Mesh] OR "Noncommunicable Diseases"[Mesh]) with limiters
10	("chronic disease*"[Title/Abstract] OR "chronic illness"[Title/Abstract] OR "chronically ill" [Title/Abstract] OR "chronic disease indicator*"[Title/Abstract] OR "chronic disease surveillance" [Title/Abstract] OR "noncommunicable disease*"[Title/Abstract] OR "non-infectious disease*" [Title/Abstract]) OR ("chronic disease*"[Text Word] OR "chronic illness"[Text Word] OR "chronically ill"[Text Word] OR "chronic disease indicator*"[Text Word] OR "chronic disease surveillance"[Text Word] OR "noncommunicable disease*"[Text Word] OR "non-infectious disease*"[Text Word]) with limiters
11	("Coronary Disease"[Mesh] OR "Heart Disease Risk Factors"[Mesh] OR "Heart Diseases"[Mesh] OR "Heart Diseases"[Majr] OR "Stroke"[Majr] OR "Cardiovascular Diseases"[Mesh] OR “aneurysm” [Mesh]) with limiters
12	("heart disease*"[Title/Abstract] OR "vascular disease*"[Title/Abstract] OR "high blood pressure" [Title/Abstract] OR "hypertension"[Title/Abstract] OR "aneurysm"[Title/Abstract] OR "stroke" [Title/Abstract]) OR ("heart disease*"[Text Word] OR "vascular disease*"[Text Word] OR "high blood pressure"[Text Word] OR "hypertension"[Text Word] OR "aneurysm"[Text Word] OR "stroke" [Text Word]) with limiters

13	("Neoplasms"[Mesh] OR "Early Detection of Cancer"[Mesh]) with limiters
14	("cancer diagnosis"[Title/Abstract] OR "cancer screen*"[Title/Abstract] OR "cancer test*" [Title/Abstract] OR "cancer*"[Title/Abstract] OR "neoplasm*"[Title/Abstract]) OR ("cancer diagnosis"[Text Word] OR "cancer screen*"[Text Word] OR "cancer test*"[Text Word] OR "cancer*" [Text Word] OR "neoplasm*"[Text Word]) with limiters
15	("Pulmonary Disease, Chronic Obstructive"[Mesh] OR "Lung Diseases, Obstructive"[Mesh]) with limiters
16	("asthma"[Title/Abstract] OR "COPD"[Title/Abstract] OR "chronic obstructive pulmonary disease" [Title/Abstract]) OR ("asthma"[Text Word] OR "COPD"[Text Word] OR "chronic obstructive pulmonary disease"[Text Word]) with limiters
17	"Alzheimer Disease"[Mesh] OR "Dementia"[Mesh] with limiters
18	("dementia"[Title/Abstract] OR "senile dementia"[Title/Abstract] OR "alzheimer*"[Title/Abstract]) OR ("dementia"[Text Word] OR "senile dementia"[Text Word] OR "alzheimer*"[Text Word]) with limiters
19	("Diabetes Mellitus"[Mesh] OR "Diabetes Mellitus, Type 1"[Mesh] OR "Diabetes Mellitus, Type 2"[Mesh]) with limiters
20	("diabetes"[Title/Abstract] OR "juvenile diabetes"[Title/Abstract] OR "type 1 diabetes" [Title/Abstract] OR "type 2 diabetes"[Title/Abstract]) OR ("diabetes"[Text Word] OR "juvenile diabetes"[Text Word] OR "type 1 diabetes"[Text Word] OR "type 2 diabetes"[Text Word]) with limiters
21	("Chronic Kidney Disease-Mineral and Bone Disorder"[Mesh] OR "Renal Insufficiency, Chronic" [Mesh]) with limiters
22	("chronic kidney disease*"[Title/Abstract] OR "chronic renal disease*"[Title/Abstract] OR "chronic renal insufficiency"[Title/Abstract] OR "kidney disease*"[Title/Abstract]) OR ("chronic kidney disease*"[Text Word] OR "chronic renal disease*"[Text Word] OR "chronic renal insufficiency"[Text Word] OR "kidney disease*"[Text Word]) with limiters
23	((obesity[Text Word] OR obese[Text Word] OR overweight[Text Word] OR weight[Text Word] OR BMI[Text Word] OR "body mass index"[Text Word] OR exercise[Text Word] OR "physical activity" [Text Word] OR "physical inactivity"[Text Word] OR "physical fitness"[Text Word] OR sedentary [Text Word] OR lifestyle[Text Word] OR diet*[Text Word] OR "dietary intake"[Text Word] OR "food intake"[Text Word] OR "healthy eating"[Text Word] OR nutrition*[Text Word] OR fruit*[Text Word] OR vegetable*[Text Word] OR food*[Text Word] OR "soft drink*"[Text Word] OR soda[Text Word] OR sweetened[Text Word] OR sugar*[Text Word] OR smok*[Text Word] OR "smoking cessation*" [Text Word] OR tobacco[Text Word] OR cigarette[Text Word] OR nicotine[Text Word] OR vape* [Text Word] OR "vaping"[Text Word] OR "e-cig*"[Text Word] OR "electronic cigarette"[Text Word] OR pipe[Text Word] OR cigar[Text Word] OR hookah[Text Word] OR alcohol*[Text Word] OR drink* [Text Word] OR drunk*[Text Word] OR liquor*[Text Word] OR intoxicat*[Text Word])) OR (obesity [Title/Abstract] OR obese[Title/Abstract] OR overweight[Title/Abstract] OR weight[Title/Abstract] OR BMI[Title/Abstract] OR "body mass index"[Title/Abstract] OR exercise[Title/Abstract] OR "physical activity"[Title/Abstract] OR "physical inactivity"[Title/Abstract] OR "physical fitness" [Title/Abstract] OR sedentary[Title/Abstract] OR lifestyle[Title/Abstract] OR diet*[Title/Abstract] OR "dietary intake"[Title/Abstract] OR "food intake"[Title/Abstract] OR "healthy eating"[Title/Abstract] OR nutrition*[Title/Abstract] OR fruit*[Title/Abstract] OR vegetable*[Title/Abstract] OR food* [Title/Abstract] OR "soft drink*"[Title/Abstract] OR

	soda[Title/Abstract] OR sweetened [Title/Abstract] OR sugar*[Title/Abstract] OR smok*[Title/Abstract] OR "smoking cessation*" [Title/Abstract] OR tobacco[Title/Abstract] OR cigarette[Title/Abstract] OR nicotine[Title/Abstract] OR vape*[Title/Abstract] OR "vaping"[Title/Abstract] OR "e-cig*"[Title/Abstract] OR "electronic cigarette"[Title/Abstract] OR pipe[Title/Abstract] OR cigar[Title/Abstract] OR hookah [Title/Abstract] OR alcohol*[Title/Abstract] OR drink*[Title/Abstract] OR drunk*[Title/Abstract] OR liquor*[Title/Abstract] OR intoxicat*[Title/Abstract])
24	Or/9-23
25	8 AND 24

Appendix 2.2: Aim 1 scoping review inclusion/exclusion criteria

Criteria	Include	Exclude
Full text available	Full text record available and legible	(E1) Full text article could not be located, no longer available
Year Published	2010 to 2021 (ok to include article accepted in 2009 if publication year was 2010 or later)	(E2) Original study published before 2010 (even if update published 2010 or later)
Language	English	(E3) Non-English
Study Type	Empirical studies (and protocols): intervention studies (e.g., RCTs, quasi-experimental, etc.); observational studies (e.g., cohort, case-control, cross-sectional, case-crossover, ecologic, case series, case reports); qualitative studies (e.g., ethnography, qual case study); QI studies; evaluation studies Must pertain to humans; may be conducted in any country *Reviews (systematic, scoping), meta-analyses – must apply a health equity TMF to assess empirical studies included in the review (tag for hand search if applicable) Will keep grey literature sources if they make it into our search or are a source document for a TMF	(E4) Non-empirical studies (e.g., debate or commentary papers, editorials, letter to the editor), conference abstracts, clinicaltrials.gov or NIH Reporter project summaries (E4) Systematic or scoping review protocols; non-empirical review (no methods for lit searching/screening (E4) Study of animals, cells, or other non-human subjects (E6) Review studies that do not apply a health equity-relevant TMF in assessing, classifying, coding, or analyzing empirical studies included in the review (tag for hand search of references from the review sample if the review is otherwise relevant)
Chronic Disease	Primary, secondary, or tertiary prevention, maintenance, treatment, or survivorship in any of these conditions: **heart disease, cancer, chronic lung disease, stroke, Alzheimer's, diabetes, chronic kidney condition, obesity** Allostatic load eligible if AL indicators are relevant to chronic disease (e.g., BMI, blood pressure) Risk/prevention topics: **physical activity, diet/ nutrition, alcohol use, tobacco use**; include even	(E5) Any non-health related topic (e.g., management practices in tech firms, environmental sustainability study that does not mention human health) (E5) Condition not on CDC chronic disease list and not paired with a condition on the list (e.g., standalone studies of HIV/AIDS, multiple sclerosis, osteoporosis, depression, mental wellbeing)

	if not referenced in connection to a specific chronic disease listed above. Primary prevention can include environments or resources related to these topics/ behaviors (e.g., food insecurity, food environment, walkability, etc.) Include across lifespan from birth to end of life (e.g., breastfeeding in context of chronic disease prevention) Include other conditions not listed above if studied in conjunction with eligible chronic disease or prevention topic (e.g., HIV/AIDS and heart disease; diet/nutrition, obesity, and depression). This includes other outcomes within a population that has a chronic disease (e.g., quality of life in cancer survivors, depression among people with diabetes).	(E5) Prevention topic other than the four listed (e.g., sun protection, safe needle exchange, access to dental care) (E5) Allostatic load or other indicators of chronic inflammation, stress, etc. not explicitly linked to relevant CD (e.g., AL measured on an emotional stress scale)
Health Equity	Authors may communicate **intentionality** to study health equity in one or more ways: • Using key search terms in a context relevant to health (e.g., equity, justice, social determinants, racism) • Equity-relevant aims/hypotheses/research questions (e.g., evaluating the impact of a nutrition policy to improve equitable access to healthy school meals) • Involving affected communities to redistribute power more fairly (e.g., advocacy groups, neighborhood residents involved in obesity prevention study design and execution) • Intervening to eliminate or overcome social or structural barriers to better health (e.g., multi-level intervention to improve accessibility of physical environment for people with mobility limitations) • Targeting an intervention towards a historically marginalized population and designing/adapting it to meet their needs/preferences (e.g., adapting a cancer screening program to improve access, linguistic and cultural concordance among rural migrant farmworkers) • Studying disparities affecting a historically marginalized population and a structural determinant of the disparity (e.g., education	(E7) Relevant terms used in a different context (e.g., discrimination in measures) (E7) Eligible chronic disease or prevention topic *without* a health equity focus (E7) Equity mentioned in secondary nature (e.g., health equity implications only in mentioned as future directions) (E8) Study within a historically marginalized population *without* consideration of health equity or related concepts (e.g., scale out of a cancer screening intervention tested in a high SES suburban population to a rural migrant farmworker population without adapting to better fit needs) (E8) Phase 1 disparities studies that do not consider potential or known causes (e.g., diabetes prevalence by race/ethnicity stratified by SES, *without* assessing causes of disparities, such as racial residential segregation or discrimination) (E8) Disparities studies that examine individual-level manifestations of a structural cause of inequity (e.g., correlating individual educational attainment with asthma disparities in Black vs. white populations)

	policy examined as a potential cause of asthma disparities in Black vs. white populations)	
Health equity framework or model (full text only)	Study describes or visually displays (via table, figure, or image) a TMF that includes constructs related to health equity AND clearly uses the health equity TMF (as a whole, or selected constructs), described explicitly by the authors or readily apparent in the paper. May include applications in the: • study aims, objectives, or research questions • identification of intervention target, selection of an intervention, design of intervention components • identification of target population and sampling • co-creation of interventions or research studies with impacted communities • identification of equity-relevant contextual determinants (barriers/facilitators) • selection of equity-relevant objectives, metrics, measures, or outcomes • development of interview guide, survey, or other data collection tool • guide data analysis, organization and interpretation of findings TMF can be from previous literature (named and cited) or developed by the current paper's authors (including study-specific logic models). Author-developed TMF must be guided by cited theoretical or empirical literature	(E6) No TMF referenced; term used in a different way (e.g., statistical model; framework refers to clinical practice guidelines; practice "model" as a way of organizing clinical care or public health practice, not conceptual/ theoretical guidance; grounded theory, framework analysis) (E6) Authors use an existing measurement tool (e.g., survey, interview guide, observational or archival rating or extraction tool) as guidance, but do not explicitly reference a TMF upon which the measure is based (E9) TMF referenced, but not clearly operationalized in study aims, intervention components, sampling, measurement, selected outcomes, etc. (mentioning TMF once in passing in intro/discussion is not sufficient) (E9) TMF not relevant to equity or related concepts; a non-health equity framework without equity-relevant operationalization (e.g., biological mechanisms, individual-level cognitions, behaviors, etc., factors beyond the individual not relevant to equity or a related concept from search terms or definitions table) (E9) authors do not cite theoretical or empirical literature for a TMF created for their study (not clear if/what existing sources informed creation of a new or study-specific TMF)

Note: parenthetical "E" with a number in the exclude column indicate the exclusion code an ineligible article was tagged with at full text review to identify reasons for exclusion for PRISMA reporting.

