

Protocol: Mapping water, sanitation and hygiene achievements to prosperity, stability, and resilience.

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Systematic Map Protocol

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About 3ie

The International Initiative for Impact Evaluation (3ie) promotes evidence-informed equitable, inclusive, and sustainable development. We support the generation and effective use of high-quality evidence to inform decision-making and improve the lives of people living in poverty in low- and middle-income countries (L&MICs). We provide guidance and support to produce, synthesize and quality assure evidence of what works, for whom, how, why and at what cost.

3ie systematic maps

Systematic maps are tools to help policymakers and researchers working in a sector or thematic area make evidence-informed decisions. They use systematic methods to search and screen the literature to identify studies that answer the selected research questions. For this systematic map, studies will be mapped onto a framework of water, sanitation, and hygiene (WaSH) intermediate outcomes and high-level outcomes pertaining to the advancement of prosperity, stability, and resilience. We will provide a visual display of the volume and type of research identified, an indication of research gaps, and a confidence rating of systematic reviews. The map can be used by development practitioners and researchers to understand the volume and characteristics of the research on WaSH outcomes and their associations to higher-level development goals, and to identify concentrations of studies and gaps that may present promising areas for future research and programming.

The systematic map protocol provides all the supporting documentation for the map, including the background information for the theme of the map, and details the methods that will be applied to systematically search and screen the evidence base, extract and analyze data, and develop the systematic map report.

About this systematic map protocol

This report presents the protocol for a systematic search to identify and map the literature quantifying the associations between water, sanitation, and hygiene intermediate outcomes and longer-term prosperity, stability, and resilience outcomes in low- and middle-income countries. The systematic map was developed by 3ie, made possible with generous support from the United States Agency for International Development (USAID)'s Bureau for Resilience and Food Security. The content of this report is the sole responsibility of the authors and does not represent the opinions of 3ie, its donors, or its Board of Commissioners. Any errors and omissions are also the sole responsibility of the authors. Please direct any comments or queries to the corresponding author, Sridevi Prasad, sprasad@3ieimpact.org.

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Acronyms

3ie	International Initiative for Impact Evaluation
CWSSH	Center for Water Security, Sanitation and Hygiene
DEP	Development Evidence Portal
EGM	Evidence Gap Map
FTS	Full-text Screening
IE	Impact Evaluation
L&MICs	Low- and Middle-Income Countries
RFS	Bureau for Resilience and Food Security
SR	Systematic Review
TAS	Title and Abstract Screening
USAID	United States Agency for International Development
WaSH	Water, Sanitation, and Hygiene

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1. Background

1.1. Development problem being addressed

The COVID-19 pandemic has brought issues related to water, sanitation, and hygiene (WaSH) back into the mainstream. It highlighted the importance of handwashing and associated behavior change interventions in helping countries navigate this pandemic (Stoler, Jepson and Wutich, 2020). The pandemic also emphasized that there was still extensive work needed to be done in meeting Sustainable Development Goal 6 (Stoler, Jepson and Wutich, 2020). As of 2020, over 2 billion people still lack access to safely managed drinking water (United Nations, no date). About 46 per cent of the world's population does not have access to safely managed sanitation and 2.3 billion people do not have basic hygiene infrastructure (United Nations, no date).

The primary and most immediate effects of inadequate WaSH are on human health. Multiple studies have looked at how improving access to clean drinking water reduces waterborne diseases, such as diarrhea, cholera, schistosomiasis (Fewtrell *et al.*, 2005; Grimes *et al.*, 2014; Strunz *et al.*, 2014; Taylor *et al.*, 2015). Large-scale randomized controlled trials have studied the impacts of combined WaSH interventions on stunting and other nutrition-related outcomes (Luby *et al.*, 2018; Null *et al.*, 2018; Humphrey *et al.*, 2019; Bekele, Rahman and Rawstorne, 2020). The link between improvements in sanitation and reduction of fecal-oral diseases have been well enumerated (Brown, Cairncross and Ensink, 2013).

There are also broader implications that both impact WaSH and can also be impacted by WaSH. As climate change becomes an increasing threat, water and sanitation services are more at risk. Increasing temperatures and change in rainfall can impact availability of water sources as well as damaging infrastructure that can then impact human health (Howard *et al.*, 2016; UNICEF, no date). Sanitation could also potentially increase greenhouse gas emissions through the treatment process; though, additional research is still needed to quantify this impact (Howard *et al.*, 2016). Household water insecurity has also been linked to migration-related climate change (Stoler *et al.*, 2021).

Inadequate WaSH also affects economic productivity as well as political governance. Women and girls are often disproportionately impacted relative to men and boys by not having accessible WaSH as they spend more time collecting water or are not able to attend school due to lack of sanitation facilities and an enabling environment to support menstrual hygiene (Graham, Hirai and Kim, 2016; Tull, 2019). This then affects their ability to use their time for other tasks or to join the workforce. Poor water supply has also been found to impede growth of small and medium enterprises which then affects overall economic growth (Olawale and Garwe, 2010; Selelo *et al.*, 2017). WaSH interventions can also impact political governance and stability as the provision of WaSH services can improve the perceptions of political leaders (JPAL South Asia, 2014).

1.2. Policy responses

As part of the 2030 Agenda for Sustainable Development, Sustainable Goal 6 focuses specifically on ensuring availability and sustainable management of water and sanitation for all. It calls for universal access to safe and affordable drinking water, sanitation and hygiene as well as improvement in water quality by 2030 (United Nations, no date). Analyses by the World Bank found that extending basic WaSH services to those who do not have access will cost approximately \$28.4 billion per year and to meet the safely managed targets in SDG 6.1 and 6.2 would cost \$114 billion per year (Hutton and Varughese, 2016). As of data from 2020, achieving universal access to WaSH by 2030 would require that the current rates of progress to be quadrupled (WHO/UNICEF JMP, 2021). Additional focus needs to be on low- and middle-income countries, those in fragile contexts, and on the most vulnerable populations as they are most at risk of not having access to improved WaSH (WHO/UNICEF JMP, 2021).

Along with the need to extend WaSH services to individuals, the World Health Organization has also emphasized that healthcare facilities should also have adequate WaSH services (World Health Organization, 2019). In order to meet full coverage of basic WaSH in healthcare facilities, it would cost between \$6.5 billion - \$9.6 billion from 2021-2030 (Chaitkin *et al.*, 2022). In 2019, about 50% of healthcare facilities had access to basic water services, 37% had basic sanitation, and 74% had hand hygiene services (World Health Organization and UNICEF, 2020). However, most countries still had not included WaSH indicators in national health systems monitoring or generated national strategies to be able to meet these targets (World Health Organization and UNICEF, 2020).

Schools are also a highly targeted area for WaSH programming and policy. By improving WaSH services in schools, education opportunities are also improved for children. Providing access to clean drinking water and sanitation facilities on school grounds ensures that students and school staff do not need to go off-premises to drink water or to use the toilet (WHO/UNICEF JMP, 2020). By having access to these facilities on premises, students and staff are able to spend more time in the classroom and then children are more likely to have better educational opportunities. Improving WaSH services in schools can also improve equity and empowerment outcomes for girls through provision of separate latrines and menstrual products that can reduce menstruation-related school absenteeism. In 2019, about 69% of schools had basic drinking water service, 57% had a handwashing facilities with soap and water, and 63% of schools had basic sanitation (WHO/UNICEF JMP, 2020). Due to the increased focus on WaSH in schools, there has been progress but still more to be done.

1.3. Why is it important to do this map?

Previous mapping and evidence synthesis research products have primarily focused on the health impacts of WaSH interventions (Fewtrell *et al.*, 2005; Jasper, Le and Bartram, 2012; Grimes *et al.*, 2014; Stocks *et al.*, 2014; Strunz *et al.*, 2014; Taylor *et al.*, 2015; Cumming and Cairncross, 2016; Mackinnon *et al.*, 2019; Bekele, Rahman and Rawstorne, 2020; Chirgwin *et al.*, 2021; Prasad, Lane and Glandon, 2021). Even the systematic reviews that study the relationship between climate change and WaSH are primarily focused on the impacts of climate change on waterborne diseases (Bouزيد,

Hooper and Hunter, 2013; Levy *et al.*, 2016). However, understanding the high-level impacts of achieving WaSH outcomes that go beyond health is becoming more important to inform the large future investments that are needed to achieve SDG 6. By looking at these associations, we can more accurately measure the return on investment. This has also been recognized in the sector as the focus on socio-economic outcomes has been growing over time. Chirgwin and colleagues (2021) found that, compared to studies published before 2009, more studies published after 2009 reported on socio-economic outcomes. This indicates that, though this may be an understudied area, there is growing research in this sector.

This systematic map seeks to go beyond the impacts on health to understand the associations between achieving WaSH outcomes and systemic development outcomes advancing prosperity, stability, and resilience. It serves as one of the first research maps to focus explicitly on these outcomes and the relationships between them.

Systematic maps highlight both absolute gaps, to be filled with new primary studies, and synthesis gaps, ready for systematic reviews and meta-analyses. The final map will be published on 3ie's online interactive platform that provides additional filters so that users can further explore the available studies, for example, by global regions, income levels, or population. It will be accompanied by a published report that addresses the key research questions and will include an analysis of the included studies.

2. Study objectives and questions

2.1 Main objectives

This project aims to facilitate access to the literature that quantifies the association between selected WaSH intermediate outcomes and selected prosperity, stability, and resilience outcomes in low- and middle- income countries (L&MICs). It will do this by identifying, describing, and summarizing the available literature in a clear and structured way. In turn, it is expected the project will facilitate the use of evidence to inform policy decisions.

To meet this aim, the specific objectives of this systematic map are threefold:

1. Identify, describe, and summarize the literature that quantifies the association between selected WaSH intermediate outcomes and selected prosperity, stability, and resilience outcomes in L&MICs
2. Improve access to this literature for policy makers, researchers, and the development community
3. Identify potential primary research and synthesis gaps

In addition, we will develop and employ a new systematic mapping framework and methodology. While evidence gap maps typically show the distribution of evidence linking interventions to outcomes, this systematic map will use an outcome-to-outcome mapping framework. That is, we will map research on the association between intermediate WaSH outcomes and high-level outcomes reflecting systemic changes in prosperity, stability, and resilience. This approach is useful for

extending analysis further along the causal chain of social change beyond the typical focus on interventions and initial outcomes, such as health outcomes, and has applications for future research concerned with the extent to which development programming outcomes contribute to systemic changes. Details of the framework are presented in Section 3 below.

2.2 Research questions

To meet these objectives, we will address the research questions shown in Table 1.

Table 1: Systematic map research questions

No.	Research Question	Type
RQ1	What is the extent and characteristics of the literature on the association between selected WaSH intermediate outcomes and selected prosperity, stability, and resilience outcomes in L&MICs?	Coverage
RQ2	What are the major primary research and synthesis gaps in the literature?	Gaps
RQ3	What outcome areas could be prioritized for primary research and/or evidence synthesis?	Research needs

3. Scope

3.1 Conceptual framework

In defining the bounds of this systematic map, we used the Joint Monitoring Programme’s definitions of drinking water, sanitation, and hygiene to define WaSH. Though the water sector encompasses more than just drinking water, we are not focusing on broader water governance or integrated water resource management. Both water governance and integrated water management interventions operate through different theories of change than WaSH interventions. By focusing solely on drinking water, the outcomes that are achieved operate through the same theory of change as sanitation and hygiene. By drinking water, we are focusing on outcomes that improve “the accessibility, availability and quality of the main source used by households for drinking, cooking, personal hygiene and other domestic uses” (WHO/UNICEF JMP, no date a). Interventions to achieve this can include the construction of boreholes, connections to piped water systems, or provision of chlorine and water filters to improve water quality. They can also include systems interventions that focus on water utilities and surveillance systems.

Sanitation outcomes are focused on improving the “management of excreta from the facilities used by individuals, through emptying and transport of excreta for treatment and eventual discharge or reuse” (WHO/UNICEF JMP, no date d). Interventions to achieve this can include the construction of latrines or wastewater treatment plants, behavior change interventions to reduce open defecation, or technologies to support fecal sludge management.

The final domain of WaSH is hygiene, which also includes menstrual health. Hygiene encompasses practices that support handwashing, food hygiene, and menstrual hygiene management (WHO/UNICEF JMP, no date b, no date c). Interventions to achieve hygiene outcomes include provision of handwashing stations with soap or menstrual health products, or behavior change interventions to improve food handling and preparation.

Though there are many different interventions that are implemented within the WaSH sector and they can often be combined together, they all lead to the same intermediate outcomes (Figure 1). These intermediate outcomes can be summarized in three broad domains: 1) improved access to safe drinking water; 2) improved access to sanitation facilities; 3) increased practice of hygiene behaviors. These intermediate outcomes then lead to improved health which ultimately lead to increased prosperity, enhanced resilience and increased stability. The focus of this map are the orange outcomes (intermediate WaSH outcomes) and the green outcomes (high-level, systemic outcomes).

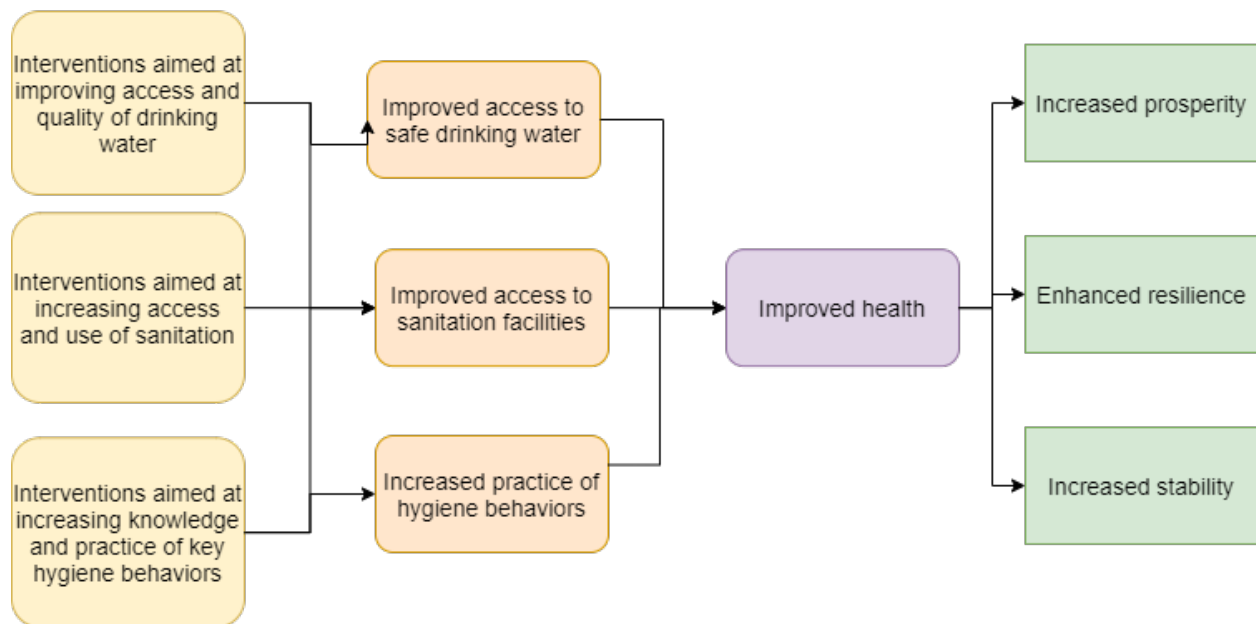


Figure 1. High-level theory of change for systematic map

This systematic map illustrates the prevalence of impact evaluations, systematic reviews, and quantitative observational studies by mapping them into a matrix in which intermediate WaSH outcomes are along the Y-axis and high-level systemic outcomes are along the X-axis. Individual studies are identified as quantifying the association between these outcomes and are mapped accordingly. The organization of these outcomes, as well as the criteria used to determine whether a given study will be included in the map, contribute to the systematic map’s conceptual framework.