Appendix 2.3: Aim 1 data extraction codebook

Variable	Description	Data entry options	Example
Section 1: Study bibliometric information			
1. Author	Last name of the first author	Free text (copy & paste)	*Smith*
2. Year	Year of article publication	Free text (copy & paste)	*2018*
3. Journal	Name of the journal in which the article is published	Free text (copy & paste)	*JAMA*
Section 2: Study context and design			
4. Setting	Select all applicable type of setting(s) in which study is conducted, i.e., where the study activities take place (e.g., location of participant recruitment, intervention delivery and/or data collection. If a study is conducted in multiple sites but a single location type (e.g., primary care + specialty clinic), select a single location category. If study is conducted in multiple location types, select all that apply (e.g., recruitment at community health fairs, grocery stores, and churches + intervention delivered at a local health department and mobile mammography van = community + public health agency). Note, this is not necessarily the type of organization running the study/intervention (e.g., a health department offering a health fair in a park or community recreation center would be coded as community, not public health agency).	Select all that apply (checkbox): • Clinical (e.g., primary care, hospital, pharmacy) • Community (e.g., parks, schools, workplaces, religious organizations, homes, community-based organizations/non-profits) • Public health agency (local or state health depts, ministries of health) • Government (e.g., state legislature, city council) • Remote/virtual (e.g., telephone, telehealth, videoconference, text message) • Other (specify with free text; e.g., extension offices, unsure of the organization type)	☑ *Community* ☑ *Public health agency*
5. Country	Country(ies) where the study takes place (i.e., where intervention was/will be delivered, where population of interest lives). If >5 countries, aggregate to the continent. If multiple continents represented, type each continent	Free text (copy & paste, text entry) (e.g., Germany, France, Austria, Italy, Spain, Portugal = Europe; Canada, US, Mexico, Brazil, Argentina, Chile = North America, South America)	*US;* *Europe*
6. Study methodology	Select whether the study was quantitative, qualitative, or mixed methods. Even if description of	Select one (radio button): • Quantitative • Qualitative	⊗ *Mixed methods*

	qual and quat integration is poor, if a study clearly uses both, select mixed methods.	• Mixed methods	
7. Study design	Select the design that best describes the approach used in the study. *If the article is a protocol paper (i.e., prospectively described study activities but does not report results, or results are only related to processes as opposed to outcomes of interested described in the methods), select "protocol" and then the appropriate study design.* Otherwise, only select a single study design.	Select all that apply (checkbox): • Protocol • Randomized trial (e.g., RCT, multi-factorial RCT) • Non-randomized trial (e.g., quasi-experimental, two arm pre-post) • Observational longitudinal (no intervention, data collected at multiple time points e.g., cohort study, ethnographic study) • Observational cross-sectional (no intervention, data collected one time, e.g., focus group or survey study, formative evaluation) • Case study (more descriptive, narrative reporting, often of lessons learned; less formal structure in methods; may pertain to a specific organization or intervention) • Other (specify with free text)	☑ *Protocol* ☑ *Randomized trial*
8. Data collection methods	Method(s)/instrument(s) used to collect data. Notes: "Objective measure" refers to primary data collection by study team (e.g., RA directly measures participant's weight, data from accelerometry device provided to the participant for the study. If weight was obtained from the EHR, this would be coded as archival). If a standardized survey is administered verbally (interview style), we will code this as self-report survey. Interviews are intended to be less formally structured, more flexible qualitative	Select all that apply (checkbox): • Observational (e.g., observation checklist) • Objective measure (quantifiable info directly collected by the study team e.g., weight, A1C) • Self-report survey (structured questionnaire, administered verbally or pen/paper, electronic)	☑ *Self-report survey* ☑ *Self-report interview or focus group*

	instruments. Look for descriptions of the items and administration methods if uncertain.	• Self-report interview or focus group (qualitative; semi-structured or unstructured) • Archival (e.g., policy document analysis, claims data, EHR data) • Other (specify with free text)	
9. Chronic disease topic	Indicate main chronic conditions and/or prevention topics of interest. To decide on what to code, look at the aims/objectives (what is the intent of the study), the measures/data collection (what chronic disease-related data are collected), and primary outcomes (what are the main outcomes of interest). Don't code for topics that are discussed broadly in the intro/background (e.g., intro may make the case diet is important because it is related to several chronic disease outcomes, but then aims indicate focus on diabetes – code diet & diabetes, not all the other diseases mentioned).	Select all that apply (checkbox): • Alcohol use • Diet/nutrition • Physical activity • Tobacco use • Alzheimer's • Cancer • Chronic kidney disease • Chronic lung disease (e.g., COPD, asthma) • Diabetes • Heart disease (e.g., heart attack, coronary heart disease, heart failure) • Obesity • Stroke	☑ *Diet/nutrition* ☑ *Diabetes*
10. Prevention/ control spectrum	Select the area(s) of focus along the prevention and control continuum. Primary prevention can include individual behaviors (e.g., smoking, exercise) or environmental factors (e.g., secondhand smoke exposure, active transit infrastructure). Articles may focus on prevention factors (e.g., diet, physical activity) broadly without a specific disease focus (code as primary prevention). Studies seeking to screen for and detect specific diseases (particularly to treat early and improve outcomes) or to prevent an existing disease from	Select all that apply (checkbox): • **Primary prevention** prevent disease before it develops (e.g., promote healthy eating & change food environment to prevent obesity in a population that does not have obesity) • **Surveillance** monitoring of disease incidence/ prevalence in a population, examining population trends over time at county, state, or other level **Secondary/tertiary prevention &**	☑ *Secondary/tertiary prevention & treatment*

	worsening will be coded in the new combined category for secondary/tertiary prevention and treatment. Surveillance should be coded for population level monitoring of diseases or risk factors, not longitudinal data collection within a specific study sample (look for large population-based surveys such as BRFSS, NHANES, etc.) Survivorship may seek to prevent one chronic disease in a population that has survived another chronic disease (e.g., cancer survivors are at higher risk of heart disease due to late effects of chemo) or may also include people in recovery for a behavior or condition related to any eligible risk factor (e.g., physical activity promotion among people in recovery from substance use or eating disorder).	**treatment** Disease screening/early detection of a disease (e.g., blood pressure monitoring, cancer screening), management of an existing disease to prevent further morbidity (e.g., diabetes self- maintenance through medication and diet), or intervention to cure/remove disease or treat acute effects (e.g., chemo for cancer, gastric bypass surgery for obesity) **Survivorship/Recovery/Rehabilitation** (monitoring & treatment of long-term disease effects (e.g., rehabilitation for stroke recovery, monitoring of late effects of chemo treatment among cancer survivors); may not be applicable to all chronic diseases)	
11. Intervention	If an intervention is delivered (or planned if a protocol paper), enter the name of the intervention if it has a title, or a brief description of the intervention if not formally named. Enter "0" if no intervention (i.e., observational study).	Free text (copy & paste, text entry)	*Diabetes Prevention Program; Colorectal cancer screening; 0*
12. Outcome type	Indicate what type of outcome(s) the study seeks to assess or intervene upon. Look at the study aims/objectives/research questions, data collection in the methods section, and reporting of results to determine the outcomes of interest. We will <u>not</u> code for data that are collected only as demographic information or control variables (e.g., patient education and insurance status used only as control variables in a model testing intervention effects). Implementation outcomes are those defined by Proctor et al.'s Implementation Outcomes	Select all that apply (checkbox): • **Determinants** may be assessed at one or more levels, often in qualitative studies (i.e., barriers/facilitators or participant needs/assets; contextual factors that may influence intervention implementation, delivery, or participant outcomes) • **Implementation outcomes** (acceptability, adoption, appropriateness, cost, feasibility,	☑ *Determinants* ☑ *Participant health outcomes*

	Framework; studies may use these exact terms or synonyms **Determinants** should be coded when a study is observational and does not intervene to improve a health, implementation, or other type of outcome (e.g., if an intervention study activity includes creating community walking trails and a measured outcome includes number or miles of trails added, this would be coded as a structural outcome because the study intervened to modify the built environment; if the availability of walking trails was assessed qualitatively as an available resource to promote physical activity but the study did not modify the environment, this would be coded as a determinant). An intervention study may also assess determinants, but an observational study without an intervention will most likely not have other outcomes other than determinants.	fidelity, reach/penetration, sustainment/ maintenance; tests of effects of implementation strategies) • **Participant health outcomes:** assessed at the individual or group patient/community member/other recipient level. May include health behaviors (e.g., increased physical activity, reduced smoking), clinical indicators (e.g., Hba1c, blood pressure, BMI), or cognitive/attitudinal outcomes (e.g., knowledge and awareness of disease, intention to seek treatment) • **Service outcomes:** assessed at the service provider (e.g., clinician, public health practitioner, etc.) or organization level; May include provider knowledge/skill/attitudes (e.g., self-efficacy to deliver intervention, implicit biases); outcomes related to the provision of health-related services (e.g., quality, safety, accessibility, affordability) • **Structural outcomes:** assessed at the community, policy, or systems level; may include built environment changes (e.g., creating walking trails, improved safety of cycling lanes), big P public policies or small p institutional policies (e.g., # of policies adopted by a state government to promote healthy eating, change in tobacco retailer density)	

13. Equity related activities and outcomes	Copy short verbatim article text or type a brief summary describing any processes or outcomes related to health equity. Look at the study aims/research questions, study design and procedures in the methods section, and reporting of results to determine the equity relevance of study outcomes. Indicators may include use of equity related terms and definitions listed at the end of this document, in particular studies that seek to assess or intervene on SDOH, reduce disparities, use participatory methods (e.g., CBPR), strengths/asset-based work with a marginalized population. Apply a critical lens to how equity-related constructs are operationalized in the study. Also summarize instances of "equity threats" or sub-optimal application or examination of equity related components (e.g., lack of trust and stigma conceptualized as a personal attribute rather than acknowledging structural factors that contribute to these).	Free text (copy & paste, text entry) *limit to short phrases/sentences as much as possible to improve ease of data analysis & second reviewer burden. All studies should have some description; if not, this study is likely not a health equity-related study and should be flagged for exclusion	*Used CBPR; provided free cancer screening, transportation, and translation services; aimed to reduce cancer screening disparities between Black and white participants*
14. Target population age	Age group included in the study/targeted by intervention, typically indicated in inclusion/exclusion criteria in methods section. If no age in inclusion criteria, determine using ages reported in sample characteristics	Select one (radio button): • Children (age <18) • All adults (age 18+) • Younger adults (ages 18-65) • Older adults (ages 65+) • All ages (no limitation) • No age range specified • Other (specify with free text)	⊗ *Other (adults aged 40+)*
15. Sample characteristics	Characteristics of the participants included in the study (based on study eligibility criteria, intervention recipient population, communities or groups with whom needs assessment is conducted). This	Select all that apply (checkbox): • Asian • Black/African American • Hispanic or Latino/a	☑ *Hispanic or Latino/a* ☑ *Immigrant* ☑ *Low-income*

	extraction item is focused specifically on characteristics or attributes that may be marginalized in the study's social context. These will vary based on the context where the study takes place (e.g., a general population of Tanzanian citizens would not be a minoritized group in Tanzania, but would be in the US context on aspects such as race and immigration status). We will rely on the authors' description, particularly in instances where coders are unfamiliar with the context. Look for description in the in the methods (in particular, study sample characteristics, characteristics for which participants were sampled, or inclusion/exclusion criteria) and reported demographic characteristics (e.g., results table 1). **Consider intentions described in the methods (e.g., specific data collection for a certain population, development/ adaptation of materials for a particular population) **Brown article as an example of a paper where it would be appropriate to pull info from background (specific info about the community in which study is conducted)	• Indigenous population (e.g., Native American, Aboriginal) • Middle Eastern/North African • Other marginalized racial/ethnic group (e.g., "travellers" in Ireland) • Marginalized religious groups (e.g., Sikhs in India) • Physical or mental disability status • Low SES/low wealth/limited resource access • Low-income (e.g., income requirements) • Low educational attainment • Low literacy • Limited language proficiency (in country's primary language, e.g., English in the US) • Uninsured • Rural • Urban/inner-city • Other disadvantaged geographic area/region (e.g., medically underserved area) • LGBTQ+ • Women • Immigrant (documented or undocumented) • Refugee • Incarcerated or formerly incarcerated • Unhoused/homeless • Other (specify with free text)	☑ *Rural*
Section 3: TMF characteristics + uses			

Note: if a study clearly applies multiple TMFs, we will have duplicate extraction spaces to extract information for each equity-relevant TMF used. See TMF Excel tracker in Box to identify Primary and secondary TMFs for each extraction. Primary TMF items will be listed in section 3, items 16-25 in Covidence. Secondary TMF(s) items will repeat in section 4 for up to two additional TMFs.			
16. Primary TMF Name	Title of TMF if named; if unnamed, use author last name, year, and brief description. Enter the name from original source when applicable (if different from empiric use). To extract on a TMF, it is not sufficient to mention briefly in intro or discussion, must have clear use.	Free text (copy & paste)	*Smith 2018 SDOH framework*
17. TMF visual	Indicate whether a visual depiction of the TMF is available (e.g., a figure, image, or table). If available, select the response with the source (i.e., visual is in the empirical article or a cited source article). If there is a visual in both the empiric use and the source article, select both options. This item will repeat in Covidence to allow for coding multiple TMFs.	Select all that apply: • No visual • Yes (empiric article) • Yes (source article)	⊗ *Yes (empiric article)*
18. TMF source	Indicate whether the TMF used in the study is an **existing** TMF in the literature *used in its original form (as shown in the source article);* an **adaptation** of an existing TMF (authors explicitly state/describe a purposeful modification to an existing framework, e.g., adding new constructs, changing how relationships between constructs are depicted, added specific operationalization for a study such as adding chronic disease focus to an originally disease agnostic TMF); **combination** of 2+ TMFs into a single framework (authors explicitly state/describe intentional integration, not two frameworks used separately); or a **new TMF** developed for a study or intervention (e.g., intervention-specific logic model. articles with **new** TMFs will not cite a literature source for their TMF).	Select one (radio button): • Existing TMF • Adapted TMF • Combined TMF • New TMF • Other (specify; select this option if unable to tell the source and type "unsure")	⊗ *Adapted FM*

	If a TMF is not new, refer to cited source literature to determine whether the TMF is used as is, adapted, or combined.		
19. TMF generalizability	Select the option that best represents the level of generalizability of the TMF. **Broadly generalizable** = can be applied with no or minimal adaptation across many contexts (e.g., SEM, WHO CSDH framework). **Somewhat generalizable** = can be applied to multiple settings, populations, or health topics with some limitations or with a moderate amount of adaptation. **Specific** = constructs are specific to a particular setting, population, and/or condition, TMF may not apply to other topics (e.g., intervention-specific logic model)	Select one (radio button): • Broadly generalizable • Somewhat generalizable • Specific	⊗ *Broadly generalizable*
20. Equity-relevant constructs	List the construct(s) related to health equity identified in the TMF (these must appear in the TMF or in the description of the TMF components). Use the health equity terms and definitions and the end of this document. For existing, adapted, or combined TMFs, start with the empiric use article to locate information on TMF constructs, definitions, and relationships between constructs. For existing TMFs, refer to the source literature for additional info as needed. For adapted and combined TMFs, only extract supplemental info from cited source literature for constructs in the empiric use TMF that match the construct in the original TMF; if the empiric use added new constructs or changed existing constructs we will not pull info for these constructs from cited source literature.	Free text (copy & paste) Number the construct so it can be matched to the definition (if available) in the next extraction element. Code main/higher level constructs (see Cardarelli 2020 use of Getting to Equity Framework). If several sub-constructs are encompassed under a higher level heading, use these sub-constructs in the definition if no construct definitions are available in the empiric or source article. Do not code constructs that are not directly related to equity (i.e., could someone with little knowledge of the TMF readily see the construct is related to equity or does the construct need to be operationalized with a specific equity focus?)	*1. health equity; 2. economic resources; 3. community capacity*

<table>
<tr><td>21. Health equity definition</td><td>Copy the definition of health equity related term(s) extracted from the TMF in item 20 above. This may be defined in the empiric use article or in a development article or other supplemental material.</td><td>Free text (copy & paste)
Number the definition(s) using the same number as the corresponding construct extracted in #20. Enter “NA” for any undefined constructs. Leave blank if no constructs are defined.</td><td>1. Health equity includes fair access to opportunities for optimal health and well-being; 2. NA; 3. NA</td></tr>
<tr><td>22. Relationship between constructs</td><td>Indicate the type(s) of relationships depicted between constructs in the TMF. TMFs may include multiple types of relationships between constructs, or may not show relationships between all constructs (e.g., table or list of constructs with no visualization or text description of how they are related to each other). Can use images when available and/or author descriptions of relationships between constructs.</td><td>Select all that apply (checkbox):
• No relationship indicated (e.g., list of constructs, no visual, text description only)
• Linear (i.e., directed, ordered sequence, such as a step-by-step process with a clear start and end; directional causal model)
• Cyclical (i.e., continuous process, often depicted in the shape of a circle)
• Nested (i.e., constructs housed within larger groupings, such as socioecological framework)
• Complex (e.g., multiple feedback loops, as in causal loop diagrams)
• Multilevel (depicts relationships between constructs occurring a multiple levels)
• Other (specify with free text)</td><td>☑ Linear
☑ Multilevel</td></tr>
<tr><td>23. Socio-ecologic levels of TMF + Levels of empiric application</td><td>For each level, enter “y” for yes and “n” for no. Each cell will have a response.

Socioecologic level(s) depicted in the TMF, based on how the constructs are visualized and/or described in the TMF in the empiric use article, supplemented by the TMF source article, as applicable.</td><td colspan="2">Matrix table (code “y” or “n” in each cell)

<table><tr><th>Socioecologic level(s)</th></tr><tr><td>Intrapersonal (internal cognitions, personal attribute)</td></tr><tr><td>Interpersonal (interactions between individuals or groups of people)</td></tr></table></td></tr>
</table>

	Levels of empiric application refers to which level(s) were operationalized in the study activities and outcomes. Look at the level(s) for the primary variables of interest, the level(s) at which an intervention operates. For example, if a study examines barriers to healthy eating related to individual behaviors, household conditions, local resources, and state-level policies, code "y" for intrapersonal, interpersonal (household), community, and policy; code "n" for organization and system)	**Organization** (e.g., hospital, school) **Community** (e.g., neighborhood, collection of people based on attribute) **System** (e.g., multiple clinics & payors in a healthcare system; broader society) **Policy** (e.g., national child nutrition policy, tobacco regulations set by state legislature)	
24. TMF applications	Indicate how the TMF is applied in the study. This may appear in multiple places throughout the text, but most likely described in greatest detail in the methods. Only code uses that have a clear application, either in the text description (authors clearly state use of TMF, e.g., "our study aims to test the relationship between discrimination and poor cardiovascular health outcomes indicated in the XYZ theory.") or obvious use of TMF constructs in the study (e.g., SDOH constructs listed as variables of interest in a measures table, results sections organized by SDOH category)	Select all that apply (checkbox): • **Inform research questions**, aims, hypotheses, etc. (e.g., aims to test relationships between constructs from TMF) • **Inform intervention selection** (e.g., policy has highest level of influence in TMF, which authors use to justify policy intervention vs. alternative) • **Guide intervention design or adaptation** (e.g., intervention includes components from TMF, adaptation process follows steps from TMF) • Identification, **sampling, or recruitment** of focus population (e.g., disparities TMF used to identify population characteristics, follow process model for recruitment of under-represented groups) • **Selection of variables** (e.g., outcomes selected from SDOH framework) • **Measurement** (e.g., TMF informs interview guide development, used to	☑ *Inform research questions* ☑ *Selection of variables* ☑ *Measurement* ☑ *Interpretation of findings*

		define reduction in health disparities assessed through archival data) • **Interpretation of findings** (e.g., qualitative results grouped by TMF constructs, TMF concepts used to explain observed causal relationships between variables) • **Other** (specify with free text)	
25. TMF Applications to IS	Coder reflection/notes on potential applications to implementation science (IS). Indicators may include TMF applications to beyond individual level, consideration of contextual factors that may influence implementation, primary or secondary outcomes related to implementation (as opposed to intervention development or testing effectiveness to change health outcomes). **Can add notes about the context in which framework is developed, applied (e.g., employed in a CBPR study, community-academic partnership)	*Free text (copy & paste relevant text as needed + type reflections)* For consensus, copy both reviewers responses (or if only one reviewer leaves a comment, default to this response for consensus)	

Appendix B: Chapter 3 (Aim 2) Appendix materials

Appendix 3.1 Equity-focused implementation strategies resource guide draft version 1 (Note: This contains the resource content, but does not include original formatting to conserve space. References are integrated into the overall references section for this dissertation)

Equity-focused implementation strategies resource guide

Introduction

The purpose of this guide is to aid implementation researchers in designing and tailoring equity-focused implementation strategies. This guide is intended for users with a foundational understanding of implementation science who may have varying levels of expertise and experience conducting equity-focused implementation work. This resource is informed by existing recommendations in the implementation science literature for selecting, tailoring, and specifying implementation strategies, as well as health equity literature from public health and various social sciences. This resource is not a comprehensive guide, rather should be paired with existing literature, tools, materials, and other resources. This resource is presented as an editable document so that users can add notes, record responses, and annotate as useful.

Section 1 of this document includes guiding terms and definitions related to health equity, as well as a brief bibliography of key literature and other resources.

Section 2 offers guidance around integrating a health equity focus into implementation strategies. This section includes a brainstorming tool with a set of prompts that investigators and research teams can use in considering equity-focused components of implementation strategies.

Section 3 contains case examples illustrating how the brainstorming prompts may be used to design new equity-focused implementation strategies or tailor existing implementation strategies through an equity lens.

This resource was developed by Callie Walsh-Bailey, Public Health Sciences PhD Candidate at Washington University in St. Louis, with support from the National Cancer Institute (3R01CA262325-02S1). The viewpoint expressed is the author's own and does not represent that of the National Institutes of Health.

Section 1: Guiding terms and definitions

Health equity is increasingly receiving greater attention in implementation science. Table 1 includes common terms and definitions related to health equity. There are varying definitions of the terms, and this is not an exhaustive list of concepts related to health equity. The bibliography in this section lists

key literature and existing open-access resources to learn more about health equity and equity-focused implementation science.