3.1.1 Framework Development

Both the intermediate WaSH outcomes and high-level outcomes that comprise the map framework were determined through a participatory process with stakeholders within USAID RFS's Center for Water Security, Sanitation and Hygiene (CWSSH) and an external advisory group of experts in the WaSH field (Appendix D).

CWSSH strategic and programmatic approaches (MIT, 2021) served as the basis for the intermediate outcomes listed on the Y-axis of the map. Specifically, CWSSH determined the scope of this map should focus on two of their four strategic approaches: 1) achieving access to sustainably managed drinking water and improvements in service quality, and 2) achieving access to sustainably managed sanitation and increasing uptake of key hygiene behaviors. Although WaSH governance and water resource management are also areas of strategic interest for CWSSH, they elected not to include these as separate intermediate WaSH outcome categories for this map due to scope limitations and greater likelihood of relevant results within the literature on drinking water, sanitation and hygiene due to the volume of development programming focused on these outcomes. Through literature scoping, review of 3ie's Development Evidence Portal (DEP) intervention and outcome taxonomies (3ie, 2021), and consultation with our advisory group of WaSH experts, we developed intermediate outcome categories for each of these WaSH domains. They consist of six categories under drinking water and eight categories under sanitation and hygiene.

CWSSH's objective is to identify research linking attainment of intermediate WaSH outcomes to three outcome domains reflecting higher-level social change in accelerating prosperity, building stability, and enhancing resilience. Using these topics as the foundation for the X-axis of the map, we followed the same process to develop measurable outcome categories under each domain. Through literature scoping, review of 3ie's DEP outcome taxonomy, and input from our WaSH expert advisory group, we developed five outcome categories under prosperity, three under stability, and five under resilience, each reflecting high-level development aims.

Further explanation of the selected intermediate and high-level outcomes, and their theorized relationships presented in a theory of change follows.

3.1.2 Outcomes

Intermediate WaSH outcomes

Intermediate outcomes in the drinking water domain include improvements in drinking water quality and access to safe drinking water sources as well as capacity strengthening of service authorities to improve operations and management of drinking water systems. Intermediate outcomes in the sanitation and hygiene domain include access to and use of sanitation infrastructure, products, and services; increased uptake of key sanitation and hygiene behaviors, as well as capacity strengthening of service authorities to improve operations and management of sanitation and hygiene facilities. Descriptions of each intermediate outcome category are listed in section 4.2.2.

High-level outcomes

Outcomes in the prosperity domain reflect non-health human capital development and economic growth. Outcomes in the stability domain reflect institutional capacity development, trust in institutions, and changes in the security environment and social relations. Outcomes in the resilience domain reflect change in environmental pollutants and ability to cope with shocks and stressors due to climate change. Descriptions of each high-level outcome category are listed in section 4.2.3

3.1.3 Theory of Change

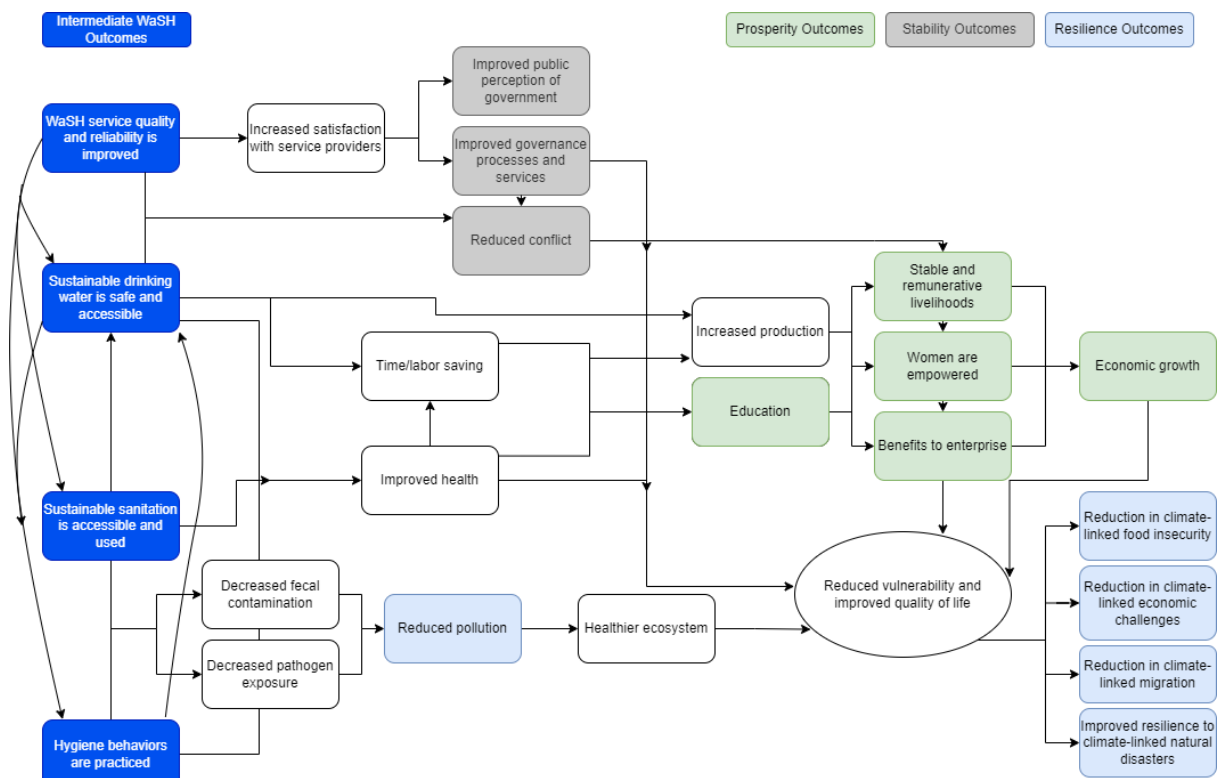


Figure 2. WaSH theory of change, intermediate WaSH outcomes to high-level outcomes

The theory of change (Figure 2) begins from a point of achievement of intermediate WaSH outcomes: conditions in which some level of improved drinking water, sanitation, and hygiene systems, services, or products are in place, functioning, and people are accessing and using these systems, services, or products.

The intermediate WaSH outcomes (in dark blue) that begin our theory of change are mutually reinforcing. When WaSH systems and services are improved and people can reliably access and use clean drinking water and sanitation facilities, they are able to practice better personal and environmental hygiene and reduce recontamination of clean water sources. A key assumption of the theory is that individuals maintain and sustain use of improved facilities and uptake of behaviors. We also assume equitable and affordable access to WaSH. Major risks to WaSH achievements include lack

of maintenance to WaSH infrastructure inhibiting functioning, access, and use; and reversion to unhygienic practices.

Achievement of these intermediate WaSH outcomes is theorized to influence our high-level outcomes of interest through both direct and indirect means. Clean drinking water and improved sanitation and hygiene reduce exposure to fecal waste and pathogens, leading to improvements in the health of individuals and ecosystems (Bouزيد, Hooper and Hunter, 2013). Improved water sources may also reduce the amount of time individuals devote to water collection and treatment (Graham, Hirai and Kim, 2016). Women and girls benefit from the establishment of environments that facilitate menstrual health and hygiene management, such as the provision of private washrooms and menstrual health supplies (Tegegne and Sisay, 2014). Healthier populations with greater time and labor capacity are able to devote more time and energy to learning and productive activities. The combined effect is expected to enable greater and more consistent participation in schooling, household production, the labor force, and business endeavors (McMichael, 2019). Women and girls may also realize empowerment gains within their households and societies due to time and productivity gains and reduced vulnerability to attacks and assaults if they no longer have to use unimproved water and sanitation in isolated areas (Tull, 2019).

At the same time, as WaSH service providers improve the quality and reliability of their services the public should gain confidence in the same. Increasing satisfaction with WaSH service providers should lead to improved public perception of service providers and greater cost recovery (JPAL South Asia, 2014). Strengthening the capacity of WaSH service authorities and improvements in the operations and maintenance of WaSH systems is envisioned as part of broader efforts to improve governance in both the public and private sector, ensuring institutions and officials are responsive, transparent, and accountable to the public, fulfilling their duties equitably and without corruption. As the public has their rights to safely and reliably access clean water, sanitation, and hygiene realized and enforced, it is theorized that conflicts will decline, from the interpersonal level to the state and regional levels.

The combined effects of healthier individuals and ecosystems, gains in human capital and economic growth, institutional improvements and reduced conflict is expected to improve quality of life and reduce overall vulnerability. Due to achievements in intermediate WaSH outcomes, individuals, communities, and countries should be healthier, more prosperous, and more stable, and therefore more resilient to shocks and stressors. When these individuals, communities, and countries experience hardships due to climate change we expect them to be better able to mitigate, adapt to, and recover from natural disasters, and reduce or mitigate resultant food insecurity, economic challenges, and migration.

This theory of change provides a general overview of how WaSH outcomes may contribute to high-level development outcomes. There are likely many more interconnections between these elements as well as other change mechanisms that we are not able to display in a single figure. However, Figure 2 illustrates the many societal benefits to which WaSH improvements may contribute, beyond improved health. This systematic map seeks to identify and present studies examining these associations.

4. Methods

4.1 Overall methodological approach

We will follow the standards and methods for evidence gap maps developed by Zie (Snilstveit *et al.*, 2016, 2017). This systematic map aims to establish what we know and do not know about the associations between WaSH intermediate outcomes and prosperity, stability, and resilience outcomes.

The map will be populated by systematically searching and screening all relevant completed and ongoing impact evaluations and systematic reviews. For this map, accepted research designs will also include quantitative observational studies in addition to impact evaluations and systematic reviews. The final product will provide a visual display of the volume of studies for each outcome-to-outcome combination, the type of study (quantitative observational study, impact evaluation, systematic review, completed or ongoing), and a confidence rating of the quality for systematic reviews. To that end, we will publish a protocol outlining the research plan and specifying detailed inclusion and exclusion criteria for the map, conduct a systematic search and screening of academic and grey literature for relevant studies, and extract and analyze data from all studies included in the map, culminating in a published systematic map and report.

4.2 Criteria for including or excluding studies

The screening criteria will draw on the PICOS framework to present them in a commonly understood format, by defining criteria in terms of the populations, outcomes, and study designs of interest (Methley *et al.*, 2014). The PICOS framework will be adapted to apply to this map's specific focus on outcomes rather than interventions and the inclusion of other quantitative study designs examining these outcome-to-outcome relationships. The PIHS framework for outcome-to-outcome mapping is presented below (Table 2).

Table 2. Comparison of PICOS and PIHS screening frameworks

PICOS Framework	PIHS Framework
Population	Population
Intervention	Intermediate outcome
Comparator	High-level outcome
Outcome	Study design
Study Design	

In the PIHS framework, intervention and comparator inclusion criteria are removed as they are not applicable to the requirements of this systematic map. Also in contrast to PICOS, the outcome criterion is separated into two separate criteria to distinguish the relationship between intermediate and high-level outcomes. Our outcome-to-outcome mapping approach is intervention agnostic, meaning we will include any study that includes one or more outcomes of interest regardless of the intervention or activity that brought about the WaSH outcome(s) or if no intervention takes place

and the study compares a context in which the outcome(s) is present to one in which it is absent. Data pertaining to intervention activities will be extracted when it is provided. Each element of the PIHS framework is described below.

4.2.1 Population (types of study participants)

We will include studies that consider any population residing in a low- or middle-income country (L&MIC). We will use the World Bank income status classification for defining L&MICs (The World Bank, 2022) and studies will be classified according to their status in the year the data for the intermediate WaSH outcome(s) was obtained, or if this information is not provided, then the year of publication.

Multi-country studies: Studies will be included if they include at least one outcome-to-outcome association for a population residing in an L&MIC, or if there are sub-group analyses for the L&MIC population reported separately, i.e. with unique intervention and comparison groups from the L&MIC(s). Studies that compare a group within an L&MIC to a comparison group in an HIC will be excluded. Studies that include HIC and L&MICs will be included if the results are specified for at least one L&MIC. Studies will be excluded if they pool data between L&MICs and HIC and do not specify L&MIC-specific results.