Table 1: Health equity and related terms and definitions

Term	Definition
Equity	The state, quality, or ideal of being just, impartial, and fair. Equity means recognizing that we do not all start from the same place and is an ongoing process that requires us to identify and overcome intentional and unintentional conditions arising systemic structures and biases.[43,45]
Health Equity	"…The assurance of the conditions for optimal health for all people. Achieving health equity requires valuing all individuals and populations equally, recognizing and rectifying historical injustices, and providing resources according to need. Health disparities will be eliminated when health equity is achieved." Health equity is a process that involves "active inputs, constant vigilance, and continuous correction."[43] "Everyone has a fair and just opportunity to be as healthy as possible. This requires removing obstacles to health such as poverty, discrimination, and their consequences, including [disenfranchisement] and lack of access to good jobs with fair pay, quality education and housing, safe environments, and health care." For the purposes of measurement, health equity means reducing and ultimately eliminating disparities in health and determinants that adversely affect marginalized groups.[116]
Health Disparities/ Inequalities	Sometimes used interchangeably, these terms refer to potentially avoidable health differences closely linked with economic, social, or environmental disadvantage. May be used as a metric for measuring progress towards achieving health equity, but are not synonymous with health equity.[115]
Social Determinants of Health (SDOH)	"The conditions in which people are born, grow, live, work and age, which are shaped by the distribution of money, power and resources."[39] "The contexts of our lives; determinants of health outside of the individual, beyond individual behaviors and individual genetic endowment. These contexts are not randomly distributed, they are shaped by historical injustices and contemporary structural factors that perpetuate the historical injustices."[41]
Structural Determinants of Health	"Social processes underlying the unequal distribution of factors [that promote or undermine health] between groups occupying unequal positions in society…" Refers to the "interplay between the socioeconomic-political context, structural mechanisms generating social stratification and the resulting socioeconomic position of individuals"; also referred to as "root causes of inequities."[39]
Health Related Social Risks	Specific adverse social conditions that are associated with poor health; individual-level adverse social determinant of health.[321]
Marginalization and Historically Marginalized Populations	Marginalization occurs when "persons are peripheralized based on their identities, associations, experiences, and environment."[322] Marginalization is context-dependent, may shift over time or by place, and is experienced in different ways by varying intersecting identities. The following is a non-exhaustive list of characteristics that may be subjected to marginalization from structural forces of discrimination and exclusion: race, ethnicity, gender identity, sexual orientation, socioeconomic status (SES) or position, housing status, geographic region, physical or mental ability, nationality, immigration status, language, literacy, religion, currently or formerly incarcerated people.[27,28,43,87,322-325]

Equitable implementation	Equitable implementation can be thought of as a process of selecting, adapting, and promoting the uptake and sustained use of beneficial interventions in a way that embraces and integrates principles of social justice, empowerment, liberation, and engagement. Equitable implementation occurs when strong equity components—including explicit attention to the culture, history, values, assets, and needs of the community—are integrated into the principles, strategies, frameworks, and tools of implementation science.[45]

Selected health equity literature: Theories, frameworks, methods, and measures

[87]Bowleg L. The problem with the phrase women and minorities: intersectionality-an important theoretical framework for public health. *American Journal of Public Health*. 2012;102(7):1267-73. doi: 10.2105/ AJPH.2012.300750

[99]Dover DC, Belon AP. The health equity measurement framework: a comprehensive model to measure social inequities in health. *International Journal for Equity in Health*. 2019;18(1):36. doi: 10.1186/s12939-019-0935-0.

[38]Ford CL, Airhihenbuwa CO. The public health critical race methodology: praxis for antiracism research. *Social Science & Medicine*. 2010;71(8):1390-8. doi: 10.1016/j.socscimed.2010.07.030.

[100]Givens ML, Catlin BB, Johnson SP, et al. What do we know about the drivers of health and equity? a narrative review of graphic representations. *Health Equity*. 2020;4(1):446-62. doi: 10.1089/heq.2020.0013.

[326]Harris P, Baum F, Friel S, et al. A glossary of theories for understanding power and policy for health equity. *Journal of Epidemiology and Community Health.* 2020;74:548-52. doi: 10.1136/jech-2019-213692.

[327]Hogan V, Rowley DL, White SB, Faustin Y. Dimensionality and R4P: A Health Equity Framework for Research Planning and Evaluation in African American Populations. *Maternal and Child Health Journal*. 2018;22(2):147-53. doi: 10.1007/s10995-017-2411-z.

[48]Jones, CP. Levels of Racism: A Theoretic Framework and a Gardener's Tale. *American Journal of Public Health*. 2000;90:1212-15. doi: 10.2105/ajph.90.8.1212

[214]Krieger N. Methods for the Scientific Study of Discrimination and Health: An Ecosocial Approach. *American Journal of Public Health*. 2012;102:936-45. doi: 10.2105/AJPH.2011.300544

[246]Krieger N. Measures of racism, sexism, heterosexism, and gender binarism for health equity research: from structural injustice to embodied harm-an ecosocial analysis. Annual Review of Public Health. 2020;41:37-62. doi: 10.1146/annurev-publhealth-040119-094017.

[5]Lett E, Adekunle D, McMurray P, et al. Health equity tourism: ravaging the justice landscape. *Journal of Medical Systems*. 2022;46(3):17. doi: 10.1007/s10916-022-01803-5.

[49]Liburd LC, Hall JE, Mpofu JJ, et al. Addressing health equity in public health practice: frameworks, promising strategies, and measurement considerations. *Annual Review of Public Health.* 2020;41:417-32. doi: 10.1146/annurev-publhealth-040119-094119

[328]Peterson A, Charles V, Yeung D, Coyle K. The Health Equity Framework: A science- and justice-based model for public health researchers and practitioners. *Health Promotion Practice.* 2020;22(6):741-6. doi: 10.1177/ 1524839920950730.

[329]Reskin B. The Race Discrimination System. Annual Review of Sociology. 2012;38(1):17-35. doi: 10.1146/ annurev-soc-071811-145508.

[39]Solar O, Irwin A. A conceptual framework for action on the social determinants of health. Social Determinants of Health Discussion Paper 2 (Policy and Practice). 2010. World Health Organization. Available from: https://www.who.int/publications/i/item/9789241500852

Equity in Implementation Science Online Resources

Collaborative for Anti-Racist Dissemination & Implementation Science (CARDIS) Resources: https://www.cardis.info/some-resources

Columbia University Implementation Science Initiative/Columbia CTSA Readings on Anti-Racism and Health Equity: https://www.irvinginstitute.columbia.edu/file/5996/download?token=sy5IYl5A

Consortium for Cancer Implementation Science (CCIS) Advancing Health Equity through Implementation Science Bibliography: https://cancercontrol.cancer.gov/sites/default/files/2022-10/health_equity_and_implementation_science_bibliography_508.pdf

Dissemination and Implementation Models Webtool Section on Health Equity: https://dissemination-implementation.org/special-topics/health-equity/

Implementation Science Centers in Cancer Control (ISC3) Health Equity Toolkit: https://stg.iscentersincancercontrol.org/health-equity-toolkit/

Stanford Social Innovation Review Special Issue on Equity in Implementation Science: https://ssir.org/supplement/bringing_equity_to_implementation

The Center for Implementation (TCI) Equity Toolbox: https://thecenterforimplementation.com/toolbox

Section 2: Designing equity-focused implementation strategies

Implementation strategies are the methods, actions, approaches, or tools used to support the adoption, implementation, and sustainment of an evidence-based intervention. Various lists and taxonomies of implementation strategies exist, such as the Expert Recommendations for Implementing Change (ERIC) Taxonomy,[313,330] the Cochrane Effective Practice and Organization of Care (EPOC) taxonomy,[331] and the

Behavior Change Technique (BCT) taxonomy.[314] To promote replicability and learning across studies and settings, Proctor and colleagues suggest naming implementation strategies with a common label, such as those available from one of the aforementioned taxonomies, and offer guidance for specifying and reporting implementation strategies,[85] shown in Figure 1.

Figure 1: Recommendations for Specifying and Reporting Implementation Strategies for Replicability

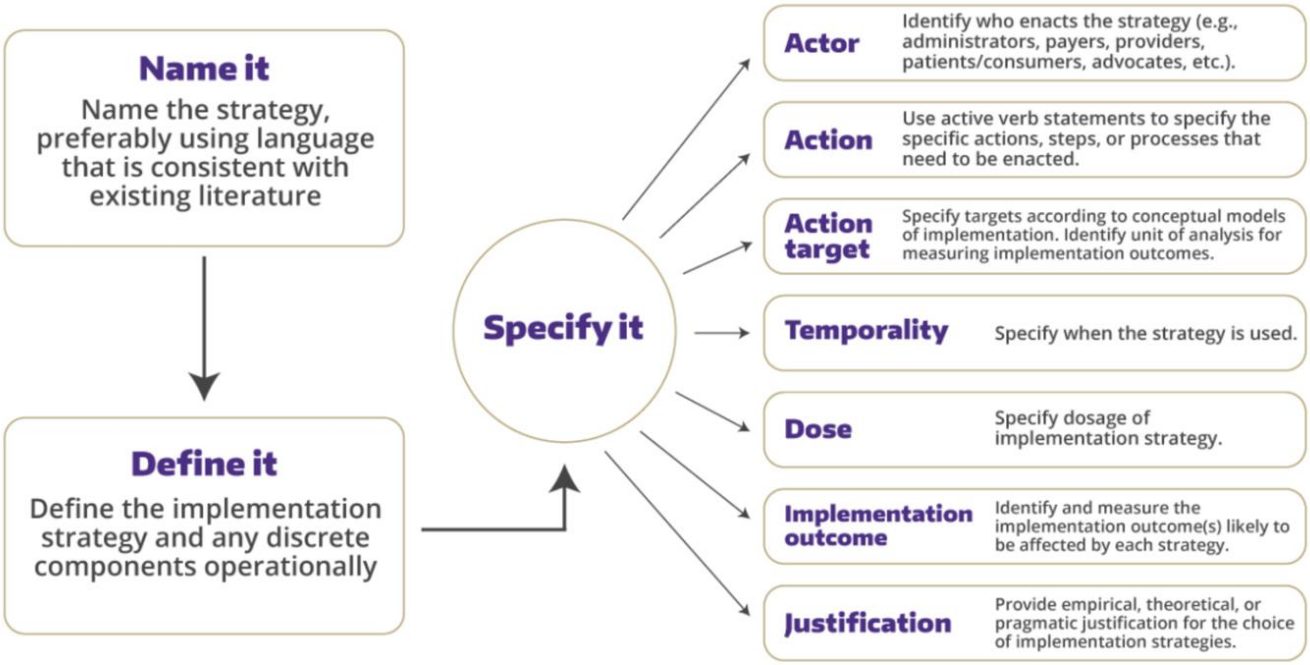


Figure credit: https://impsciuw.org/implementation-science/research/implementation-strategies/, Adapted from Proctor EK, Powell BJ, McMillen JC. Implementation strategies: Recommendations for specifying and reporting. Implement Sci. 2013;8(139).

It is recommended to match implementation strategies to determinants that hinder or support implementation (i.e., barriers or facilitators) to improve strategy effectiveness.[251,252,254] One strategy may target multiple determinants, or several strategies may be needed to sufficiently address a single determinant. To promote equitable implementation, determinants related to equitable implementation research and practice processes and health equity outcomes should be the focal target. Determinants frameworks and theories that include equity-related constructs can be useful in identifying and selecting key determinants to target with appropriate implementation strategies. This resource does not offer in depth guidance regarding the identification and selection of equity-relevant determinants. Readers may wish to use other existing resources to inform this step, such as those listed in Section 1.

Once key determinants influencing equitable implementation and health equity outcomes are identified, implementation researchers and their teams should select the implementation strategy(ies) intended to promote equitable implementation processes and outcomes. There are numerous methods for selecting implementation strategies; strategy selection should be informed by best available research evidence, conceptual guidance from relevant theories and frameworks, local data (such as that from a needs

assessment) and experiences and perspectives of key individuals and groups involved in or affected by the implementation activities.

Equity focused implementation strategy brainstorming

The brainstorming activity in this section is organized into two parts. The first part includes questions and considerations that do not fall within a single strategy component and impact overall implementation efforts. The second part includes brainstorming prompts to consider within each specific component of the implementation strategy. This brainstorming activity can be completed by an individual, or ideally by a team of collaborators representing diverse interests, lived and professional experiences, and perspectives.

Table 2 offers a brainstorming tool that implementation researchers and their collaborators can use to guide the inclusion of equity in the design and tailoring of their implementation strategies. The strategy components are organized by Proctor and colleagues' recommendations for specifying and reporting implementation strategies, with additional strategy components added. These are not an exhaustive list of considerations when integrating equity into the design and tailoring of implementation strategies. Rather, these are intended to serve as a starting place for identifying and making explicit how the implementation strategy design choices may relate to equitable implementation and to encourage careful thought about ways to strengthen the equity impact of selected implementation strategies.

For implementation efforts involving multiple sites or settings, consider how responses to the prompts vary. To compare across sites, you may wish to enter your responses for each site or group of sites within the same cell (e.g., Site A has XY resource; Site B has Z resource). For sites with different attributes and responses, this may point to opportunities to tailor the strategy to the local context.

Part 1: Overarching questions and considerations

The historical and current context surrounding implementation needs to be carefully considered and articulated from the onset of an implementation effort. This should be informed by a socio-ecological lens that considers multiple interconnected levels of influence, which can be guided by existing theories and frameworks listed in section 1. Multiple sources, such as scientific and non-scientific literature, news, existing data from local needs assessments and other sources, perspectives from collaborators and affected individuals and groups should be used to generate a holistic picture of the context. Researchers should reflect on the following questions:

- Who is directly or indirectly impacted by implementation (e.g., patients, program participants, community members, clinicians or other types of practitioners, direct supervisors, mid or upper-level leadership)?
- What are key attributes of the implementation setting(s) (i.e., key attributes of the setting, personnel)?
- What is known about the local context surrounding the implementation setting (e.g., nearby neighborhoods, municipality, or region)? Consider geography, built and natural environment, population demographics, and social, economic, and political contexts.
- What key events (ongoing, recent, or historic) may directly or indirectly impact implementation (e.g., natural disasters, disease outbreak, social movements, elections, legal or regulatory actions, etc.)

- What assumptions does the researcher/research team have about the implementation effort (including of the evidence-based intervention, the determinants influencing implementation, the people, groups, organizations, and settings involved in implementation, and the impacts of implementation)?

Part 2: Implementation strategy brainstorming

Instructions:
Apply the prompts in table 2 to tailor an existing implementation strategy through an equity lens, or to design an equity-focused implementation strategy. You may choose to start in any order that is helpful, the strategy components do not have to follow a specific sequence.

1. Name and define each discrete implementation strategy. For each discrete strategy, complete the following:
2. Specify the starting components of the implementation strategy.
    - If starting with an existing implementation strategy (i.e., a strategy that has already been designed), first specify the each of the components of the selected strategy in the "starting strategy component" box.
    - If starting with the initial design of an implementation strategy, consider the potential specification of each component and enter the option(s) into the corresponding "starting strategy component" box.
3. Think through the brainstorming prompts for each component and enter your ideas in the corresponding "response" box.
4. Consider options for re-designing the strategy component to improve its equity impact (i.e., to promote greater equity in implementation processes or outcomes, to avoid potential negative consequences). If an existing strategy component is not believed to have negative equity-related consequences or is believed to be optimized for equity in its current state compared to viable alternatives, record this decision in the "revised strategy component" box.

For each discrete implementation strategy in your project, name and define the strategy.

Strategy name: _____

Strategy Definition:
_____

Table 2: Brainstorming prompts for equity-focused strategy design and tailoring

Strategy Component	Starting strategy component	Brainstorming Prompt	Response	Revised strategy component
Actor (who delivers strategy)		Consider the social position of actors and recipients (in their organization, community, broader society) • To what extent is equity valued and actively promoted by actors and recipients? • What is the power differential between actors and recipients? How can power be more fairly distributed? • What level of trust do recipients have of actors delivering the strategy? Who do recipients trust?		
Action (steps, actions to do the strategy)		• Which actions place undue burden on any actors or recipients? How? • What existing resources or capabilities can be leveraged to enact the strategy? Does using these deplete them for use for other purposes? • What additional components are needed to better serve marginalized settings and groups? (e.g., cultural humility, advocacy, trust building)		
Modality* (what method(s) will be used to deliver the strategy)		Consider location of strategy delivery (physical or virtual space) and written, audio, visual, or other types of materials used to deliver the strategy. • To what extent are recipients able to engage with the selected modality? • How does the modality take into consideration the abilities of recipients and potential accommodations?		
Action target (who and what the strategy seeks to change)		• How do current and historic social, economic, and political structural determinants influence implementation? • What is the equity relevance of the action targets?		

		• How does the strategy create or impede opportunities for fair and equitable access to resources and supports needed for change?		
Temporality (when the strategy is used)		• When is the strategy delivered? How does this timing relate to other key events and processes? How might the strategy affect these events and processes? • Should the strategy be sustained over time (or does it have a discrete start and end)? If necessary, how can its sustainment be ensured? • Does the timing of measurement of the strategy's effects detect short- or long-term change?		
Dose (the intensity or how much of the strategy is delivered)		• How might the dose of the strategy place undue burden on actors or recipients? • How might reducing or increasing the dose impact equity?		
Outcomes* (what implementation, service, or other outcomes is the strategy likely to impact)		• What are the potential unintended consequences (positive or negative) of this strategy? • To whom are the outcomes important? • What other outcomes may be important to underrepresented interests?		
Justification (empirical, theoretical, or practical rationale for selecting this strategy)		• How are underrepresented or marginalized perspectives considered? • What does available empirical, theoretical, or practical information suggest about the strategy's impact on equitable implementation processes and outcomes?		
Measurement* (what and how to measure to determine the strategy's effects)		• How does the target metric consider equity (e.g., quality of effort, magnitude of change, disparities in change)? • What measurement approaches are best suited to elicit information about equity impacts? • How are unintended consequences assessed?		

		• How do measures leverage existing strengths and capabilities? • How burdensome is the measurement approach and to whom?		

*indicates a strategy component that is modified or not listed in the Proctor et al. recommendations.

Section 3: Case examples (TO BE COMPLETED WITH USER-GENERATED DATA)

- Case examples of applying brainstorming prompts
    - Process (summary of user testing & study applications)

Appendix 3.2: User testing interview guide and survey (intro section removed for space)

Part 1
To start, I will ask you a few questions about how you think about health equity in your work.

1. Can you please describe the ways in which health equity shows up in your implementation research?
   Probes
   a. *What populations do you work with? What are some of the disparities or inequities these populations experience?*
   b. *What kinds of community or non-research collaborators you work with? How do you engage them in research?*
   c. *What outcomes do you hope to achieve that are related to health disparities or health equity?*

2. What are some challenges you face in conducting equity-focused implementation research?

3. What are some challenges you face in designing equity-focused implementation strategies?
   a. *In your work, how do equity-focused strategies look different from standard strategies?*
   b. *What do you need to do differently to design equity-focused implementation strategies?*

4. What tools or resources would help you in conducting equity-focused implementation research?
   a. *What resources exist that help you do this work? How do you use them?*
   b. *What resources would you like that you haven't found or haven't been created yet?*
   c. *What kind of information would be helpful to you?*
   d. *What would your ideal resource look like?*

Section 2:
I am going to ask for your input on the draft resource document. If you made annotations to the document I emailed you can share your screen, otherwise I can share mine. I will ask you to walk through the resource and verbalize your impressions as you go through each section. I am interested in your overall impressions, specific things you liked, disliked, found confusing, or think are missing. I will ask some probing questions if you go silent or to clarify your feedback.

5. Starting with the first section, please tell me what came to mind as you read this information?
   [Repeat probes for each section of resource]
   a. *What do you think about the information in this section? Was it helpful, irrelevant?*
   b. *What do you think about the level of detail – is it too much, too little, or just about right?*
   c. *How well is the information organized? Are there any pieces that should be re-ordered?*
   d. *How might you apply this information in your work? When would you use it?*

Section 3:
I would like you to think about a particular implementation strategy from your work. This can be from a completed or ongoing project. Can you walk me through how you would apply these probes to think about the components of that strategy?
6. What is the strategy?

7. Which strategy component is easiest to start with? (e.g., Actor, action, etc.)?

Probes

a. *How do these probes help you think differently about this strategy?*
b. *Are there any components of the strategy that might look different if you applied these probes? How would they look different?*
c. *What probes were easiest for you to answer? Which were hardest to answer?*
d. *Who would you need to engage to answer these questions?*

Wrap up

8. As I think about revising this resource guide, what recommendations do you have?
   Probes
   a. What content would you want to see in the final version?
   b. What could be cut out?
   c. What should be added that's missing?
   d. How would you like to see the information displayed?

9. Is there any other input or thoughts you would like to share that haven't come up yet?

Survey (Programmed into Zoom poll)

I am going to pull up Zoom poll with a few demographic items and brief questions about your overall impressions of the resource. This will help me get quantitative ratings that I can compare across participants. Please be as honest as possible and press submit when you are done.

1. Please enter the number of years you have worked in your field of research after receiving your terminal degree (text box for numeric entry)

2. Please select the response that best describes your gender identity
   - ☐ Woman
   - ☐ Man
   - ☐ Non-binary or gender fluid
   - ☐ Transgender woman
   - ☐ Transgender man
   - ☐ Prefer not to answer

3. Please select the response(s) that describe your racial and/or ethnic identity (select all that apply)
   - ☐American Indian or Alaska Native
   - ☐ Asian
   - ☐ Black or African American
   - ☐ Hispanic or Latino/a/x
   - ☐ Native Hawaiian or Other Pacific Islander
   - ☐ Middle Eastern or North African
   - ☐ White
   - ☐ Prefer not to answer

Usability rating items, adapted from Lyon et al.[266]

Please use the following scale to rate how much you agree with the statements below:	**Strongly Disagree** **1**	**Disagree** **2**	**Neither Agree nor Disagree** **3**	**Agree** **4**	**Strongly Agree** **5**
1. I think that I would like to use this resource frequently	1	2	3	4	5
2. I found the resource unnecessarily complex	1	2	3	4	5
3. I thought the resource was easy to use	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this resource	1	2	3	4	5
5. I found the various components of this resource were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this resource	1	2	3	4	5
7. I would imagine that most people would learn to use this resource very quickly	1	2	3	4	5
8. I found the resource very cumbersome to use	1	2	3	4	5
9. I felt very confident using this resource	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this resource	1	2	3	4	5

Scoring:

- For each of the **odd** numbered questions, **subtract 1 from the score.**
- For each of the **even** numbered questions, **subtract their value from 5.**
- Take these new values which you have found and add up the total score. Then **multiply this by 2.5**

Appendix 3.3 Revised Equity-focused implementation strategies resource guide draft
(Note: This contains the resource content, but does not include original formatting to conserve space. References are integrated into the overall references section for this dissertation)

Equity-focused implementation strategies resource guide

Introduction

Health equity is increasingly receiving greater attention in implementation science.[45,70,92,280,315,332] To realize the potential of implementation science to reduce health disparities and promote health equity, the field must integrate equity as a central focus within implementation science methods, measures, models and frameworks.[70,280,315] One key opportunity for explicit, intentional integration of equity is in the design and tailoring of implementation strategies.

The purpose of this resource is to aid implementation researchers in designing and tailoring equity-focused implementation strategies. This guide is intended for use by researchers who have a foundational understanding of implementation science with varying levels of experience conducting equity-focused research. This resource is informed by existing implementation science guidance for selecting, tailoring, and specifying implementation strategies, as well as health equity literature from various fields. This resource is not a comprehensive guide; it should be paired with existing literature, tools, and materials.

Contents

Section 1 includes guiding terms and definitions related to health equity, as well as a brief bibliography of key literature and other resources. The implementation science resources include existing collections of equity-focused implementation science literature, toolkits, and other materials.

Section 2 offers guidance around integrating a health equity focus into implementation strategies. This a brainstorming tool with a set of prompts and user tips that investigators and research teams can use in considering equity-focused components of implementation strategies.

Section 3 contains case examples illustrating applications of the brainstorming activity to design and specify equity-focused implementation strategies.

Section 4 provides the list of cited references used to create this resource.

This resource was developed by Callie Walsh-Bailey, Public Health Sciences/Dissemination and Implementation Science PhD Candidate at Washington University in St. Louis, with support from the National Cancer Institute (3R01CA262325-02S1). The viewpoint expressed is the author's own and does not represent that of the National Institutes of Health.

Section 1: Conceptualizing health equity

Table 1: **Terms and definitions related to health equity.** These terms offer a non-exhaustive list of concepts related to health equity used throughout this resource.