4.2.2 Intermediate WaSH outcomes

Included studies must demonstrate that one or more intermediate outcomes have been attained. The study must show that there has been an improvement in WaSH-related outcomes (e.g., households now have access to piped water systems or either by comparing to a separate group or over time. Studies examining the absence of an intermediate outcome (e.g. lack of clean or reliable drinking water, lack of access to sanitation) will be excluded. Studies that examine WaSH outcomes in the following categories will be included in the map:

Table 3: Intermediate WaSH outcome details

Intermediate Outcome	Description	Exclude
Drinking water outcomes:		
Drinking water systems are sustainably managed, operated, and maintained.	Improvements in management, system monitoring, oversight, preventative or responsive maintenance, system repairs, and operation of drinking water supply systems (reliable water supply; reduction in non-revenue water; improved billing and financial management; improved infrastructure and reduction in leaks; improved monitoring processes). Improvements in water service authorities'* capacities (i.e. training and qualifications completed or obtained; increased knowledge, skills, abilities; improved performance and adherence to regulations and standards);	Exclude studies focusing on management, operations, or maintenance of river/watershed basins, industrial water sources, irrigation systems, broader integrated water resource management and water governance not related to drinking water supply

Improvement in water utility consumer relations	Measures, of new consumer sign-ups; Reduction in complaints; Improved revenue collection from consumers paying; Improvements in incorporating community comments	Exclude utilities that do not disaggregate drinking water provision from other water provision (irrigation/agriculture, industrial water, water resource management)
Oversight agencies and local surveillance systems provide oversight and regulatory functions of drinking water systems	Improvements in external oversight agencies and local surveillance systems capacities (i.e. training and qualifications completed or obtained; increased knowledge, skills, abilities; improved performance and adherence to regulations and standards); Improved oversight and regulation of water service providers (i.e. compliance with policies and monitoring processes; lack of violations). Oversight agencies and local surveillance systems include institutions that are separate from the water supplier.	Exclude studies focusing on oversight and regulatory functions of river/watershed basins, industrial water sources, irrigation systems, broader integrated water resource management and water governance not related to drinking water supply
Drinking water quality is improved in drinking water systems	Measures of the change in water quality (physical, chemical, or biological contaminants) in improved drinking water systems (piped water supply, boreholes, wells, taps, community standpipes, water tankers).	Exclude irrigation, non-potable water, non-improved water drinking sources (i.e. surface water, unprotected well or spring)
Individuals or communities have access to enhanced drinking water services	Measures of the participants who have access to and/or use enhanced drinking water service levels (i.e. limited, basic, safely managed) as defined by WHO/UNICEF JMP [^] . Change can either occur within an enhanced drinking water service level or from a non-enhanced drinking water service level to an enhanced drinking water service level.	Exclude irrigation, non-potable water, or non-improved water drinking sources (i.e. surface water, unprotected well or spring) if only focus of study
Increased uptake of safe drinking water management practices by individuals and communities	Measures of participants who start practicing safe drinking water management, including safe storage, point-of use testing and treatment, avoidance of recontamination.	Exclude irrigation, non-potable water, or non-improved water drinking sources (i.e. surface water, unprotected well or spring) if only focus of study
Sanitation and hygiene outcomes:		
Communal or public sanitation and/or hygiene facilities are overseen and sustainably managed	Improvements in management, regulation, oversight, maintenance, condition, and operation of communal or public sanitation or hygiene facilities. Improvements in sanitation and hygiene service authorities' capacities (i.e. training and qualifications completed or obtained; increased knowledge, skills, abilities; improved performance, customer service, and adherence to regulations and standards),	Exclude wastewater treatment that does not have to do with sewage or fecal waste, such as slaughterhouse or abattoir or industrial waste, wastewater, or effluent.
Increased demand for sanitation and/or hygiene	Measures of demand for sanitation and/or hygiene products and/or services	Exclude oral or dental hygiene

products** and/or services***		
Functioning markets for sanitation and/or hygiene products and/or services	Measures of commercial supply and/or availability of sanitation and/or hygiene products and services, may be from either private or public sources, involves a purchase price.	Exclude oral or dental hygiene
Individuals or communities have consistent and convenient access to sanitation and/or hygiene products and/or services	Measures of both access (the potential to use these items, improvements in coverage and accessibility) and use (the number of people who actually use these items), as study authors may not always be clear about this distinction.	Exclude oral or dental hygiene
Enabling environments for menstrual health and hygiene (MHH)	Measures to facilitate MHH are implemented or expanded, i.e. menstrual supplies provided, private washrooms, disposal options.	Exclude studies that only focus on barriers to menstrual health and hygiene
Increased uptake of hand hygiene practices by individuals and communities	Measures of participants who start practicing handwashing with soap or hand sanitization.	Exclude oral or dental hygiene
Increased uptake of safe excreta disposal practices by individuals and communities	Measures of participants who start practicing the safe disposal of feces. Includes on-site fecal waste collection and treatment and all fecal waste management through non-centralized systems.	Exclude studies that focus on change in unimproved sanitation sources^^ (pit latrines without a slab or platform, hanging latrines or bucket latrines)
Increased uptake of safe food hygiene practices by individuals and communities	Measures of participants who start practicing safe food hygiene: washing hands before food handling and eating, using clean food preparation surfaces and utensils, avoiding cross-contamination of raw and ready-to-eat foods, cooking foods to appropriate temperatures, serving and storing food at appropriate temperatures.	Exclude oral or dental hygiene

*Service authorities refer to any institution that provides water, sanitation or hygiene services and include water and sanitation utilities (public or private-owned), government agencies or ministries that manage WaSH, and non-governmental entities that provide WaSH infrastructure

**Sanitation and hygiene products include toilets; soap; sanitizing agents; detergents; disinfectants; washing stations; toilet tissue, wipes, or personal washing supplies; menstrual health and hygiene products including sanitary pads, tampons, menstrual cups, and reusable menstrual products.;

***Sanitation and hygiene services include the provision and maintenance of toilet or latrine facilities; waste management (i.e. transportation and treatment); sewer connections

^JMP definitions of drinking water service levels can be found here: <https://washdata.org/monitoring/drinking-water>

^^JMP definitions of sanitation service levels can be found here: <https://washdata.org/monitoring/sanitation>

4.2.3 High-level, systemic outcomes

Included studies must demonstrate that at least one of the preceding intermediate outcomes is associated with at least one of the following high-level outcomes:

Table 4: High-level outcome details

High-level Outcomes	Description	Exclude
Prosperity outcomes:		
Education	Measures of school enrollment, registration, presence or absence, drop-out rate, advancement or graduation or completion at the primary, secondary or tertiary level. Learning outcomes such as test scores, literacy and numeracy skills, academic achievement.	Exclude measures of cognitive development, early childhood development, child development, biological indicators, outcomes measuring achievements outside of a school or classroom educational setting such as tutoring, after-school programs, and extra-curricular activities.
Livelihoods	'The activities, the assets, and the access that jointly determine the living gained by an individual or household' (Ellis, 1999). Specifically, these include income-generating and productive activities; physical and financial assets, as well as intangible assets such as knowledge, skills, social capital; and the ability of individuals and households to access these resources and opportunities.	Exclude livelihoods that are focused on provision of water, sanitation products, or hygiene products
Women's empowerment	'...a process by which women who have been denied the ability to make strategic life choices acquire such an ability' (Kabeer, 1999; see also Pereznieta and Taylor, 2014 for dimensions of women's economic empowerment). Includes measures of women's advancements in the following areas: <ul style="list-style-type: none"> ● Resources: material, human and social resources which serve to enhance the ability to exercise choice, including time and time-use studies; ● Agency: ability to define one's goals and act upon them and operationalized decision-making; and/or ● Achievement: ways of being and doing which can be realized by different individuals. 	Exclude studies that do not disaggregate outcomes by gender (e.g., studies that focus on time use but not disaggregated by gender)
Benefits to enterprise	Micro- or meso-level economic benefits: innovation, start-ups, expansion and growth, job creation, productivity, profitability, investment and funding, risk and loss mitigation for enterprises of all sizes, public and private. Pertains to businesses operating above the household level.	Exclude enterprises that focus on provision of water, sanitation products, or hygiene products
Economic growth	Macro-level economic benefits: GDP growth, market development, sector growth and development, trade.	

Stability outcomes:		
Public perception of institutions	Public perceptions of service reliability, service equity, trust in water provision and quality, performance of officials, satisfaction, public approval; confidence in WaSH services as measured in willingness to pay, fees paid, ratings.	Exclude studies that focus on perception of water quality
Governance processes or services	Adoption of institutional (public or private sector) improvements in transparency and accountability, participation and inclusion, bureaucratic processes, infrastructure and service provision, reform, timely response, upholding access to WaSH as a basic human right as well as specific water access and ownership rights. Includes reductions in corruption, defined as: the abuse of entrusted authority for private gain (USAID, 2005).	Excludes improvements to WaSH systems themselves
Conflict	Conflict prevention (inter-personal to inter-state scale): preventing, reducing, and addressing violence, abuse, disputes, grievances, theft, conflict, war. Peacebuilding: social cohesion, reconciliation between different groups, increased understanding and trust between different groups, collaborative contact to get different groups working together, or intergroup dialogue to build trust.	Exclude peacekeeping forces
Resilience outcomes:		
Climate-linked food insecurity	Food insecurity outcome areas when explicitly linked to climate change : hunger, food availability, food access, malnutrition, stunting, wasting, sub-optimal child growth outcomes, low birthweight, micronutrient deficiencies including anemia.	Exclude general food insecurity studies that are not linked to climate change
Climate-linked economic challenges	Economic hardship outcome areas when explicitly linked to climate change : poverty, crop loss, asset loss, debt, any household economic hardship.	Exclude broader economic challenges studies not linked to climate change
Climate-linked migration	Migration outcome areas when explicitly linked to climate change : emigration, immigration, internal migration, displacement, refugees and asylum seekers.	Exclude migration studies not linked to climate change
Resilience to climate-linked natural disasters	Measures of individuals, communities, or countries' ability to mitigate, adapt to, and recover from shocks and stressors due to natural disasters such as floods, droughts, landslides, extreme storms, extreme temperatures, fires, sea level rise or others when these events are explicitly linked to climate change . Resilience: "The ability of people, households, communities, countries, and systems to mitigate, adapt to and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth" (USAID, 2012).	Exclude natural disasters studies that are not linked to climate change
Pollution	Pollutant(s) in a body of water or watershed. Pollutant defined as "substance which disrupts and interferes with the equilibrium of a water system and impairs the suitability of using the water for a desired purpose" (UNEP, 2018, p. 18). Pollutants may include chemicals, salinity, organic matter and excess nutrients, physical waste and particulates, wastewater, effluent, sewage, pathogens,	Exclude studies that focus on water, air, or soil quality in general without focus on change of pollutants in environment

	pharmaceuticals, and radioactivity. Greenhouse gas emissions: carbon dioxide, carbon footprint, methane; gas reduction and mitigation measures including gas or carbon capture, carbon offsets. Soil pollution.	
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4.2.4 Study designs

We will include three categories of study designs:

- Evidence synthesis: systematic reviews, meta-analyses, and evidence gap maps
- Impact evaluations
- Quantitative observational studies: Studies employing quantitative methods to measure the association between intermediate and high-level, systemic outcomes

Systematic review: A systematic review (SR) is a synthesis of the research evidence on a particular topic, such as the effectiveness of water supply and sanitation, obtained through an exhaustive systematic literature search for all relevant studies using widely accepted scientific strategies to minimize error associated with appraising the design and results of studies. A systematic review uses methods of internal and external validity quality assurance that make it more similar to a primary study (e.g. double-coding of data, calculation of effect sizes from data reported, synthesis of finding). Studies will be excluded if they do not examine WaSH outcomes in a real-world setting, i.e. experiments conducted in tightly-controlled settings, like those of laboratory or efficacy studies, will be excluded.

Included synthesis study designs:

We will include systematic reviews, meta-analyses, and evidence gap maps that describe the search, inclusion criteria, data collection and synthesis methods used (Snilstveit *et al.*, 2016). Any evidence reviews, such as literature reviews, that do not adopt these methods will be excluded. If reviews include multiple research methods, we will include these if at least 50 per cent of studies are comprised of study designs specified below, or where the effectiveness component of the review was empty (i.e. no eligible studies were identified) and thus no findings on effectiveness are reported. Where reviews include a mixture of evidence from both high-income and L&MICs, we will include them if they present disaggregated evidence for L&MICs, or if more than 50 per cent of the evidence of non-disaggregated results is from L&MICs. Where there are no disaggregated results for L&MICs and more than 50 per cent of the evidence for consolidated findings in a systematic review comes from high-income countries, or where it is impossible to ascertain the composition of evidence by income level, the studies are excluded.

Impact evaluation: An impact evaluation (IE) is a study that uses rigorous methods to provide a quantitative estimate of the impact of an intervention. This is accomplished by constructing a counterfactual, which provides evidence about what would have happened in the absence of the intervention. In an impact evaluation, the outcomes of those who receive the intervention are compared with those of a comparison group that does not receive the intervention. The comparison

group may be a specific population in the study area that does not receive the treatment (as in an RCT) or may be constructed by researchers (as in propensity score matching or regression discontinuity design). For an impact evaluation to be valid, there must be a sound statistical basis for claiming that the comparison group represents what would have happened to the treatment group had they not received the intervention.

We will include studies that implement at least one of the following study designs that are widely used to evaluate intervention effectiveness (Becker *et al.*, 2017; Reeves, Wells and Waddington, 2017). Only studies that clearly state the method that they use and that we determine are applying that label correctly will be included.

Included impact evaluation study designs:

Impact evaluations will be included provided they meet the following criteria:

1. Intervention was implemented successfully
2. Sufficient take-up of intervention
 - a. If take-up data of the intervention is provided in the study, we will define sufficient take-up as the majority of the intended intervention recipients reported having participated in the intervention (e.g., number of community members attending behavior change session on open defecation or number of girls who received menstrual pads). If intervention take-up is not provided in the study, we will assume that there was sufficient take-up of the intervention.
3. Intervention achieved intermediate outcome
 - a. Achievement will be defined as any measure of improvement in WaSH-related behaviors or access, compared to either a comparison group or over time. This improvement does not need to be statistically significant.
4. Intervention measured impact at high-level outcome
 - a. The analysis must quantify the association between the intermediate outcome and the high-level outcome. Studies that report the outcomes separately but do not quantify the relationship between both set of outcomes will not be included.

Researchers will review study criteria hierarchically. Each study will fulfill Criteria #1 and #2 to meet internal validity of #3.

Methods will include:

- Randomized controlled trials (RCTs) with assignment at the individual, household, community, or other cluster level. Randomization can be based on a lottery, oversubscription, or a stepped wedge design but assignment must be implemented prior to intervention implementation.
- Quasi-experimental designs that aim to estimate treatment effects through a counterfactual scenario, mitigate selection bias, and/or control for confounding:

- Regression discontinuity designs, where assignment is based on a threshold measured before intervention, and the study uses prospective or retrospective approaches of analysis to control for unobservable confounding.
- Natural experiments with clearly defined intervention and comparison groups that exploit random natural variation in assignment (such as a lottery) or random rollout or errors in implementation.
- Studies attempting to control for time-invariant confounding, including difference-in-differences, fixed-effects models, or using econometric methods.
- Studies assessing changes in trends in outcomes over a series of time points with a contemporaneous comparison (interrupted time series, ITS), and with sufficient observations to establish a trend and control for effects on outcomes due to factors other than the intervention (such as seasonality).
- Studies that use matching techniques to construct a comparison group, such as statistical matching, covariate matching, coarsened-exact matching, and propensity score matching.
- Studies that control for endogeneity using instrumental variable (IV) approaches such as two-stage least squares procedures.
- Studies that build a counterfactual through synthetic control approaches.

Included quantitative observational designs:

Observational designs may be included if they quantify the association between the intermediate outcomes of interest and high-level outcomes of interest. In addition to quantifying the association between outcomes, study methods must make some attempt to control for confounding (e.g. by controlling for covariates). Though studies do not need to measure how an intervention achieves this intermediate outcome, studies do need to include some sort of comparison of different states (either over time or with a separate comparison group).

Observational studies will be included provided they meet the following criteria:

1. Study measures the achievement of one or more intermediate WaSH outcomes. Studies examining the absence or lack of WaSH or unimproved WaSH are excluded.
 - a. In longitudinal studies: measure change in WaSH outcome over time. For instance, Jeuland and colleagues (2013) track improvements in WaSH coverage over time and associated economic benefits.
 - b. In cross-sectional studies: compare rate of or access to WaSH outcome between two or more groups. For example, Ceric and Vucijak (2011) examine differences in a high-level outcome of interest between households that are connected to a sewage network and households that are not connected to a sewage network.
2. Study quantifies the association between intermediate outcome and high-level outcome
 - a. Studies that only include the intermediate outcome and high-level outcome as covariates in the same model will not be included. They must be on opposite sides of the model (i.e., one should be an independent variable and the other should be the dependent variable).

Methods may include:

- Multivariate regression analyses with controls for confounders (this could be stated as multivariate regression, OLS, pooled OLS, random effects, logistic regression, probit, tobit models. that include control variables);
- Controlled before-and-after studies;
- Controlled ex-post studies;
- Modelling studies that draw on population-level data to forecast events across time or to create a country or economy-wide counterfactual scenario at a single point in time, as in CGE models (modelling estimates must be based on real data, i.e. national surveys or other primary data sources, that is then used to create a counterfactual scenario or forecast beyond the timeframe of the data source; studies that create their own data simulations not based in real data will be excluded);
- Cost analysis studies (this could include economic evaluations, cost-benefit analyses, cost-effectiveness analyses); or
- Cohort studies that control for confounders (this could include longitudinal or panel studies, case-control studies).

Excluded study designs:

We will exclude studies that do not quantify the association between outcomes of interest. Before-after studies or cross-sectional studies that do not attempt to control for confounding in any way will be excluded. Observational studies that solely report descriptive statistics will also be excluded. Experiments conducted in tightly controlled settings, like those of a laboratory, and studies that measure immediate reactions to a short-term exposure, i.e. studies where implementation and data collection is started and completed within a single day, will be excluded.

4.2.5 Other inclusion and exclusion criteria

Language: Studies published in any language will be included, although the search terms used will be in English only.

Publication date: Studies will be included if they are using data from 2010 or after. If the year of the data source is not available, then we will use publication date and only studies that are published 2010 or after will be included. This date was selected in conjunction with the funder in order to limit the scope of studies to recent findings.

Status of studies: We will include ongoing and completed impact evaluations and systematic reviews. For ongoing studies, we will include prospective study records, protocols and trial registrations. Providing an indication of the prevalence and characteristics of on-going evaluation evidence is expected to enrich the analysis of current evidence gaps and support decision making in relation to evidence generation.

4.3 Search strategy

The search strategy follows guidelines for systematic literature searching (Kugley *et al.*, 2017). This strategy has been designed to address potential publication bias issues by systematically searching academic bibliographic databases and implementing additional searches for grey literature in specialist organizational websites, websites of bilateral and multilateral agencies and repositories of research in international development.

Reported WaSH outcomes are expected to occur in several development and humanitarian sectors. As such, the strategy will consider sector specific databases where appropriate. Currently, the proposed search strategy consists of a systematic search of four academic databases and 43 websites of key organizations and online repositories for the initial screening. Where possible, the review team will contact key experts and organizations through our advisory group (presented in Appendix D) to identify additional studies that meet the inclusion criteria.

An example of the search strings employed by the strategy for one database are presented in Appendix A. The precise strings and logic (e.g. index terms and truncation operators) will be adapted for each database and platform.

4.3.1 List of proposed search databases

- CAB Abstracts (EBSCO)
- Africa-Wide (EBSCO)
- World Bank, Agris, RePEc (EBSCO Discovery)
- Web of Science (SSCI)

4.3.2 Specific WaSH organization websites

Hand-searched by reviewers	Automated search by webscrapers
NC State Global WaSH Cluster	IRC WASH
Sustainable Sanitation Alliance	Sanitation and Water for All
WaSH Cluster Resource Center	Rural Water Supply Network
Water Security Research Centre, UEA	UNC Water Institute
WaterAid	

4.3.3 Other organizations' websites

Hand-searched by reviewers	Automated search by webscrapers
African Development Bank (AfDB) – Evaluation Reports	Abdul Latif Jameel Poverty Action Lab (J-Pal)
BRAC Institute of Governance and Development	Asian Development Bank (ADB) – Evaluation Resources
BRAC Research and Evaluation Division (RED) Archive	Campbell Library
British Library of Development Studies (BLDS)	Center for Global Development

Cochrane library	DFID Research for Development (R4D)
Global Development Network	German Institute for Development Evaluation (DEval)
IDRC	Inter-American Development Bank (IDB)
Innovations for Poverty Action (IPA)	Mercy Corps
International Initiative for Impact Evaluation (3ie)	NBER Working Papers
Development Evidence Portal	
International Rescue Committee (IRC)	Overseas Development Institute (ODI)
Norwegian Agency for Development Cooperation (NORAD)	USAID Learning Lab
Oxfam Policy and Practice	
Registry of International Development Impact Evaluations (RIDIE)	USAID Development Experience Clearinghouse
Save the Children	World Bank – Development Impact Evaluation Initiative (DIME)
	World Bank – Independent Evaluation Group (IEG)
Sida	
Social Science Research Network (SSRN)	
UN Women	
United Nations Development Programme (UNDP)	
United Nations Evaluation Group	
United Nations High Commissioner for Refugees (UNHCR)	

We will also conduct forward and backward citation tracking, described in detail in section 4.4 below, to ensure that no relevant body of literature is missed.

4.4 Screening protocol

We will import all search results into the systematic review software [EPPI-reviewer 4](#). This platform will be used to manage references, identify, and remove duplicate studies, and screen records for inclusion using the procedures outlined below.

Import study records: All output files (e.g. RIS or.txt files) of the search strategy will be imported into EPPI.

Removal of duplicate studies: An automated process within EPPI will be used to identify duplicate files. Duplicates will be confirmed by a human screener before removal.

Training of screeners: The core project team will train a team of independent research consultants on the protocol, with a focus on understanding the subject matter and the screening process. All screeners will screen the same set of study data and be scored on consistency (i.e. did screeners make the decision that was consistent with the core team?) until at least an 85 per cent level of consistency is achieved in terms of the decision to include or exclude a study. Initially, a selected set of around 25 studies will be screened to provide training to the team. There will be several rounds of practice until the 85 per cent consistency is achieved.

Title and abstract screening (TAS): After completing training and attaining an 85 per cent agreement rate, consultants will be assigned batches of 700-2000 studies to be screened on title and abstract. We will combine double-screening with machine learning functionality to speed up the screening process. Previous training data from initial screening by the core team will be sent to the machine learning partners to develop a model that will prioritize studies for the full title and abstract screening. The machine learning model will rank studies based on three criteria: 1) Publication date is 2010 and after; 2) Study takes place in a low- or middle-income country; 3) Study is related to the WaSH sector. These three criteria match the first three exclusion criteria within the full screening criteria. Consultants will screen batches of studies based on the full screening criteria and the results from this screening will be provided to the machine learning team to refine the model. After the model has reached the threshold where it can only be incrementally improved, the model will be run on the remaining set of results to identify the priority abstracts to be screened by the consultants and to automatically exclude records with very low probabilities of inclusion. The entire screening process will continue with a double screening approach where two independent research consultants screen each abstract, give a judgment of include or exclude, and any include or exclude disagreement is reconciled with the supervision of a core team member. Several exclude codes will be available to provide more information on the reasons for exclusion in each case. Screening codes will be applied in a hierarchical order so that consistent comparisons can be made about why studies were excluded and at what stage in the screening process. The output of this process will be a set of screened studies suitable for full text screening.

Full text screening (FTS): We will retrieve the full text for each study that meets all the TAS inclusion criteria. Two reviewers will independently examine each full text in detail against the protocol again and will decide whether the study meets inclusion criteria or not. Any disagreements between reviewers will be reconciled with the supervision of a core team member. The output of this stage will be a set of studies deemed suitable to be included in the systematic map.

Checks for linked publications: The project team will attempt to group publications that focus on the same intervention and study population (i.e. publications that report on the same study). This typically occurs in cases where an author group publishes more than one paper in relation to one study on a specific population. Descriptive information will only be extracted once for each group of linked publications, drawing on all linked publications so that extraction is as comprehensive as possible.

Forward and backward citation tracking: We will conduct forward citation tracking for all studies included at FTS stage. For all the excluded studies that are marked “Check study references” in either TAS or FTS (typically used for studies such as systematic reviews that do not meet inclusion criteria but may include or reference studies that may be relevant to this systematic map), backward citation tracking will be implemented by trained consultants. The output will be added to EPPI and screened at TAS and FTS again following protocol described above.

Each step in this process will be documented in detail and graphically presented in a flow chart (PRISMA) in the final report to facilitate replication of the approach.

4.5 Data extraction and critical appraisal

We will systematically extract data from all included studies using variations on the example data extraction template in Appendix B, based on study type. We will use 3ie's Development Evidence Portal platform to complete this task, with extraction fields customized to the specifications of this systematic map project. The data will cover the following broad areas:

- **Basic study and publication information:** This coding will focus on capturing the general characteristics of the study including authors, publication date and status, study location, study design, intervention type, outcomes reported, definition of outcome measures, population of interest, study and program funders.
- **Topical cross-cutting issues:** We will extract data on a number of cross-cutting issues, including gender, context, equity, and cost-effectiveness.
- **Critical appraisal:** All included systematic reviews will be critically appraised following the practices adopted by 3ie Development Evidence Portal protocol, which draws on Lewin et al. (2009). This appraisal assesses systematic reviews according to criteria relating to the search, screening, data extraction, and synthesis activities conducted, and covers all the most common areas where biases are introduced. Each systematic review will be rated as low, medium, or high confidence drawing on guidance provided in Snilstveit and colleagues (2017). The tool used for this process is presented in Appendix C. We will not critically appraise impact evaluations, as this is typically beyond the scope of EGMs and systematic maps.

The following processes will be implemented to collect this information:

1. **Develop and refine data extraction tools and codebooks:** The draft tools developed for this project will be reviewed and potentially refined in light of any feedback received by the systematic map advisory group and insights from project implementation.
2. **Data extraction training and pilot:** Coders assigned to each data extraction task will undergo training in using the tools provided. Additional group training will be completed as required prior to the main-stage extraction.
3. **Main-stage extraction:** Data will be extracted from studies by single coders. In the case of critical appraisal assessments, studies will first be single extracted and then reviewed by a systematic review methods expert. Meetings will be held periodically with coders on the project to provide support and resolve queries.
4. **Quality checks:** From the beginning of the data extraction phase, the project team will check the extracted data. A member of the core team will perform quality checks of each study extracted by consultants prior to publication of the map.

4.6 Dealing with multicomponent outcomes

There may be included studies that analyze the association between multiple intermediate outcomes and high-level outcomes. If the study reports discrete quantitative measures for each included intermediate outcome, then the study will be coded to appear for each included intermediate outcome. However, if the study does not report discrete measures for the included outcomes, then

the study will be part of a “Multi-component outcome” category on the map. Depending on the number of studies included in this composite category, the project team may report the top 5 combinations within this category.

4.7 Analysis and reporting

We will conduct a range of descriptive analyses to provide an overview of included studies across the following dimensions:

- Publication year
- Publication type
- Geography
- Study participants
- Intermediate outcomes
- High-level outcomes
- Study type characteristics
- Results of the systematic review critical appraisal
- Equity and cross cutting themes considerations, e.g. population and gender

Where appropriate, we will consider running cross-tabs to provide more nuanced overview of the evidence identified. We will produce the following analytical outputs:

- **Interactive systematic map:** An interactive systematic map that visually presents the current state of the literature, categorised by coverage with respect to the pre-determined outcome-outcome framework, quality and completeness. Filters may be incorporated into the map to enable more targeted use – for example, by restricting the studies to a specific unit of analysis. This will be stored on the 3ie website and shared as a public good.
- **Presentation:** A Microsoft PowerPoint presentation will provide an overview of the emerging findings of the systematic map. This will be presented by the core project team and will provide an opportunity for USAID to comment on findings and to collaboratively discuss opportunities for additional analyses, presentation of results and implications. It will be designed such that it can be used by USAID and for internal learning purposes.
- **Systematic map technical report:** The systematic map technical report will include a detailed overview of the method, theory of change, and the key results of the map; it will provide a high level of analytical detail and will be supported by technical annexes. This report will conclude by directly addressing the key research questions stated in Section 2 and provide a set of research and policy implications. This will be published by 3ie and shared as a public good.
- **Systematic map executive summary:** This report will provide a high-level summary of the results and primarily focus on answering the research questions specified in Section 2 using non-technical language.

5. Timeline and communication

5.1 Timeline

The approximate date for submission of the systematic map report is August 2022. All final analytical outputs will be published on the 3ie Evidence Hub. USAID may also publish relevant materials.