Term	Definition
Equity	The state, quality, or ideal of being just, impartial, and fair. Equity means recognizing that we do not all start from the same place, and is an ongoing process that requires us to identify and overcome conditions arising from systemic structures and biases.[43,45]
Health Equity	The assurance of the conditions for optimal health for all people, which requires valuing all individuals and populations equally, recognizing and rectifying historical and ongoing injustices, and providing resources according to need. **Health equity is a process** involving "active inputs, constant vigilance, and continuous correction."[43] Requires removing obstacles to health such as poverty, discrimination, and their consequences, including [disenfranchisement] and lack of access to good jobs with fair pay, quality education and housing, safe environments, and health care." Health equity means reducing and ultimately eliminating disparities in health and determinants adversely affecting marginalized groups.[116]
Health Inequity	Unfair, unjust, unnecessary, avoidable differences in health arising from systemic disadvantage of marginalized groups. Preferred term over disparity as inequity invokes fairness and justice.[53]
Health Disparity/ Inequality	Used interchangeably, these terms refer to potentially avoidable health differences linked with economic, social, or environmental disadvantage. Differ from health inequity in that they do not necessarily include fairness and justice in their conceptualization.[115,264]
Social Determinants of Health (SDOH)	The conditions in which people are born, grow, live, work and age; shaped by the distribution of money, power and resources.[321,333] The contexts of our lives; determinants of health beyond individual behaviors and genetic endowment. These contexts, not randomly distributed, are shaped by historical injustices and contemporary structural factors that perpetuate these injustices.[41]
Structural Determinants of Health	Social processes underlying the unequal distribution of factors that promote or undermine health between groups occupying unequal positions in society; the interaction between policies, socioeconomic context, structural mechanisms generating social stratification, and the resulting position of individuals in society; also referred to as "root causes of inequities."[334]
Health Related Social Risks	Specific adverse social conditions (e.g., XXX) that are associated with poor health; individual-level adverse social determinant of health.[321]
Marginalization and Marginalized Populations	Marginalization occurs when people are peripheralized based on their identities, associations, experiences, and environment.[322] Marginalization is context-dependent, may shift over time or by place, and is experienced in different ways by varying intersecting identities. The following characteristics, among others, may be subjected to marginalization from structural forces of discrimination and exclusion: race, ethnicity, gender identity, sexual orientation, socioeconomic status or position, housing status, geographic region, physical or mental ability, nationality, immigration status, language, literacy, religion, current or former incarceration.[27,28,43,87,322-325]
Equitable implementation	The process of selecting, adapting, and promoting the uptake and sustained use of beneficial interventions in a way that embraces and integrates principles of social justice, empowerment, self-determination, liberation, and community engagement and co-production. Equitable implementation occurs when "explicit attention to the culture, history, values, assets, and needs of the community—are integrated into the principles, strategies, frameworks, and tools of implementation science"[45] and when EBIs designed or adapted to promote equity and address inequities and their root causes are routinely implemented and appropriately sustained in settings serving marginalized populations.[280]

The concepts from Table 1 are further explained and operationalized in the selected health equity literature and implementation science resources listed below. The health equity literature offers

conceptual and practical guidance for defining and operationalizing health equity in research, including frameworks and measures.

Selected health equity literature

Conceptual articles

1. ***Discusses integration of intersectional perspective into research*** [87]Bowleg L. 2012. The problem with the phrase women and minorities: intersectionality-an important theoretical framework for public health

2. ***Cautions & guiding principles for conducting sustained, committed health equity research*** [5]Lett E, et al. 2022. Health equity tourism: ravaging the justice landscape

3. ***A systems perspective for conceptualizing race discrimination*** [329]Reskin B. 2012. The Race Discrimination System

4. ***Guidance for researchers to identify & understand their positionality*** [335]Darwin Holmes AG. 2020. Researcher Positionality – A Consideration of Its Influence and Place in Qualitative Research - A New Researcher Guide

5. ***Definitions & considerations in identifying researcher positionality*** [336]Manohar N, et al. 2019. Researcher positionality in cross-cultural and sensitive research

Theories, frameworks, measures & methods

6. ***Narrative review of health equity-related frameworks*** [100]Givens ML, et al. 2020. What do we know about the drivers of health and equity? a narrative review of graphic representations

7. ***Glossary of theories on health equity-related dynamics of power and policy*** [326]Harris P, et al. 2020. A glossary of theories for understanding power and policy for health equity

8. ***Narrative review of health equity-related concepts, frameworks, measures and metrics*** [49]Liburd LC, et al. 2020. Addressing health equity in public health practice: frameworks, promising strategies, and measurement considerations

9. ***Causal framework of multi-level factors affecting equitable health outcomes*** [99]Dover DC & Belon AP. 2019. The health equity measurement framework: a comprehensive model to measure social inequities in health

10. ***Multi-level science- and justice-based framework for promoting health equity*** [328]Peterson A, et al. 2020. The Health Equity Framework: A science- and justice-based model for public health researchers and practitioners

11. ***Framework and allegory for conceptualizing 3 levels of racism*** [48]Jones, CP. 2000. Levels of racism: a theoretic framework and a gardener's tale

12. ***Comprehensive social determinants of health framework with in-depth construct descriptions*** [334]Solar O & Irwin A. 2010. A conceptual framework for action on the social determinants of health

13. ***Model & iterative methodology of Public Health Critical Race Praxis*** [38]Ford CL & Airhihenbuwa CO. 2010. The public health critical race methodology: praxis for antiracism research

14. ***R4P action-oriented framework for health equity planning, evaluation, and research, with accompanying measure*** [327]Hogan V, et al. 2018. Dimensionality and R4P: A Health Equity Framework for Research Planning and Evaluation in African American Populations

15. ***Methodological considerations related assessing to discrimination and inequities, through an ecosocial lens*** [214]Krieger N. 2012. Methods for the scientific study of discrimination and health: an Ecosocial approach

16. ***Measurement approaches at multiple levels for health equity research*** [246]Krieger N. 2020. Measures of racism, sexism, heterosexism, and gender binarism for health equity research: from structural injustice to embodied harm-an ecosocial analysis

Equity in Implementation Science Online Resources

Existing repositories and toolkits that include bibliographies of equity-focused implementation science literature, guidance for equity-focused implementation research, and other materials.

17. ***Repository of readings, podcasts, and websites related to antiracism*** Collaborative for Anti-Racist Dissemination & Implementation Science (CARDIS) Resources: https://www.cardis.info/some-resources

18. ***Bibliography of health equity and antiracism articles, resources, and curricula*** Columbia University Implementation Science Initiative/Columbia CTSA Readings on Anti-Racism and Health Equity: https://www.irvinginstitute.columbia.edu/file/5996/download?token=sy5IYl5A

19. ***Annotated bibliography of health equity literature & resources.*** Consortium for Cancer Implementation Science (CCIS) Advancing Health Equity through Implementation Science Bibliography: https://cancercontrol. cancer.gov/sites/default/files/2022-10/health_equity_and_implementation_science_bibliography_508.pdf

20. ***Interactive webtool with frameworks and examples of health equity integration into D&I*** Dissemination and Implementation Models Webtool Section on Health Equity: https://dissemination-implementation.org/ special-topics/health-equity/

21. ***Introductory tool for integrating health equity into implementation research*** Implementation Science Centers in Cancer Control (ISC3) Health Equity Toolkit: https://stg.iscentersincancercontrol.org/health-equity-toolkit/

22. ***Collection of articles on equity in D&I*** Stanford Social Innovation Review Special Issue on Equity in Implementation Science: https://ssir.org/supplement/bringing_equity_to_implementation

23. ***Repository of videos, presentations, articles, and other equity focused D&I resources*** The Center for Implementation (TCI) Equity Toolbox: https://thecenterforimplementation.com/toolbox

24. ***Guide with tools, educational materials, and other resources for conducting engaged research*** University of Colorado Dissemination, Implementation, Communication, and Engagement (DICE) Stakeholder Engagement Navigator https://dicemethods.org/

Section 2: Designing equity-focused implementation strategies

Implementation strategies are methods, approaches, or tools used to support the adoption, implementation, and sustainment of an EBI. There are various lists of implementation strategies, such as the Expert Recommendations for Implementing Change (ERIC) Taxonomy,[313,330] the Cochrane Effective Practice and Organization of Care (EPOC) taxonomy,[331] and the Behavior Change Technique (BCT) taxonomy.[314]

To promote replicability and learning across studies and settings, Proctor et al. suggest naming strategies with a common label, such as those from one of the above taxonomies, and offer guidance for reporting implementation strategies. Strategies should be specified by each component (e.g., actor who enacts the strategy, the actions taken to enact the strategy, etc.; see Figure 1)[85]

Figure 1: Recommendations for Specifying and Reporting Implementation Strategies for Replicability

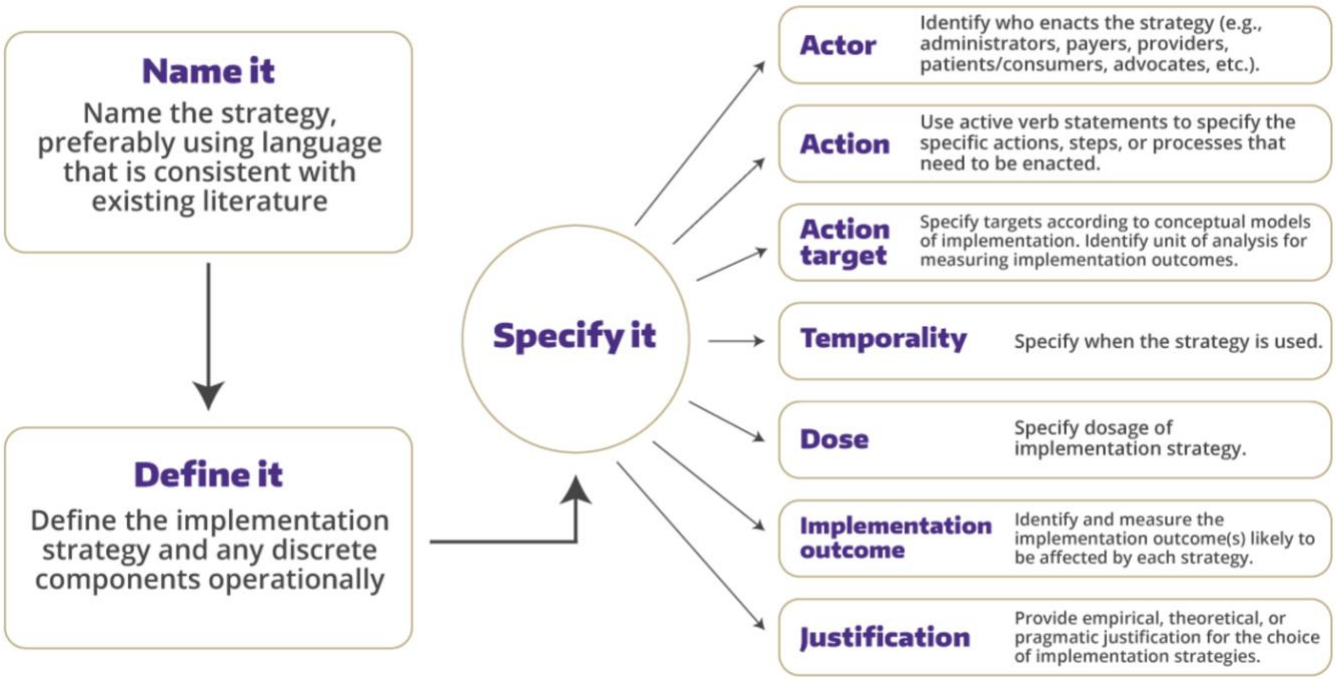


Figure credit: https://impsciuw.org/implementation-science/research/implementation-strategies/, Adapted from Proctor EK, Powell BJ, McMillen JC. Implementation strategies: Recommendations for specifying and reporting. Implement Sci. 2013;8(139).[85]

It is recommended to match implementation strategies to determinants that hinder or support implementation (i.e., barriers or facilitators).[251,252,254] One strategy may target multiple determinants, or several strategies may be needed to address one determinant. To promote equitable implementation, equity-related determinants (e.g., systematic racism, discriminatory policies, existing community assets) should be focal targets to consider and potentially modify through implementation strategies. Frameworks and theories that include equity-related constructs can be used to identify key determinants. This resource does not offer in depth guidance regarding the identification and selection of equity-relevant determinants; to inform this step, readers may wish to use resources listed in Section 1.

Once key equity-related determinants are identified, researchers and their teams, along with engagement with communities and affected recipients, should select the implementation strategy(ies) intended to promote equitable implementation processes and outcomes. There are numerous methods for selecting implementation strategies; strategy selection should be informed by best available research evidence, conceptual guidance from relevant theories and frameworks, local data (such as that from a needs assessment) and experiences and perspectives of individuals and groups involved in or affected by the implementation activities.

Equity focused implementation strategy brainstorming

This brainstorming activity can be completed by an individual, or ideally by a team of collaborators representing diverse interests, lived and professional experiences, and perspectives. Each team member should independently reflect on their positionality before working through the activity as a team (see articles #4 & #5 in Section 1)

The brainstorming activity is organized into two parts. Part 1 includes overarching questions and considerations that span implementation. Part 2 includes a table of brainstorming prompts (Table 2) organized by implementation strategy components. The strategy components are those identified in Proctor and colleagues' recommendations for specifying and reporting implementation strategies, with additional or revised components. This is a starting place for identifying and making explicit how strategy design choices may relate to equitable implementation and encourages careful thought about ways to strengthen the equity impact of selected implementation strategies.

Refer to section 3 for examples illustrating the completion of the brainstorming activity in table 2.