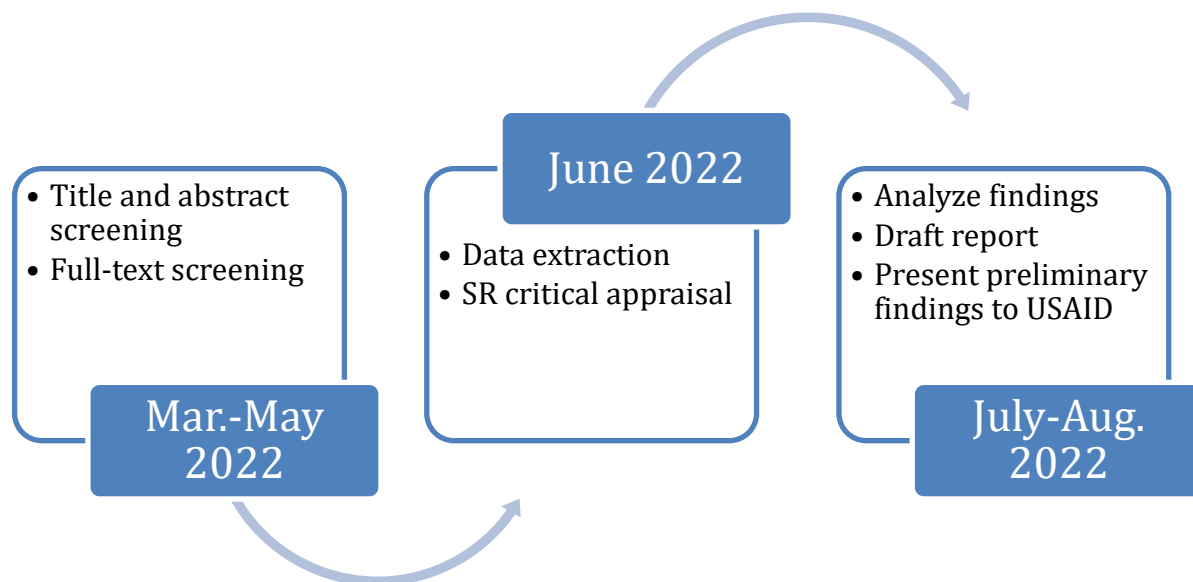


Figure 2. WASH systematic map workflow over time

5.2 Engagement and communication plan

It is important that the results of the systematic map are shared with USAID and its internal audiences, and more broadly to the development sector. The project will complete the following activities to engage with key stakeholders to attempt to ensure the results of the project accurately reflect the policy and research needs of key stakeholders:

- **Develop a systematic map advisory group:** The project team, in collaboration with USAID, will engage with key stakeholders with academic and/or practitioner expertise in the WaSH field. The advisory group will have the aim of providing pro-bono support to the project at several key stages of the project. These stages include developing the systematic map framework and project protocol, reviewing and interpreting emerging findings, and

developing and optimizing the analytical outputs produced to aid evidence uptake and use. Advisory group details are provided in Appendix D.

- **Analytical outputs:** Additional analytical outputs will be produced as required depending on the needs of specific audiences, as described in subsection 4.8 above.
- **Disseminate findings to stakeholders; publish and communicate results:** Findings from the systematic map will be disseminated to USAID, the systematic map advisory group, and other relevant stakeholder. The interactive map and report described in subsection 4.8 will be published on 3ie’s website and made available as a public good in an engaging and accessible format. 3ie will promote the systematic map through its communication channels and through the systematic map advisory group.

6. Additional information about the systematic map

Roles and responsibilities:

- **Framework development:**Sridevi K. Prasad, Heather van Buskirk
- **Systematic map methodology:**SKP, HvB
- **Search strategy:**SKP, HvB, John Eyers
- **Screening and data extraction:**SKP, HvB, consultant team
- **Analysis and reporting:**SKP, HvB

6.1 Sources of support

This systematic map was commissioned by the United States Agency for International Development (USAID) under the Bureau for Resilience and Food Security (RFS).

6.2 Declarations of interest

No conflict of interest to declare.

6.3 Plans for updating the systematic map

At the time of publication, there are no plans in place for updating the systematic map.

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8. Appendices

8.1 Appendix A: Search strategy

1. CAB Abstracts (Ebsco) – Searched 23rd December 2021

Other Ebsco Databases searched using the same strategy:

2. Repec/World Bank e-library/AGRIS (via Ebsco Discovery): 3811

3. Africa-Wide : 2688

S26 S8 OR S10 OR S12 Limiters - Publication Year: 20100101-20211231; Language: English

13,356

S25 S8 OR S10 OR S12

15,245

S24 S13 AND S17 AND S22 Limiters - Publication Year: 20100101-20211231; Language: English

6,837

S23 S13 AND S17 AND S22

9,862

S22 S18 OR S19 OR S20 OR S21

54,962

S21 TI (((water or sanitation or sanitary or hygien* or WASH) N5 (behavio* or menstrua* or handwash* or hand-wash* or "hand wash*"))) OR AB (((water or sanitation or sanitary or hygien* or WASH) N5 (behavio* or menstrua* or handwash* or hand-wash* or "hand wash*"))) OR SU (((water or sanitation or sanitary or hygien* or WASH) N5 (behavio* or menstrua* or handwash* or hand-wash* or "hand wash*")))

9,527

S20 TI ((((domestic or household* or drinking or potable or piped or tap) N2 water) N6 (monitor* or manag* or regulat* or enforc* or accountab* or surveillance or vigilan* or safeguard* or test* or quality or access* or sustain*))) OR AB ((((domestic or household* or drinking or potable or piped or tap) N2 water) N6 (monitor* or manag* or regulat* or enforc* or accountab* or surveillance or vigilan* or test* or safeguard* or quality or access* or sustain*))) OR SU ((((domestic or household* or drinking or potable or piped or tap) N2 water) N6 (monitor* or manag* or regulat* or enforc* or accountab* or surveillance or vigilan* or test* or safeguard* or quality or access* or sustain*)))

11,620

S19 TI ((((domestic or household* or drinking or potable or piped or tap) N2 water) N6 (treat* or process* or purif* or safe or service*))) OR AB ((((domestic or household* or drinking or potable or piped or tap) N2 water) N6 (treat* or process* or purif* or safe or service*))) OR SU ((((domestic or household* or drinking or potable or piped or tap) N2 water) N6 (treat* or process* or purif* or safe or service*)))

12,323

S18 TI (((sewage or sewerage or "human waste" or feces or faeces or fecal or faecal or excreta or excrement or WASH) N6 (treat* or dispos* or process* or purif*))) OR AB (((sewage or sewerage or "human waste" or feces or faeces or fecal or faecal or excreta or excrement or WASH) N6 (treat* or dispos* or process* or purif*))) OR SU (((sewage or sewerage or "human waste" or feces or faeces or fecal or faecal or excreta or excrement or WASH) N6 (treat* or dispos* or process* or purif*)))

25,432

S17 S14 OR S15 OR S16

2,865,167

S16 TI ((observational N2 (study or analysis)) or ((multivariate or logistic* or multi-country) N2 regression) or "random effect*" or "probit model" or "simulation model*" or "control* ex-post" or (control* N2 (before N3 after) N2 study) or "time series" or ((cohort or case-control or longitudinal or retrospective or prospective or follow-up) N2 (study or analysis))) OR AB ((observational N2 (study or analysis)) or ((multivariate or logistic* or multi-country) N2 regression) or "random effect*" or "probit model" or "simulation model*" or "control* ex-post" or (control* N2 (before N3 after) N2 study) or "time series" or ((cohort or case-control or longitudinal or retrospective or prospective or follow-up) N2 (study or analysis))) OR SU ((observational N2 (study or analysis)) or ((multivariate or logistic* or multi-country) N2 regression) or "random effect*" or "probit model" or "simulation model*" or "control* ex-post" or (control* N2 (before N3 after) N2 study) or "time series" or ((cohort or case-control or longitudinal or retrospective or prospective or follow-up) N2 (study or analysis)))

289,020

S15 TI ("random* control* trial*" or "random* trial*" or rct* or (random* N3 allocat*) or "quasi experiment*" or quasi-experiment* or evaluat* or impact* or assess* or multi-level or multilevel or "multi level" or dif-dif or psm or "double difference" or difference-in-difference or rdd or "difference in difference" or "double difference" or "statistical matching*" or "propensity score matching" or "covariate matching" or "coarsened-exact matching" or "propensity-weighted" or "multiple regression" or "statistical regression" or "regression discontinuity*" or "cohort analysis" or (quantitative N2 (method*" or study or design or analysis)) or "interrupted time series" or (("fixed effect*" or "random effect*") N3 (model or estimation)) or "instrumental variable" or ((cost* or economic) N2 (benefit or effective* or analy*))) OR AB ("random* control* trial*" or "random* trial*" or rct* or (random* N3

allocat*) or "quasi experiment*" or quasi-experiment* or evaluat* or impact* or assess* or multi-level or multilevel or "multi level" or dif-dif or psm or "double difference" or difference-in-difference or rdd or "difference in difference" or "double difference" or "statistical matching*" or "propensity score matching" or "covariate matching" or "coarsened-exact matching" or "propensity-weighted" or "multiple regression" or "statistical regression" or "regression discontinuity*" or "cohort analysis" or (quantitative N2 (method*" or study or design or analysis)) or "interrupted time series" or (("fixed effect*" or "random effect*") N3 (model or estimation)) or "instrumental variable" or ((cost* or economic) N2 (benefit or effective* or analy*))) OR SU ("random* control* trial*" or "random* trial*" or rct* or (random* N3 allocat*) or "quasi experiment*" or quasi-experiment* or evaluat* or impact* or assess* or multi-level or multilevel or "multi level" or dif-dif or psm or "double difference" or difference-in-difference or rdd or "difference in difference" or "double difference" or "statistical matching*" or "propensity score matching" or "covariate matching" or "coarsened-exact matching" or "propensity-weighted" or "multiple regression" or "statistical regression" or "regression discontinuity*" or "cohort analysis" or (quantitative N2 (method*" or study or design or analysis)) or "interrupted time series" or (("fixed effect*" or "random effect*") N3 (model or estimation)) or "instrumental variable" or ((cost* or economic) N2 (benefit or effective* or analy*)))

2,724,343

S14 TI (("systematic review" or meta-analy* or "meta analy*" or metaanaly* or "literature review" or "gap map" or "evidence map" or EGM or "scoping review" or "rapid review" or "evidence review" or ((project or program*) N2 (evaluation or review)))) OR AB (("systematic review" or meta-analy* or "meta analy*" or metaanaly* or "literature review" or "gap map" or "evidence map" or EGM or "scoping review" or "rapid review" or "evidence review" or ((project or program*) N2 (evaluation or review)))) OR SU (("systematic review" or meta-analy* or "meta analy*" or metaanaly* or "literature review" or "gap map" or "evidence map" or EGM or "scoping review" or "rapid review" or "evidence review" or ((project or program*) N2 (evaluation or review))))

65,182

S13 TI ((afghanistan or albania or algeria or "american samoa" or angola or "antigua and barbuda" or antigua or barbuda or argentina or armenia or armenian or azerbaijan or bangladesh or republic of belarus or belarus or byelarus or belorussia or byelorussian or belize or "british honduras" or benin or dahomey or bhutan or bolivia or "bosnia and herzegovina" or bosnia or herzegovina or botswana or bechuanaland or brazil or brasil or bulgaria or "burkina faso" or "burkina fasso" or "upper volta" or burundi or urundi or "cabo verde" or "cape verde" or cambodia or kampuchea or "khmer republic" or cameroon or cameron or cameroun or "central african republic" or "ubangi shari" or chad or chile or china or colombia or comoros or "comoro islands" or "iles comores" or mayotte or "democratic republic of the congo" or "democratic republic congo" or congo or zaire or "costa rica" or "cote divoire" or "cote d ivoire" or "cote divoire" or "cote d ivoire" or "ivory coast" or croatia or cuba or djibouti or "french somaliland" or dominica or "dominican republic" or ecuador or egypt or "united arab republic" or "el salvador" or "equatorial guinea" or "spanish guinea" or eritrea or estonia or eswatini or swaziland or ethiopia or fiji or gabon or "gabonese republic" or gambia or "georgia (republic) " or georgian or ghana

or "gold coast" or gibraltar or grenada or guatemala or guinea or "guinea bissau" or guyana or "british guiana" or haiti or hispaniola or honduras or hungary or india or indonesia or timor or iran or iraq or jamaica or jordan or kazakhstan or kazakh or kenya or "democratic peoples republic of korea" or "north korea" or kosovo or kyrgyzstan or kirghizia or kirgizstan or "kyrgyz republic" or kirghiz or laos or "lao pdr" or "lao people's democratic republic" or latvia or lebanon or "lebanese republic" or lesotho or basutoland or liberia or libya or "libyan arab jamahiriya" or lithuania or "republic of north macedonia" or macedonia or madagascar or "malagasy republic" or malawi or nyasaland or malaysia or "malay federation" or "malaya federation" or maldives or "indian ocean islands" or "indian ocean" or mali or micronesia or "federated states of micronesia" or kiribati or "marshall islands" or nauru or palau or tuvalu or mauritania or mauritius or mexico or moldova or moldovian or mongolia or montenegro or morocco or ifni or mozambique or "portuguese east africa" or myanmar or burma or namibia or nepal or "netherlands antilles" or nicaragua or niger or nigeria or muscat or pakistan or panama or "papua new guinea" or "new guinea" or paraguay or peru or philippines or philipines or phillippines or philippines or romania or russia or "russian federation" or rwanda or ruanda or samoa or "pacific islands" or polynesia or "samoan islands" or "navigator island" or "navigator islands" or "sao tome and principe" or senegal or serbia or seychelles or "sierra leone" or melanesia or "solomon island" or "solomon islands" or "norfolk island" or "norfolk islands" or somalia or "south africa" or "south sudan" or "sri lanka" or ceylon or "saint kitts and nevis" or "st. kitts and nevis" or "saint lucia" or "st. lucia" or "saint vincent and the grenadines" or "saint vincent" or "st. vincent" or grenadines or sudan or suriname or surinam or "dutch guiana" or "netherlands guiana" or syria or "syrian arab republic" or tajikistan or tadjikistan or tadjhikistan or tadjhik or tanzania or tanganyika or thailand or siam or "timor leste" or "east timor" or togo or "togolese republic" or tonga or tunisia or turkey or turkmenistan or turkmen or uganda or ukraine or uruguay or uzbekistan or uzbek or vanuatu or "new hebrides" or venezuela or vietnam or "viet nam" or "middle east" or "west bank" or gaza or palestine or yemen or zambia or zimbabwe or "northern rhodesia" or "global south" or "africa south of the sahara" or "sub-saharan africa" or "subsaharan africa" or "africa, central" or "central africa" or "africa, northern" or "north africa" or "northern africa" or magreb or maghrib or sahara or "africa, southern" or "southern africa" or "africa, eastern" or "east africa" or "eastern africa" or "africa, western" or "west africa" or "western africa" or "west indies" or "indian ocean islands" or caribbean or "central america" or "latin america" or "south and central america" or "south america" or "asia, central" or "central asia" or "asia, northern" or "north asia" or "northern asia" or "asia, southeastern" or "southeastern asia" or "south eastern asia" or "southeast asia" or "south east asia" or "asia, western" or "western asia" or "europe, eastern" or "east europe" or "eastern europe" or "developing country" or "developing countries" or "developing nation*" or "developing population*" or "developing world" or "less developed countr*" or "less developed nation*" or "less developed population*" or "less developed world" or "lesser developed countr*" or "lesser developed nation*" or "lesser developed population*" or "lesser developed world" or "under developed countr*" or "under developed nation*" or "under developed population*" or "under developed world" or "underdeveloped countr*" or "underdeveloped nation*" or "underdeveloped population*" or "underdeveloped world" or "middle income countr*" or "middle income nation*" or "middle income population*" or "low income countr*" or "low income nation*" or "low income population*" or "lower income countr*" or "lower income nation*" or "lower income population*" or "underserved countr*" or "underserved nation*" or "underserved population*" or "underserved world"

or "under served countr*" or "under served nation*" or "under served population*" or "under served world" or "deprived countr*" or "deprived nation*" or "deprived population*" or "deprived world" or "poor countr*" or "poor nation*" or "poor population*" or "poor world" or "poorer countr*" or "poorer nation*" or "poorer population*" or "poorer world" or "developing econom*" or "less developed econom*" or "lesser developed econom*" or "under developed econom*" or "underdeveloped econom*" or "middle income econom*" or "low income econom*" or "lower income econom*" or "low gdp" or "low gnp" or "low gross domestic" or "low gross national" or "lower gdp" or "lower gnp" or "lower gross domestic" or "lower gross national" or lmic or lmics or "third world" or "lami countr*" or "transitional countr*" or "emerging economies" or "emerging nation*")) OR AB ((afghanistan or albania or algeria or "american samoa" or angola or "antigua and barbuda" or antigua or barbuda or argentina or armenia or armenian or azerbaijan or bangladesh or republic of belarus or belarus or byelarus or belorussia or byelorussian or belize or "british honduras" or benin or dahomey or bhutan or bolivia or "bosnia and herzegovina" or bosnia or herzegovina or botswana or bechuanaland or brazil or brasil or bulgaria or "burkina faso" or "burkina fasso" or "upper volta" or burundi or urundi or "cabo verde" or "cape verde" or cambodia or kampuhea or "khmer republic" or cameroon or cameron or cameroun or "central african republic" or "ubangi shari" or chad or chile or china or colombia or comoros or "comoro islands" or "iles comores" or mayotte or "democratic republic of the congo" or "democratic republic congo" or congo or zaire or "costa rica" or "cote divoire" or "cote d ivoire" or "cote divoire" or "cote d ivoire" or "ivory coast" or croatia or cuba or djibouti or "french somaliland" or dominica or "dominican republic" or ecuador or egypt or "united arab republic" or "el salvador" or "equatorial guinea" or "spanish guinea" or eritrea or estonia or eswatini or swaziland or ethiopia or fiji or gabon or "gabonese republic" or gambia or "georgia (republic)" or georgian or ghana or "gold coast" or gibraltar or grenada or guatemala or guinea or "guinea bissau" or guyana or "british guiana" or haiti or hispaniola or honduras or hungary or india or indonesia or timor or iran or iraq or jamaica or jordan or kazakhstan or kazakh or kenya or "democratic peoples republic of korea" or "north korea" or kosovo or kyrgyzstan or kirghizia or kirgizstan or "kyrgyz republic" or kirghiz or laos or "lao pdr" or "lao people's democratic republic" or latvia or lebanon or "lebanese republic" or lesotho or basutoland or liberia or libya or "libyan arab jamahiriya" or lithuania or "republic of north macedonia" or macedonia or madagascar or "malagasy republic" or malawi or nyasaland or malaysia or "malay federation" or "malaya federation" or maldives or "indian ocean islands" or "indian ocean" or mali or micronesia or "federated states of micronesia" or kiribati or "marshall islands" or nauru or palau or tuvalu or mauritania or mauritius or mexico or moldova or moldovian or mongolia or montenegro or morocco or ifni or mozambique or "portuguese east africa" or myanmar or burma or namibia or nepal or "netherlands antilles" or nicaragua or niger or nigeria or muscat or pakistan or panama or "papua new guinea" or "new guinea" or paraguay or peru or philippines or philipines or phillippines or philippines or romania or russia or "russian federation" or rwanda or ruanda or samoa or "pacific islands" or polynesia or "samoan islands" or "navigator island" or "navigator islands" or "sao tome and principe" or senegal or serbia or seychelles or "sierra leone" or melanesia or "solomon island" or "solomon islands" or "norfolk island" or "norfolk islands" or somalia or "south africa" or "south sudan" or "sri lanka" or ceylon or "saint kitts and nevis" or "st. kitts and nevis" or "saint lucia" or "st. lucia" or "saint vincent and the grenadines" or "saint vincent" or "st. vincent" or grenadines or sudan or suriname or surinam or "dutch guiana" or "netherlands guiana" or syria or "syrian arab republic" or tajikistan or tadjikistan or tadhikistan or tadhik or tanzania

or tanganyika or thailand or siam or "timor leste" or "east timor" or togo or "togolese republic" or tonga or tunisia or turkey or turkmenistan or turkmen or uganda or ukraine or uruguay or uzbekistan or uzbek or vanuatu or "new hebrides" or venezuela or vietnam or "viet nam" or "middle east" or "west bank" or gaza or palestine or yemen or zambia or zimbabwe or "northern rhodesia" or "global south" or "africa south of the sahara" or "sub-saharan africa" or "subsaharan africa" or "africa, central" or "central africa" or "africa, northern" or "north africa" or "northern africa" or magreb or maghrib or sahara or "africa, southern" or "southern africa" or "africa, eastern" or "east africa" or "eastern africa" or "africa, western" or "west africa" or "western africa" or "west indies" or "indian ocean islands" or caribbean or "central america" or "latin america" or "south and central america" or "south america" or "asia, central" or "central asia" or "asia, northern" or "north asia" or "northern asia" or "asia, southeastern" or "southeastern asia" or "south eastern asia" or "southeast asia" or "south east asia" or "asia, western" or "western asia" or "europe, eastern" or "east europe" or "eastern europe" or "developing country" or "developing countries" or "developing nation*" or "developing population*" or "developing world" or "less developed countr*" or "less developed nation*" or "less developed population*" or "less developed world" or "lesser developed countr*" or "lesser developed nation*" or "lesser developed population*" or "lesser developed world" or "under developed countr*" or "under developed nation*" or "under developed population*" or "under developed world" or "underdeveloped countr*" or "underdeveloped nation*" or "underdeveloped population*" or "underdeveloped world" or "middle income countr*" or "middle income nation*" or "middle income population*" or "low income countr*" or "low income nation*" or "low income population*" or "lower income countr*" or "lower income nation*" or "lower income population*" or "underserved countr*" or "underserved nation*" or "underserved population*" or "underserved world" or "under served countr*" or "under served nation*" or "under served population*" or "under served world" or "deprived countr*" or "deprived nation*" or "deprived population*" or "deprived world" or "poor countr*" or "poor nation*" or "poor population*" or "poor world" or "poorer countr*" or "poorer nation*" or "poorer population*" or "poorer world" or "developing econom*" or "less developed econom*" or "lesser developed econom*" or "under developed econom*" or "underdeveloped econom*" or "middle income econom*" or "low income econom*" or "lower income econom*" or "low gdp" or "low gnp" or "low gross domestic" or "low gross national" or "lower gdp" or "lower gnp" or "lower gross domestic" or "lower gross national" or lmic or lmics or "third world" or "lami countr*" or "transitional countr*" or "emerging economies" or "emerging nation*")) OR SU ((afghanistan or albania or algeria or "american samoa" or angola or "antigua and barbuda" or antigua or barbuda or argentina or armenia or armenian or azerbaijan or bangladesh or republic of belarus or belarus or byelarus or belorussia or byelorussian or belize or "british honduras" or benin or dahomey or bhutan or bolivia or "bosnia and herzegovina" or bosnia or herzegovina or botswana or bechuanaland or brazil or brasil or bulgaria or "burkina faso" or "burkina fasso" or "upper volta" or burundi or urundi or "cabo verde" or "cape verde" or cambodia or kampuchea or "khmer republic" or cameroon or cameron or cameroun or "central african republic" or "ubangi shari" or chad or chile or china or colombia or comoros or "comoro islands" or "iles comores" or mayotte or "democratic republic of the congo" or "democratic republic congo" or congo or zaire or "costa rica" or "cote divoire" or "cote d ivoire" or "cote divoire" or "cote d ivoire" or "ivory coast" or croatia or cuba or djibouti or "french somaliland" or dominica or "dominican republic" or ecuador or egypt or "united arab republic" or "el salvador" or "equatorial guinea" or "spanish guinea" or eritrea or estonia or eswatini or

swaziland or ethiopia or fiji or gabon or "gabonese republic" or gambia or "georgia (republic) " or georgian or ghana or "gold coast" or gibraltar or grenada or guatemala or guinea or "guinea bissau" or guyana or "british guiana" or haiti or hispaniola or honduras or hungary or india or indonesia or timor or iran or iraq or jamaica or jordan or kazakhstan or kazakh or kenya or "democratic peoples republic of korea" or "north korea" or kosovo or kyrgyzstan or kirghizia or kirgizstan or "kyrgyz republic" or kirghiz or laos or "lao pdr" or "lao people's democratic republic" or latvia or lebanon or "lebanese republic" or lesotho or basutoland or liberia or libya or "libyan arab jamahiriya" or lithuania or "republic of north macedonia" or macedonia or madagascar or "malagasy republic" or malawi or nyasaland or malaysia or "malay federation" or "malaya federation" or maldives or "indian ocean islands" or "indian ocean" or mali or micronesia or "federated states of micronesia" or kiribati or "marshall islands" or nauru or palau or tuvalu or mauritania or mauritius or mexico or moldova or moldovian or mongolia or montenegro or morocco or ifni or mozambique or "portuguese east africa" or myanmar or burma or namibia or nepal or "netherlands antilles" or nicaragua or niger or nigeria or muscat or pakistan or panama or "papua new guinea" or "new guinea" or paraguay or peru or philippines or philipines or phillippines or philippines or romania or russia or "russian federation" or rwanda or ruanda or samoa or "pacific islands" or polynesia or "samoan islands" or "navigator island" or "navigator islands" or "sao tome and principe" or senegal or serbia or seychelles or "sierra leone" or melanesia or "solomon island" or "solomon islands" or "norfolk island" or "norfolk islands" or somalia or "south africa" or "south sudan" or "sri lanka" or ceylon or "saint kitts and nevis" or "st. kitts and nevis" or "saint lucia" or "st. lucia" or "saint vincent and the grenadines" or "saint vincent" or "st. vincent" or grenadines or sudan or suriname or surinam or "dutch guiana" or "netherlands guiana" or syria or "syrian arab republic" or tajikistan or tadjikistan or tadjhikistan or tadjhik or tanzania or tanganyika or thailand or siam or "timor leste" or "east timor" or togo or "togolese republic" or tonga or tunisia or turkey or turkmenistan or turkmen or uganda or ukraine or uruguay or uzbekistan or uzbek or vanuatu or "new hebrides" or venezuela or vietnam or "viet nam" or "middle east" or "west bank" or gaza or palestine or yemen or zambia or zimbabwe or "northern rhodesia" or "global south" or "africa south of the sahara" or "sub-saharan africa" or "subsaharan africa" or "africa, central" or "central africa" or "africa, northern" or "north africa" or "northern africa" or magreb or maghrib or sahara or "africa, southern" or "southern africa" or "africa, eastern" or "east africa" or "eastern africa" or "africa, western" or "west africa" or "western africa" or "west indies" or "indian ocean islands" or caribbean or "central america" or "latin america" or "south and central america" or "south america" or "asia, central" or "central asia" or "asia, northern" or "north asia" or "northern asia" or "asia, southeastern" or "southeastern asia" or "south eastern asia" or "southeast asia" or "south east asia" or "asia, western" or "western asia" or "europe, eastern" or "east europe" or "eastern europe" or "developing country" or "developing countries" or "developing nation*" or "developing population*" or "developing world" or "less developed countr*" or "less developed nation*" or "less developed population*" or "less developed world" or "lesser developed countr*" or "lesser developed nation*" or "lesser developed population*" or "lesser developed world" or "under developed countr*" or "under developed nation*" or "under developed population*" or "under developed world" or "underdeveloped countr*" or "underdeveloped nation*" or "underdeveloped population*" or "underdeveloped world" or "middle income countr*" or "middle income nation*" or "middle income population*" or "low income countr*" or "low income nation*" or "low income population*" or "lower income countr*" or "lower income nation*" or "lower income population*" or

"underserved countr*" or "underserved nation*" or "underserved population*" or "underserved world" or "under served countr*" or "under served nation*" or "under served population*" or "under served world" or "deprived countr*" or "deprived nation*" or "deprived population*" or "deprived world" or "poor countr*" or "poor nation*" or "poor population*" or "poor world" or "poorer countr*" or "poorer nation*" or "poorer population*" or "poorer world" or "developing econom*" or "less developed econom*" or "lesser developed econom*" or "under developed econom*" or "underdeveloped econom*" or "middle income econom*" or "low income econom*" or "lower income econom*" or "low gdp" or "low gnp" or "low gross domestic" or "low gross national" or "lower gdp" or "lower gnp" or "lower gross domestic" or "lower gross national" or Imic or Imics or "third world" or "lami countr*" or "transitional countr*" or "emerging economies" or "emerging nation*"))

2,601,917

S12 S1 AND S5 AND S6 AND S11 Limiters - Publication Year: 20100101-20211231

2,107

S11 TI ((((quality or improv*) N3 (service* or infrastructur*)) or (revenue* N3 (loss* or reduc*)) or (leak* N3 (monitor* or reduc* or prevent*)) or ("drinking water" N8 (consumer or consumers or (service* N3 provi*) or communit* or household* or test* or monitor* or treat* or surveillance or centraliz* or centralis*)) OR AB ((((quality or improv*) N3 (service* or infrastructur*)) or (revenue* N3 (loss* or reduc*)) or (leak* N3 (monitor* or reduc* or prevent*)) or ("drinking water" N8 (consumer or consumers or (service* N3 provi*) or communit* or household* or test* or monitor* or treat* or surveillance or centraliz* or centralis*)) OR SU ((((quality or improv*) N3 (service* or infrastructur*)) or (revenue* N3 (loss* or reduc*)) or (leak* N3 (monitor* or reduc* or prevent*)) or ("drinking water" N8 (consumer or consumers or (service* N3 provi*) or communit* or household* or test* or monitor* or treat* or surveillance or centraliz* or centralis*))

34,818

S10 S1 AND S5 AND S6 AND S9 Limiters - Publication Year: 20100101-20211231

6,364

S9 TI ((behavio* or ((sustain* or convenient) N3 access*) or demand or handwash* or ((wash* or hygien*) N3 hand*) or (safe N3 (water or "food hygiene" or excreta or "fecal waste*" or "faecal waste*")) or (menstrua* N2 hygiene) or ((commun* or public) N4 (facilit* or service*)))) OR AB ((behavio* or ((sustain* or convenient) N3 access*) or demand or handwash* or ((wash* or hygien*) N3 hand*) or (safe N3 (water or "food hygiene" or excreta or "fecal waste*" or "faecal waste*")) or (menstrua* N2 hygiene) or ((commun* or public) N4 (facilit* or service*)))) OR SU ((behavio* or ((sustain* or convenient) N3 access*) or demand or handwash* or ((wash* or hygien*) N3 hand*) or (safe N3 (water or "food hygiene" or excreta or "fecal waste*" or "faecal waste*")) or (menstrua* N2 hygiene) or ((commun* or public) N4 (facilit* or service*))))