User tips and reflections:

- ★ An individual will likely be unable to answer all the questions alone, and a group will likely not agree on the answers to all of these questions. Teams can use this brainstorming activity to identify and learn from different perspectives.
- ★ Teams should establish communication and collaboration norms that promote psychological safety before engaging in this activity.
- ★ This activity will likely take multiple sessions to complete.
- ★ Users can take a stepwise or tiered approach. The first pass generates big picture ideas; the second pass focuses on how to operationalize these (i.e., how to practically carry out decisions).
- ★ This activity can be used to prospectively plan equity-focused implementation strategies, to tailor strategies throughout implementation to improve equity impacts or avoid negative consequences, or for retrospective assessment to learn and improve in future efforts.
- ★ Brainstorming can be completed multiple times at various points over the course of implementation as a reflexive exercise.

- ★ Users may want to start with the questions or strategy components that are easiest for them to answer, or over which they have the most control.

- ★ (Re)designing the strategy likely requires tradeoffs and it may not be possible to enact all revised strategy components. Consider which tradeoffs are likely to improve equity (how and for whom), and which could lead to negative consequences. There is no perfect solution, but this can raise awareness of issues to look for during implementation and can identify ideas about how to address these.

- ★ If multiple sites or settings are involved, consider how responses vary across sites. To compare across sites, you can enter your responses for each site or group of sites within the same cell. Different attributes and responses can point to opportunities for tailoring by selecting options that best fit each context.

- ★ Be explicit in defining groups and populations of interest (who are the intended recipients of an EBI, who needs to be part of implementation). Be specific in stating the characteristics are subject to marginalization.

- ★ Teams should assess whether & how the team has diverse representation, and if necessary, identify ways to include more diverse members, preferably who identify with communities of research interest.

Part 1: Overarching questions and considerations

The historical and current context surrounding implementation needs to be carefully considered and articulated from the onset of an implementation effort. This should be informed by a socio-ecological lens that considers multiple interconnected levels of influence, which can be guided by existing theories and frameworks (such as those in section 1). Multiple sources, such as scientific and non-scientific literature, news, existing data from local needs assessments and other sources, perspectives from collaborators and affected individuals and groups should be used to generate a holistic picture of the context.

Consider the following questions:

- What assumptions does the researcher/team have about the implementation effort (including of the intervention, the determinants influencing implementation, the people, organizations, and settings involved in implementation, and potential equity impacts)?
- What key events (ongoing, recent, or historic) may directly or indirectly impact implementation (e.g., natural disasters, disease outbreak, social movements, elections, legal or regulatory actions, etc.)?
- What is known about the intervention and its effectiveness for the selected population, setting, context, or ability to promote equity?
- Who is impacted by implementation (e.g., patients, program participants, community members, practitioners, direct supervisors, upper-level leadership)? How are these groups or individuals involved in implementation? Who is not involved and why not?
- What are key attributes of the implementation setting(s) (e.g., physical, technological, or social features of the setting, characteristics of the personnel)?

- What is known about the local context surrounding the implementation setting (e.g., nearby neighborhoods, municipality, or region)? Consider geography, built and natural environment, population demographics, and social, economic, and political contexts (e.g., residential racial segregation, area deprivation, grassroots organizations serving communities)

Part 2: Implementation strategy brainstorming

Instructions:
Apply the prompts in Table 2 to tailor an existing implementation strategy through an equity lens, or to design an equity-focused implementation strategy.

1. Name and define each discrete implementation strategy (using a label from an existing repository when possible). For each discrete strategy, complete the following:
2. Specify the starting components of the implementation strategy. You may start in any order that is helpful, the components do not have to follow a particular sequence.
    - If starting with an existing implementation strategy (i.e., a strategy that has already been designed in your project or from another source), first specify the each of the components of the selected strategy in the "starting strategy component" box.
    - If prospectively designing a new implementation strategy (i.e., first time deployment of a strategy in your project, developing a novel implementation strategy not found from another source), consider the potential specification of each component and enter the option(s) into the corresponding "starting strategy component" box.
3. Think through the prompts for each component and enter your ideas in the corresponding "response" box.
4. Consider options for revising the strategy component to improve its equity impact (i.e., promote more equitable processes or outcomes, avoid potential negative consequences). If an existing strategy component is believed to be optimized for equity in its current state compared to viable alternatives, record this decision in the "revised strategy component" box.

Intervention:
Identify the EBI (i.e., a program, practice, policy, treatment, etc.) to be implemented.

Intervention name and description: _____

Brief information about implementation context (setting, intended EBI recipient):
_____

For each discrete implementation strategy in your project, name and define the strategy.

Strategy name: _____

Strategy Definition:
_____

Table 2: Brainstorming prompts for equity-focused strategy design and tailoring				
Strategy Component	**Starting strategy component**	**Brainstorming Prompt**	**Response**	**Revised strategy component**
Actor (who delivers strategy)		Consider the social position of actors and recipients (in their organization, community, broader society) • To what extent is equity valued and actively promoted by actors and recipients? • To what extent do the actors reflect the characteristics of the intended strategy and intervention recipients? • What is the power differential between actors and recipients? How can power be more fairly distributed? • Are all actors (e.g., researchers, practitioners, community collaborators) fairly compensated for their work? • What level of trust do recipients have of actors delivering the strategy? Who do recipients trust?		
Action (steps, actions to do the strategy)		• Which actions place undue burden on any actors or recipients? How? • What existing resources or capabilities can be leveraged to enact the strategy? Does using these deplete them for use for other purposes? • What additional actions or components are needed to better serve marginalized groups and settings? (e.g., cultural humility, advocacy, trust building)		
Modality* (i.e., delivery approach; what method(s) will be used to deliver the strategy)		Consider where (physical or virtual space) and how (written, audio, visual, other types of materials) the strategy is delivered • To what extent are recipients able to engage with the selected modality? What challenges might recipients experience with this modality? • How does the modality take into consideration the abilities of recipients and potential accommodations (e.g., mobility, language and literacy)?		
Action target (who and what the strategy seeks to change)		• How do current and historic social, economic, and political structural determinants (e.g., systemic racism, reimbursement structures, healthcare laws) influence implementation? • What is the equity relevance of the action targets (e.g., increase practitioner knowledge of SDOH, improve access to services)? • How does the strategy create or impede opportunities for fair and equitable access to resources and supports needed for change?		

Temporality (when the strategy is used)		• When is the strategy delivered? How does this timing relate to other key events and processes? How might the strategy affect, or be affected by, these events and processes? • Should the strategy be sustained over time (or does it have a discrete start and end)? If necessary, how can its sustainment be ensured? • Does measurement timing detect short- or long-term change?		
Dose (the intensity or how much of the strategy is delivered)		• How might the dose of the strategy place undue burden on actors or recipients? • How does the dose affect reach and engagement of those involved in implementation? • How might reducing or increasing the dose impact equity?		
Outcomes* (what implementation or other outcomes is the strategy likely to impact)		• What are potential unintended consequences (positive or negative) of this strategy? • To whom are the outcomes important? • What other outcomes may be important to underrepresented interests?		
Justification (empirical, theoretical, or practical rationale for selecting this strategy)		• How are underrepresented or marginalized perspectives considered? • What does available empirical, theoretical, or practical information suggest about the strategy's impact on equitable implementation processes and outcomes?		
Measurement* (what and how to measure to determine the strategy's effects)	2	• How does the target metric consider equity (e.g., quality of effort, disparities in change, representation of different members involved in implementation)? • What measurement approaches are best suited to elicit information about equity impacts? • How are unintended consequences assessed? • How burdensome is the measurement approach and to whom? • How do measures leverage existing strengths and capabilities? • How burdensome is the measurement approach and to whom?		

Note: *indicates a strategy component that is modified or not listed in the Proctor et al.[85] recommendations.

Section 3: Case examples (TO BE COMPLETED WITH USER-GENERATED DATA)

Intervention: Colorectal cancer screening (FOBT or FIT) for patients ages 45-75 in rural clinical settings.

Implementation strategy focused on clinic staff and providers.

Strategy name: Training (make training dynamic)

Strategy definition: Conduct an interactive training that varies the information delivery methods that cater to different work and learning styles

Strategy Component	**Starting strategy component**	**Brainstorming Prompt** (subset from Table 2 above)	**Response**	**Revised strategy component**
Actor (who delivers strategy)	Physician clinical champion	Consider the social position of actors and recipients (in organization, community, broader society) What is the power differential between actors and recipients? How can power be more fairly distributed?	Physicians have high social position & relative power over other roles in care team (e.g., MA, RN) and patients. Involve other roles in training	Include peer nominated non-physician roles, patient advocates as trainers
Action (steps, actions to do the strategy)	Didactic education on CRC screening guidelines; participant Q&A	• What additional components are needed to better serve marginalized settings and groups? (e.g., cultural humility, advocacy, trust building)	Content bias, discrimination, & harms in health care; shared decision making (SDM); Show screening disparities (e.g., by race, ethnicity, insurance status, etc.)	Patient advocates who represent marginalized groups share info about historic & current reasons for patient hesitancy, mistrust. Use clinic data to show screening inequities; training team demonstrate mock patient encounter using empathic listening & SDM, then have providers practice; Fairly compensate trainers for their time
Modality* (what method(s) will be used to deliver the strategy)	Zoom-didactic (live and recorded); emailed handouts	Consider location of strategy delivery (physical or virtual space) and written, audio, visual, or other types of materials used to deliver the strategy.	Rural clinics may experience limited internet bandwidth, no color printers for printing handouts. May have care team	Simplify wording; Add captions to didactic presentation; use larger font and visual aids (images) on slides & handouts;

		• To what extent are recipients able to engage with the selected modality?	members who are hard of hearing or have vision limitations Staff across roles may not be familiar with implementation or medical jargon	provide hard copies to clinics; Offer flexible options (virtual, hybrid, in person in a physically accessible space)
Action target (who and what the strategy seeks to change)	Increase care team knowledge of screening guidelines and screening options; Increase provider self-efficacy and skill in discussing CRC screening with patients	• How do current and historic social, economic, and political structural determinants influence implementation? • What is the equity relevance of the action targets (e.g., increase practitioner knowledge of SDOH, improve access to services)?	Patient mistrust due to discrimination; social norms around screening; social needs; provider bias; poor health service accessibility may impact screening. Provider skills should include cultural humility & shared decision making	Increase care team knowledge of SDOH & influences on patient receptivity towards screening. Improve provider self-efficacy & skills in engaging in shared decision making; Increase provider awareness of potential biases & opportunities for building trust
Temporality (when the strategy is used)	One-time at beginning of project; recording delivered during new hire onboarding	• Should the strategy be sustained over time (or does it have a discrete start and end)? If necessary, how can its sustainment be ensured? • Does measurement timing detect short- or long-term change?	One-time training may be insufficient to increase provider skill & self-efficacy in engaging patients; brief refreshers can help with skills practice	Information delivery remains one-time; add brief monthly skills practice over 3-6 months; assess practice sessions & monitor EHR data to determine need for continued practice
Dose (the intensity or how much of the strategy is delivered)	One time 30-minute session	• How does the dose affect reach and engagement of those involved in implementation? • How might reducing or increasing the dose impact equity?	One-time brief training may not be sufficient for improving skill. Increasing time and frequency may add to workload or take providers offline, reducing patient access	Short (~15 minute) refreshers may balance need for continued practice without burdening care team or trainers
Outcomes* (what implementation or other outcomes is the strategy likely to impact)	Increase provider fidelity to recommending CRC screening to appropriate patients & documenting in EHR	• What are potential unintended consequences (positive or negative) of this strategy? • To whom are the outcomes important? • What other outcomes may be important to underrepresented interests?	Increasing training time, adding SDOH & SDM components may communicate importance of these. Fair and unbiased treatment of patients, improved reach to underserved groups may be important to patients & advocates	Add improve provider adoption, penetration of SDM in their practice; patient satisfaction with care, trust in provider; improve reach among patient groups experiencing inequities (does revised training

				reduce screening inequities?)
Justification (empirical, theoretical, or practical rationale for selecting this strategy)	Training is part of facilitation package shown empirically to increase provider recommendation of CRC screening	• How are underrepresented or marginalized perspectives considered? • What does available empirical, theoretical, or practical information suggest about the strategy's impact on equitable implementation processes and outcomes?	Traditional training centers expert knowledge, may not adequately address reasons providers inequitably recommend screening or patient hesitancy (informed by SDOH framework, theories of power & discrimination)	Including marginalized perspectives can help redistribute power & increase their influence in practice change; Skills practice more likely than didactic delivery alone to change skill
Measurement* (what and how to measure to determine the strategy's effects)	Chart audit to determine % of patients who were recommended CRC screening, change in provider documentation	• How does the target metric consider equity (e.g., quality of effort, disparities in change, representation of different members involved in implementation)? • What measurement approaches are best suited to elicit information about equity impacts? • How do measures leverage existing strengths and capabilities? • How burdensome is the measurement approach and to whom?	Documentation of screening recommendation does alone does not indicate reach. Need to determine if reach of recommendation & uptake of screening differs inequitably. Low-burden chart audit requires EHR, use of automated documentation (e.g., dot phrase), and data support to review data; patient perspective missing from measurement	Apply intersectional lens to determine any patient groups, characteristics who disproportionately do not receive recommendation or complete screening; follow-up to determine reasons for disparity (observation, informal convo w/ providers, patient surveys, interviews); leverage existing staff (e.g., data analyst) or protect training team time to review data; compensate patient advocate to conduct outreach for patient data collection

Appendix C: Chapter 4 (Aim 3) Appendix materials

Appendix 4.1 HEALTH parent educator interview guide, with adaptation questions in blue text

Intro text:
Thank you for agreeing to speak with me today. We can do some quick introductions, I will give you some information about the interview and give you a chance to ask any questions you might have, and then we can get started, does that sound ok?