318,418

7,814

S7 TI(((governance or financ* or budget* or policy or policies or accountab* or reform* or transparen* or regulat* or legislat* or law or laws or legal* or ((allocat* or apportion* or portion* or shar* or dispens* or administrat* or assign* or earmark*) N3 (resourc* or fund* or revenue*)) or coordinat* or co-ordinat* or loan* or microloan* or grant* or invest* or revenue* or (cost* N3 recover*) or "user fee*" or tariff* or equity or bond or bonds) N3 (WaSH or water or sanitation or hygiene or wastewater))) OR AB(((governance or financ* or budget* or policy or policies or accountab* or reform* or transparen* or regulat* or legislat* or law or laws or legal* or ((allocat* or apportion* or portion* or shar* or dispens* or administrat* or assign* or earmark*) N3 (resourc* or fund* or revenue*)) or coordinat* or co-ordinat* or loan* or microloan* or grant* or invest* or revenue* or (cost* N3 recover*) or "user fee*" or tariff* or equity or bond or bonds) N3 (WaSH or water or sanitation or hygiene or wastewater))) OR SU(((governance or financ* or budget* or policy or policies or accountab* or reform* or transparen* or regulat* or legislat* or law or laws or legal* or ((allocat* or apportion* or portion* or shar* or dispens* or administrat* or assign* or earmark*) N3 (resourc* or fund* or revenue*)) or coordinat* or co-ordinat* or loan* or microloan* or grant* or invest* or revenue* or (cost* N3 recover*) or "user fee*" or tariff* or equity or bond or bonds) N3 (WaSH or water or sanitation or hygiene or wastewater)))

51,308

S6 TI ((WASH or sanitation or sewage or sewerage or (dispos* N3 excreta) or wastewater or "waste water" or (water N3 (suppl* or quality or quantit* or standard* or (resource* N3 manag*))) or ((domestic or household* or drinking or potable or piped) N2 water) or (Water N3 Access*) or hygiene)) OR AB ((WASH or sanitation or sewage or sewerage or (dispos* N3 excreta) or wastewater or "waste water" or (water N3 (suppl* or quality or quantit* or standard* or (resource* N3 manag*))) or ((domestic or household* or drinking or potable or piped) N2 water) or (Water N3 Access*) or hygiene)) OR SU ((WASH or sanitation or sewage or sewerage or (dispos* N3 excreta) or wastewater or "waste water" or (water N3 (suppl* or quality or quantit* or standard* or (resource* N3 manag*))) or ((domestic or household* or drinking or potable or piped) N2 water) or (Water N3 Access*) or hygiene))

498,632

S5 S2 OR S3 OR S4

2,852,964

S4 TI ((observational N2 (study or analysis)) or ((multivariate or logistic* or multi-country) N2 regression) or "random effect*" or "probit model" or "simulation model*" or "control* ex-post" or (control* N2 (before N3 after) N2 study) or "time series" or ((cohort or case-control or longitudinal or retrospective or prospective or follow-up) N2 (study or analysis))) OR AB ((observational N2 (study or analysis)) or ((multivariate or logistic* or multi-country) N2 regression) or "random effect*" or "probit

model" or "simulation model*" or "control* ex-post" or (control* N2 (before N3 after) N2 study) or "time series" or ((cohort or case-control or longitudinal or retrospective or prospective or follow-up) N2 (study or analysis))) OR SU ((observational N2 (study or analysis)) or ((multivariate or logistic* or multi-country) N2 regression) or "random effect*" or "probit model" or "simulation model*" or "control* ex-post" or (control* N2 (before N3 after) N2 study) or "time series" or ((cohort or case-control or longitudinal or retrospective or prospective or follow-up) N2 (study or analysis)))

289,020

S3 TI ("random* control* trial*" or "random* trial*" or rct* or (random* N3 allocat*) or "quasi experiment*" or quasi-experiment* or evaluat* or impact* or assess* or multi-level or multilevel or "multi level" or dif-dif or psm or "double difference" or difference-in-difference or rdd or "difference in difference" or "double difference" or "statistical matching*" or "propensity score matching" or "covariate matching" or "coarsened-exact matching" or "propensity-weighted" or "multiple regression" or "statistical regression" or "regression discontinuity*" or "cohort analysis" or (quantitative N2 (method*" or study or design or analysis)) or "interrupted time series" or (("fixed effect*" or "random effect*") N3 (model or estimation)) or "instrumental variable" or ((cost* or economic) N2 (benefit or effective* or analy*))) OR AB ("random* control* trial*" or "random* trial*" or rct* or (random* N3 allocat*) or "quasi experiment*" or quasi-experiment* or evaluat* or impact* or assess* or multi-level or multilevel or "multi level" or dif-dif or psm or "double difference" or difference-in-difference or rdd or "difference in difference" or "double difference" or "statistical matching*" or "propensity score matching" or "covariate matching" or "coarsened-exact matching" or "propensity-weighted" or "multiple regression" or "statistical regression" or "regression discontinuity*" or "cohort analysis" or (quantitative N2 (method*" or study or design or analysis)) or "interrupted time series" or (("fixed effect*" or "random effect*") N3 (model or estimation)) or "instrumental variable" or ((cost* or economic) N2 (benefit or effective* or analy*))) OR SU ("random* control* trial*" or "random* trial*" or rct* or (random* N3 allocat*) or "quasi experiment*" or quasi-experiment* or evaluat* or impact* or assess* or multi-level or multilevel or "multi level" or dif-dif or psm or "double difference" or difference-in-difference or rdd or "difference in difference" or "double difference" or "statistical matching*" or "propensity score matching" or "covariate matching" or "coarsened-exact matching" or "propensity-weighted" or "multiple regression" or "statistical regression" or "regression discontinuity*" or "cohort analysis" or (quantitative N2 (method*" or study or design or analysis)) or "interrupted time series" or (("fixed effect*" or "random effect*") N3 (model or estimation)) or "instrumental variable" or ((cost* or economic) N2 (benefit or effective* or analy*)))

2,712,124

S2 TI (("systematic review" or meta-analy* or "meta analy*" or metaanaly* or "literature review" or "gap map" or "evidence map" or EGM or "scoping review" or "rapid review" or "evidence review" or ((project or program*) N2 (evaluation or review)))) OR AB (("systematic review" or meta-analy* or "meta analy*" or metaanaly* or "literature review" or "gap map" or "evidence map" or EGM or "scoping review" or "rapid review" or "evidence review" or ((project or program*) N2 (evaluation or review)))) OR SU (("systematic review" or meta-analy* or "meta analy*" or metaanaly* or "literature review" or

"gap map" or "evidence map" or EGM or "scoping review" or "rapid review" or "evidence review" or ((project or program*) N2 (evaluation or review))))

65,182

S1 TI ((afghanistan or albania or algeria or "american samoa" or angola or "antigua and barbuda" or antigua or barbuda or argentina or armenia or armenian or azerbaijan or bangladesh or republic of belarus or belarus or byelarus or belorussia or byelorussian or belize or "british honduras" or benin or dahomey or bhutan or bolivia or "bosnia and herzegovina" or bosnia or herzegovina or botswana or bechuanaland or brazil or brasil or bulgaria or "burkina faso" or "burkina fasso" or "upper volta" or burundi or urundi or "cabo verde" or "cape verde" or cambodia or kampuchea or "khmer republic" or cameroon or cameron or cameroun or "central african republic" or "ubangi shari" or chad or chile or china or colombia or comoros or "comoro islands" or "iles comores" or mayotte or "democratic republic of the congo" or "democratic republic congo" or congo or zaire or "costa rica" or "cote divoire" or "cote d ivoire" or "cote divoire" or "cote d ivoire" or "ivory coast" or croatia or cuba or djibouti or "french somaliland" or dominica or "dominican republic" or ecuador or egypt or "united arab republic" or "el salvador" or "equatorial guinea" or "spanish guinea" or eritrea or estonia or eswatini or swaziland or ethiopia or fiji or gabon or "gabonese republic" or gambia or "georgia (republic)" or georgian or ghana or "gold coast" or gibraltar or grenada or guatemala or guinea or "guinea bissau" or guyana or "british guiana" or haiti or hispaniola or honduras or hungary or india or indonesia or timor or iran or iraq or jamaica or jordan or kazakhstan or kazakh or kenya or "democratic peoples republic of korea" or "north korea" or kosovo or kyrgyzstan or kirghizia or kirgizstan or "kyrgyz republic" or kirghiz or laos or "lao pdr" or "lao people's democratic republic" or latvia or lebanon or "lebanese republic" or lesotho or basutoland or liberia or libya or "libyan arab jamahiriya" or lithuania or "republic of north macedonia" or macedonia or madagascar or "malagasy republic" or malawi or nyasaland or malaysia or "malay federation" or "malaya federation" or maldives or "indian ocean islands" or "indian ocean" or mali or micronesia or "federated states of micronesia" or kiribati or "marshall islands" or nauru or palau or tuvalu or mauritania or mauritius or mexico or moldova or moldovian or mongolia or montenegro or morocco or ifni or mozambique or "portuguese east africa" or myanmar or burma or namibia or nepal or "netherlands antilles" or nicaragua or niger or nigeria or muscat or pakistan or panama or "papua new guinea" or "new guinea" or paraguay or peru or philippines or philipines or philippines or philippines or romania or russia or "russian federation" or rwanda or ruanda or samoa or "pacific islands" or polynesia or "samoan islands" or "navigator island" or "navigator islands" or "sao tome and principe" or senegal or serbia or seychelles or "sierra leone" or melanesia or "solomon island" or "solomon islands" or "norfolk island" or "norfolk islands" or somalia or "south africa" or "south sudan" or "sri lanka" or ceylon or "saint kitts and nevis" or "st. kitts and nevis" or "saint lucia" or "st. lucia" or "saint vincent and the grenadines" or "saint vincent" or "st. vincent" or grenadines or sudan or suriname or surinam or "dutch guiana" or "netherlands guiana" or syria or "syrian arab republic" or tajikistan or tadjikistan or tadjhikistan or tadjhik or tanzania or tanganyika or thailand or siam or "timor leste" or "east timor" or togo or "togolese republic" or tonga or tunisia or turkey or turkmenistan or turkmen or uganda or ukraine or uruguay or uzbekistan or uzbek or vanuatu or "new hebrides" or venezuela or vietnam or "viet nam" or "middle east" or "west bank" or gaza or palestine or yemen or zambia or zimbabwe or "northern

rhodesia" or "global south" or "africa south of the sahara" or "sub-saharan africa" or "subsaharan africa" or "africa, central" or "central africa" or "africa, northern" or "north africa" or "northern africa" or magreb or maghrib or sahara or "africa, southern" or "southern africa" or "africa, eastern" or "east africa" or "eastern africa" or "africa, western" or "west africa" or "western africa" or "west indies" or "indian ocean islands" or caribbean or "central america" or "latin america" or "south and central america" or "south america" or "asia, central" or "central asia" or "asia, northern" or "north asia" or "northern asia" or "asia, southeastern" or "southeastern asia" or "south eastern asia" or "southeast asia" or "south east asia" or "asia, western" or "western asia" or "europe, eastern" or "east europe" or "eastern europe" or "developing country" or "developing countries" or "developing nation*" or "developing population*" or "developing world" or "less developed countr*" or "less developed nation*" or "less developed population*" or "less developed world" or "lesser developed countr*" or "lesser developed nation*" or "lesser developed population*" or "lesser developed world" or "under developed countr*" or "under developed nation*" or "under developed population*" or "under developed world" or "underdeveloped countr*" or "underdeveloped nation*" or "underdeveloped population*" or "underdeveloped world" or "middle income countr*" or "middle income nation*" or "middle income population*" or "low income countr*" or "low income nation*" or "low income population*" or "lower income countr*" or "lower income nation*" or "lower income population*" or "underserved countr*" or "underserved nation*" or "underserved population*" or "underserved world" or "under served countr*" or "under served nation*" or "under served population*" or "under served world" or "deprived countr*" or "deprived nation*" or "deprived population*" or "deprived world" or "poor countr*" or "poor nation*" or "poor population*" or "poor world" or "poorer countr*" or "poorer nation*" or "poorer population*" or "poorer world" or "developing econom*" or "less developed econom*" or "lesser developed econom*" or "under developed econom*" or "underdeveloped econom*" or "middle income econom*" or "low income econom*" or "lower income econom*" or "low gdp" or "low gnp" or "low gross domestic" or "low gross national" or "lower gdp" or "lower gnp" or "lower gross domestic" or "lower gross national" or lmic or lmics or "third world" or "lami countr*" or "transitional countr*" or "emerging economies" or "emerging nation*")) OR AB ((afghanistan or albania or algeria or "american samoa" or angola or "antigua and barbuda" or antigua or barbuda or argentina or armenia or armenian or azerbaijan or bangladesh or republic of belarus or belarus or byelarus or belorussia or byelorussian or belize or "british honduras" or benin or dahomey or bhutan or bolivia or "bosnia and herzegovina" or bosnia or herzegovina or botswana or bechuanaland or brazil or brasil or bulgaria or "burkina faso" or "burkina fasso" or "upper volta" or burundi or urundi or "cabo verde" or "cape verde" or cambodia or kampuchea or "khmer republic" or cameroon or cameron or cameroun or "central african republic" or "ubangi shari" or chad or chile or china or colombia or comoros or "comoro islands" or "iles comores" or mayotte or "democratic republic of the congo" or "democratic republic congo" or congo or zaire or "costa rica" or "cote divoire" or "cote d ivoire" or "cote divoire" or "cote d ivoire" or "ivory coast" or croatia or cuba or djibouti or "french somaliland" or dominica or "dominican republic" or ecuador or egypt or "united arab republic" or "el salvador" or "equatorial guinea" or "spanish guinea" or eritrea or estonia or eswatini or swaziland or ethiopia or fiji or gabon or "gabonese republic" or gambia or "georgia (republic)" or georgian or ghana or "gold coast" or gibraltar or grenada or guatemala or guinea or "guinea bissau" or guyana or "british guiana" or haiti or hispaniola or honduras or hungary or india or indonesia or timor or iran or iraq or jamaica or jordan or kazakhstan or