My name is [NAME], I am a [Role description] working with the HEALTH study. Would you please introduce yourself and tell me if you have a preferred nick name or title you wish to be addressed by?

Thank you, [participant NAME]. We are speaking with parent educators who went through the HEALTH training and delivered the HEALTH curriculum to moms they are working with. The goal of these interviews is to understand perceptions of the HEALTH intervention, any changes that needed to be made to deliver the HEALTH curriculum, and ways we might be able to improve HEALTH. We are very much interested in your experiences and thoughts. There are no right or wrong answers. Anything you share with me today will be kept confidential and will not be shared with other staff or leaders at your site.

The interview should take about 45 minutes. You can skip any questions you prefer not to answer and you can decide to stop the interview at any time. We keep all records related to the interview in a secure location accessible only to study team members that need to work with the data. We will not share names or identifying information in any reports, presentations, or other products that come out of this project. Do you have any questions?

I would like to audio record our discussion to make sure we accurately capture the thoughts and feedback you share. We will not save any video recordings and only the team members who are responsible for pulling together findings from what we learn in the interviews will be able to listen to the audio recording. Do I have your permission to record? [start recording once permission granted]

Opening question:
1. To start off, can you please tell me a bit about how you have been delivering visits while you've been part of the HEALTH study? Have these been in person, virtual, or hybrid?

Adoption
2. Did you use the HEALTH curriculum with families in the study?
    - *Probes: If yes: What made you decide to deliver HEALTH? If no: Why not? What might have made it easier to deliver HEALTH? What did the families receive instead of HEALTH?*

Outer Setting
<u>Patient Needs & Resources</u>

3. How well do you think HEALTH meets the needs of the families served by your site?
    - *Probes: In what ways will HEALTH meet their needs? E.g., improved access to healthy eating and activity resources? Reduced travel time and expense to access healthy eating and activity resources?*
4. To what extent do you think HEALTH was beneficial for the families you served?
5. What resources from HEALTH do you feel were most beneficial for families? (E.g., handouts, activities, prompts from the lessons)
    - *Probe: What did you hear from families about the resources provided through HEALTH?*
6. How do you think the families served by your site responded to HEALTH?
7. What barriers or challenges did families experience that made it difficult for them to participate in HEALTH?
    - *Probe*: *Were there families you felt like you could not share information about HEALTH with? What about these families make you feel this way?*

Appropriateness

(Patient Needs, Tension for change)

8. Prior to when your site decided to start using HEALTH, did you see a need for specific curriculum related to healthy eating and physical activity?
    - If yes, what (kinds of) needs did you see for healthy eating and physical activity?

9. How does HEALTH compare to other healthy eating and physical activity programs at your site?
    - *Probes: What advantages does HEALTH have compared to existing programs? What disadvantages does HEALTH have compared to existing programs?*

10. How did your perception of the HEALTH curriculum change over time?
    - *Probes*: after the training? After you started delivering the curriculum?

11. How do you feel HEALTH fits with: how you deliver information to families?; within the foundational PAT curriculum?"
    - *Probe: If fits well – what are some of the aspects that make HEALTH a good fit?; If not well - What would you change to make the curriculum fit better?*

Implementation

Acceptability

12. What do you like about the HEALTH curriculum compared to the foundational curriculum?
    - *Probe: What might have improved your experience with the HEALTH curriculum?*

Feasibility

13. What helped you deliver the HEALTH curriculum? What made it harder to deliver the curriculum?

Adaptation

We would like to learn about any changes or modifications made to the HEALTH curriculum. There are no right or wrong answers, and we anticipate some changes were needed. Understanding these will help us to make improvements.

14. Can you please tell me about some of the changes you made to the HEALTH curriculum or how you delivered it?

For each adaptation, probe on the following:
15. Specifically, what did the change involve?
    - *Probe: Was something added, deleted, substituted, changed to better fit the families, delivered at a different time or in a different way*?
16. What was the basis or rationale for this change?
    - *Probe: Was this change made based on family preferences, educator needs or experiences, to save money or other resources, or for another reason?*
17. Who first thought of or suggested this change (family, parent educator, PAT supervisor)?
18. Who was responsible for carrying out this change?
19. What were the key outcomes or results of this change?
    - *Probe: Did it result in more or less participation by families, get more or fewer sites? Educators? involved, improve or decrease consistency of delivery, improve or reduce outcomes, reduce or increase time or costs?*

[Other Comments, additional features of the adaption not covered above]:

Intervention Characteristics

Evidence Strength & Quality/Readiness

20. What do staff at your site think of HEALTH?
    - *Probes: Parent educators? Your supervisor(s)? What do administrators or other higher-level leaders at your site think of HEALTH?*

Leadership Engagement

21. What level of involvement has leadership at your site had so far with HEALTH?
    - *Probe: What kind of support have they given you? Can you provide specific examples?*

Available Resources

22. Do you have sufficient resources to deliver HEALTH? (e.g., time, supervision & feedback, training, educational materials, practice, peer support)
    - *[If Yes] What resources have you received, or would like to receive?*
    - *[If no] What resources were not available?*

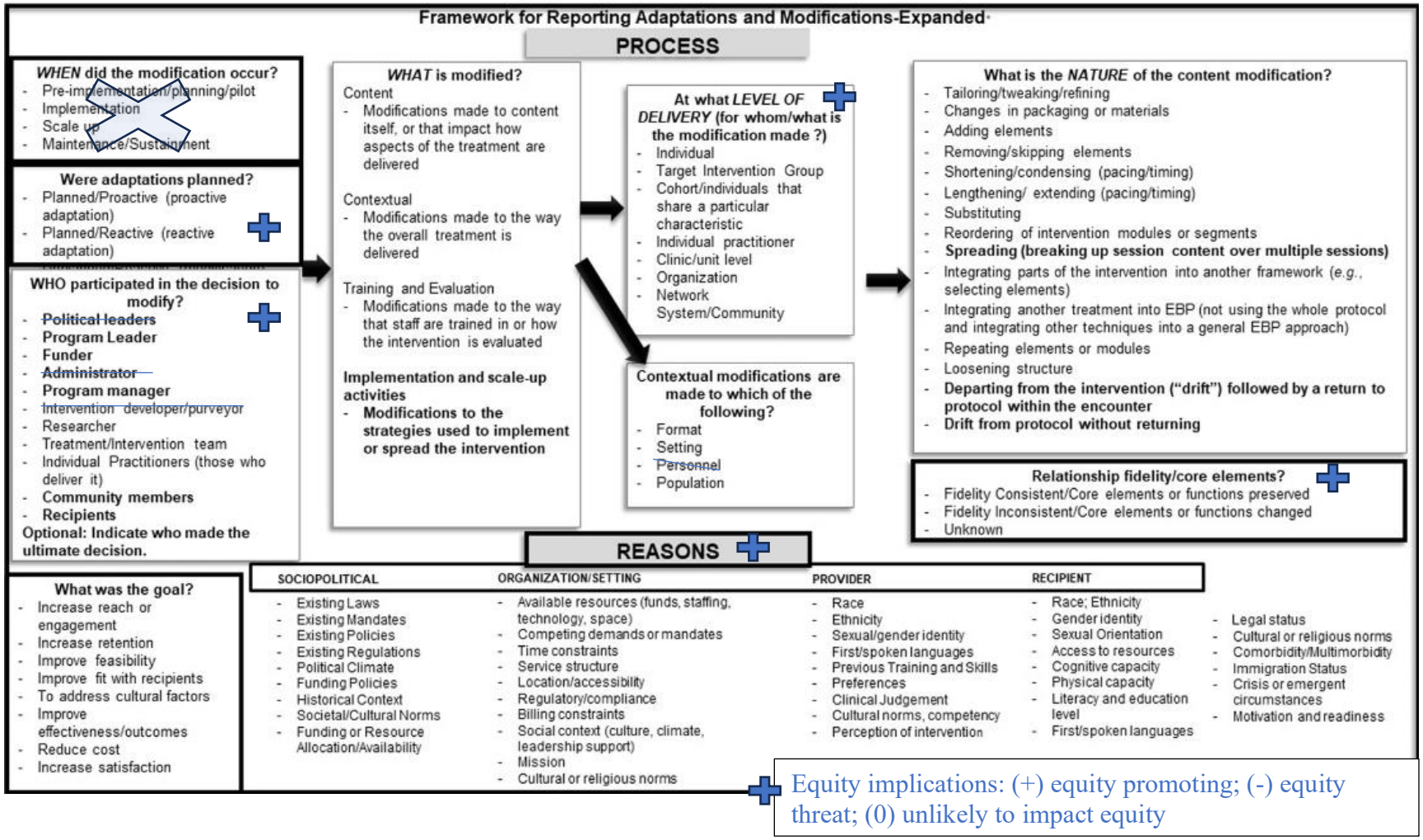
Self-efficacy

23. How confident are you in delivering HEALTH?
    - *Probes: What gives you that level of confidence (or lack of confidence)? (if not highly confident). – what could help make you more confident in delivering HEALTH?*

Complexity

24. How easy or difficult is HEALTH to deliver?
    - *Please consider the following aspects of HEALTH: duration, scope, intricacy and number of steps involved and whether the intervention reflects a clear departure from previous practices.*

Appendix 4.2: Revised FRAME for HEALTH adaptation coding (image from Wiltsey Stirman et al., 2019[90])



Note: "X" symbol indicates domain removed, text strikethrough indicates individual code removed (not relevant to current study); "+" icon indicates new code option(s) added within this domain or existing code options revised to improve fit with study. See following page for additional detail about additions and revisions.

Removed When did modification occur (all modifications took place during implementation)

Were adaptations planned?

- **Added** "unplanned/reactive"

Who participated in decision to modify?

- **Removed** Political leaders; Administrator; Intervention developer/purveyor (Intervention developer is combined PAT National and HEALTH study team)
- **Revised** Program Leader to "PAT National"; Program Manager to "Site Leaders" (i.e., supervisors who oversee parent educators at intervention sites); Researcher to "HEALTH team"; Treatment/Intervention team to "PE team" (i.e., team of parent educators at an intervention site); and Individual Practitioners to "Individual PE"

At what level of delivery (for whom/what is modification made?)

- **Revised** Clinic/unit level to "PE team"

Contextual modifications are made to which of the following?

- **Removed** Personnel

Relationship to fidelity/core functions?

- **Revised** Fidelity Consistent to "Likely Fidelity Consistent"; Fidelity Inconsistent to "Likely Fidelity Inconsistent"

Reasons – Sociopolitical

- **Combined** Existing Laws, Mandates, Policies, Regulations into a single item
- **Added** Large scale event (e.g., COVID-19 pandemic)

Reasons – Organization/Setting

- **Added** Neighborhood environment (e.g., availability of parks, walkability, food desert or food swamp, safety)

Reasons – Recipient

- **Added** Crisis or emergent circumstances (broad or non-specific family stressors or crises); Food security (E.g., access to, affordability of high-quality foods); Housing (e.g., housing stability, quality of housing); Income/finances (e.g., household financial security, ability to pay for basic needs); Social support (e.g., family, friends who offer emotional support or functional assistance); Preferences (e.g., participant interests, priorities)
- **Revised** Motivation and readiness to "Existing knowledge, motivation, and readiness"

Added "Equity Implications" Domain

- (+) Equity promoting = Potential to enhance, promote equitable processes or outcomes
- (-) Equity threat = Potential to decrease equity/exacerbate inequities
- (0) Equity neutral = Unlikely to impact equity