kazakh or kenya or "democratic peoples republic of korea" or "north korea" or kosovo or kyrgyzstan or kirghizia or kirgizstan or "kyrgyz republic" or kirghiz or laos or "lao pdr" or "lao people's democratic republic" or latvia or lebanon or "lebanese republic" or lesotho or basutoland or liberia or libya or "libyan arab jamahiriya" or lithuania or "republic of north macedonia" or macedonia or madagascar or "malagasy republic" or malawi or nyasaland or malaysia or "malay federation" or "malaya federation" or maldives or "indian ocean islands" or "indian ocean" or mali or micronesia or "federated states of micronesia" or kiribati or "marshall islands" or nauru or palau or tuvalu or mauritania or mauritius or mexico or moldova or moldovian or mongolia or montenegro or morocco or ifni or mozambique or "portuguese east africa" or myanmar or burma or namibia or nepal or "netherlands antilles" or nicaragua or niger or nigeria or muscat or pakistan or panama or "papua new guinea" or "new guinea" or paraguay or peru or philippines or philipines or phillippines or philippines or romania or russia or "russian federation" or rwanda or ruanda or samoa or "pacific islands" or polynesia or "samoan islands" or "navigator island" or "navigator islands" or "sao tome and principe" or senegal or serbia or seychelles or "sierra leone" or melanesia or "solomon island" or "solomon islands" or "norfolk island" or "norfolk islands" or somalia or "south africa" or "south sudan" or "sri lanka" or ceylon or "saint kitts and nevis" or "st. kitts and nevis" or "saint lucia" or "st. lucia" or "saint vincent and the grenadines" or "saint vincent" or "st. vincent" or grenadines or sudan or suriname or surinam or "dutch guiana" or "netherlands guiana" or syria or "syrian arab republic" or tajikistan or tadjikistan or tadhikistan or tadhik or tanzania or tanganyika or thailand or siam or "timor leste" or "east timor" or togo or "togolese republic" or tonga or tunisia or turkey or turkmenistan or turkmen or uganda or ukraine or uruguay or uzbekistan or uzbek or vanuatu or "new hebrides" or venezuela or vietnam or "viet nam" or "middle east" or "west bank" or gaza or palestine or yemen or zambia or zimbabwe or "northern rhodesia" or "global south" or "africa south of the sahara" or "sub-saharan africa" or "subsaharan africa" or "africa, central" or "central africa" or "africa, northern" or "north africa" or "northern africa" or magreb or maghrib or sahara or "africa, southern" or "southern africa" or "africa, eastern" or "east africa" or "eastern africa" or "africa, western" or "west africa" or "western africa" or "west indies" or "indian ocean islands" or caribbean or "central america" or "latin america" or "south and central america" or "south america" or "asia, central" or "central asia" or "asia, northern" or "north asia" or "northern asia" or "asia, southeastern" or "southeastern asia" or "south eastern asia" or "southeast asia" or "south east asia" or "asia, western" or "western asia" or "europe, eastern" or "east europe" or "eastern europe" or "developing country" or "developing countries" or "developing nation*" or "developing population*" or "developing world" or "less developed countr*" or "less developed nation*" or "less developed population*" or "less developed world" or "lesser developed countr*" or "lesser developed nation*" or "lesser developed population*" or "lesser developed world" or "under developed countr*" or "under developed nation*" or "under developed population*" or "under developed world" or "underdeveloped countr*" or "underdeveloped nation*" or "underdeveloped population*" or "underdeveloped world" or "middle income countr*" or "middle income nation*" or "middle income population*" or "low income countr*" or "low income nation*" or "low income population*" or "lower income countr*" or "lower income nation*" or "lower income population*" or "underserved countr*" or "underserved nation*" or "underserved population*" or "underserved world" or "under served countr*" or "under served nation*" or "under served population*" or "under served world" or "deprived countr*" or "deprived nation*" or "deprived population*" or "deprived world" or "poor countr*" or "poor nation*" or "poor

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2,601,917

4. Web of Science (Social Sciences Citation Index) – Searched 23rd December 2021

19 6,439

#18 OR #12 OR #10 OR #8

18 2,030

#17 AND #5 AND #1

17 5,173

#16 OR #15 OR #14 OR #13

16 2,608

(TS=((water or sanitation or sanitary or hygien* or WASH) NEAR/5 (behavio* or menstrua* or handwash* or hand-wash* or "hand wash*")))

15 1,449

(TS=((domestic or household* or drinking or potable or piped or tap) NEAR/2 water) NEAR/6 (monitor* or manag* or regulat* or enforc* or accountab* or surveillance or vigilan* or safeguard* or test* or quality or access* or sustain*))

14 1,041

(TS=((domestic or household* or drinking or potable or piped or tap) NEAR/2 water) NEAR/6 (treat* or process* or purif* or safe or service*))

13 783

(TS=((sewage or sewerage or "human waste" or feces or faeces or fecal or faecal or excreta or excrement or WASH) NEAR/6 (treat* or dispos* or process* or purif*))

12 714

#11 AND #6 AND #5 AND #1

11 29,767

(TS((((quality or improv*) NEAR/3 (service* or infrastructur*)) or (revenue* NEAR/3 (loss* or reduc*)) or (leak* NEAR/3 (monitor* or reduc* or prevent*)) or ("drinking water" NEAR/8 (consumer or consumers or (service* NEAR/3 provi*) or communit* or household* or test* or monitor* or treat* or surveillance or centraliz* or centralis*))))))

10 3,794

#9 AND #6 AND #5 AND #1

9 728,448

(TS=((behavio* or ((sustain* or convenient) NEAR/3 access*) or demand or handwash* or ((wash* or hygien*) NEAR/3 hand*) or (safe NEAR/3 (water or "food hygiene" or excreta or "fecal waste*" or "faecal waste*")) or (menstrua* NEAR/2 hygiene) or ((commun* or public) NEAR/4 (facilit* or service*))))

8 2,229

#7 AND #5 AND #1

7 6,871

(TS=((governance or financ* or budget* or policy or policies or accountab* or reform* or transparen* or regulat* or legislat* or law or laws or legal* or ((allocat* or apportion* or portion* or shar* or dispens* or administrat* or assign* or earmark*) NEAR/3 (resourc* or fund* or revenue*)) or coordinat* or co-ordinat* or loan* or microloan* or grant* or invest* or revenue* or (cost* NEAR/3 recover*) or "user fee*" or tariff* or equity or bond or bonds) NEAR/3 (WaSH or water or sanitation or hygiene or wastewater))))

6 29,713

(TS=(WASH or sanitation or sewage or sewerage or (dispos* NEAR/3 excreta) or wastewater or "waste water" or (water NEAR/3 (suppl* or quality or quantit* or standard* or (resource* NEAR/3 manag*))) or ((domestic or household* or drinking or potable or piped) NEAR/2 water) or (Water NEAR/3 Access*) or hygiene))

5 1,531,215

#4 OR #3 OR #2

4 273,480

(TS=(observational NEAR/2 (study or analysis)) or ((multivariate or logistic* or multi-country) NEAR/2 regression) or "random effect*" or "probit model" or "simulation model*" or "control* ex-post" or (control* NEAR/2 (before NEAR/3 after) NEAR/2 study) or "time series" or ((cohort or case-control or longitudinal or retrospective or prospective or follow-up) NEAR/2 (study or analysis)))

3 1,370,642

(TS=("random* control* trial*" or "random* trial*" or rct* or (random* NEAR/3 allocat*) or "quasi experiment*" or quasi-experiment* or evaluat* or impact* or assess* or multi-level or multilevel or "multi level" or dif-dif or psm or "double difference" or difference-in-difference or rdd or "difference in difference" or "double difference" or "statistical matching*" or "propensity score matching" or "covariate matching" or "coarsened-exact matching" or "propensity-weighted" or "multiple regression" or "statistical regression" or "regression discontinuity*" or "cohort analysis" or (quantitative NEAR/2 (method* or study or design or analysis)) or "interrupted time series" or (("fixed effect*" or "random effect*") NEAR/3 (model or estimation)) or "instrumental variable" or ((cost* or economic) NEAR/2 (benefit or effective* or analy*))))

2 170,798

(TS=("systematic review" or meta-analy* or "meta analy*" or metaanaly* or "literature review" or "gap map" or "evidence map" or EGM or "scoping review" or "rapid review" or "evidence review" or ((project or program*) NEAR/2 (evaluation or review))))

1 1,061,241

(TS=(afghanistan or albania or algeria or "american samoa" or angola or "antigua and barbuda" or antigua or barbuda or argentina or armenia or armenian or aruba or azerbaijan or bahrain or bangladesh or barbados or republic of belarus or belarus or byelarus or belorussia or byelorussian or belize or "british honduras" or benin or dahomey or bhutan or bolivia or "bosnia and herzegovina" or bosnia or herzegovina or botswana or bechuanaland or brazil or brasil or bulgaria or "burkina faso" or "burkina fasso" or "upper volta" or burundi or urundi or "cabo verde" or "cape verde" or cambodia or kampuchea or "khmer republic" or cameroon or cameron or cameroun or "central african republic" or "ubangi shari" or chad or chile or china or colombia or comoros or "comoro islands" or "iles comores" or mayotte or "democratic republic of the congo" or "democratic republic congo" or congo or zaire or "costa rica" or "cote divoire" or "cote d ivoire" or "cote divoire" or "cote d ivoire" or "ivory coast" or croatia or cuba or cyprus or "czech republic" or czechoslovakia or djibouti or "french somaliland" or dominica or "dominican republic" or ecuador or egypt or "united arab republic" or "el salvador" or "equatorial guinea" or "spanish guinea" or eritrea or estonia or eswatini or swaziland or ethiopia or fiji or gabon or "gabonese republic" or gambia or "georgia (republic) " or georgian or ghana or "gold coast" or gibraltar or greece or grenada or guam or guatemala or guinea or "guinea bissau" or guyana or "british guiana" or haiti or hispaniola or honduras or hungary or india or indonesia or timor or iran or iraq or "isle of man" or jamaica or jordan or kazakhstan or kazakh or kenya or "democratic peoples republic of korea" or "republic of korea" or "north korea" or "south korea" or korea or kosovo or kyrgyzstan or kirghizia or kirgizstan or "kyrgyz republic" or kirghiz or laos or "lao pdr" or "lao people's democratic republic" or latvia or lebanon or "lebanese republic" or lesotho or basutoland or liberia or libya or "libyan arab jamahiriya" or lithuania or macau or macao or "republic of north macedonia" or macedonia or madagascar or "malagasy republic" or malawi or niasaland or malaysia or "malay federation" or "malaya federation" or maldives or "indian ocean islands" or "indian ocean" or mali or malta or micronesia or "federated states of micronesia" or kiribati or "marshall islands" or nauru or "northern mariana islands" or palau or tuvalu or mauritania or mauritius or mexico or moldova or moldovian or mongolia or montenegro or morocco or ifni or mozambique or "portuguese east africa" or myanmar or burma or namibia or nepal or "netherlands antilles" or nicaragua or niger or nigeria or oman or muscat or pakistan or panama or "papua new guinea" or "new guinea" or paraguay or peru or philippines or philipines or phillipines or philippines or poland or "polish people's republic" or portugal or "portuguese republic" or "puerto rico" or romania or russia or "russian federation" or ussr or "soviet union or union of soviet socialist republics" or rwanda or ruanda or samoa or "pacific islands" or polynesia or "samoan islands" or "navigator island" or "navigator islands" or "sao tome and principe" or "saudi arabia" or senegal or serbia or seychelles or "sierra leone" or slovakia or "slovak republic" or slovenia or melanesia or "solomon island" or "solomon islands" or "norfolk island" or "norfolk islands" or somalia or "south africa" or "south sudan" or "sri lanka" or ceylon or "saint kitts and nevis" or "st. kitts and nevis" or "saint lucia" or "st. lucia" or "saint vincent and the grenadines" or "saint vincent" or "st. vincent" or grenadines or sudan or suriname or surinam or "dutch guiana" or "netherlands guiana" or syria or "syrian arab republic" or tajikistan or tadjikistan or tadzhikistan or tadzhik or tanzania or tanganyika or thailand or siam or "timor leste" or "east timor" or togo or "togolese republic" or tonga or "trinidad and tobago" or trinidad or tobago or tunisia or turkey or turkmenistan or turkmen or

uganda or ukraine or uruguay or uzbekistan or uzbek or vanuatu or "new hebrides" or venezuela or vietnam or "viet nam" or "middle east" or "west bank" or gaza or palestine or yemen or yugoslavia or zambia or zimbabwe or "northern rhodesia" or "global south" or "africa south of the sahara" or "sub-saharan africa" or "subsaharan africa" or "africa, central" or "central africa" or "africa, northern" or "north africa" or "northern africa" or magreb or maghrib or sahara or "africa, southern" or "southern africa" or "africa, eastern" or "east africa" or "eastern africa" or "africa, western" or "west africa" or "western africa" or "west indies" or "indian ocean islands" or caribbean or "central america" or "latin america" or "south and central america" or "south america" or "asia, central" or "central asia" or "asia, northern" or "north asia" or "northern asia" or "asia, southeastern" or "southeastern asia" or "south eastern asia" or "southeast asia" or "south east asia" or "asia, western" or "western asia" or "europe, eastern" or "east europe" or "eastern europe" or "developing country" or "developing countries" or "developing nation*" or "developing population*" or "developing world" or "less developed countr*" or "less developed nation*" or "less developed population*" or "less developed world" or "lesser developed countr*" or "lesser developed nation*" or "lesser developed population*" or "lesser developed world" or "under developed countr*" or "under developed nation*" or "under developed population*" or "under developed world" or "underdeveloped countr*" or "underdeveloped nation*" or "underdeveloped population*" or "underdeveloped world" or "middle income countr*" or "middle income nation*" or "middle income population*" or "low income countr*" or "low income nation*" or "low income population*" or "lower income countr*" or "lower income nation*" or "lower income population*" or "underserved countr*" or "underserved nation*" or "underserved population*" or "underserved world" or "under served countr*" or "under served nation*" or "under served population*" or "under served world" or "deprived countr*" or "deprived nation*" or "deprived population*" or "deprived world" or "poor countr*" or "poor nation*" or "poor population*" or "poor world" or "poorer countr*" or "poorer nation*" or "poorer population*" or "poorer world" or "developing econom*" or "less developed econom*" or "lesser developed econom*" or "under developed econom*" or "underdeveloped econom*" or "middle income econom*" or "low income econom*" or "lower income econom*" or "low gdp" or "low gnp" or "low gross domestic" or "low gross national" or "lower gdp" or "lower gnp" or "lower gross domestic" or "lower gross national" or lmic or lmics or "third world" or "lami countr*" or "transitional countr*" or "emerging economies" or "emerging nation*") OR CU=(afghanistan or albania or algeria or "american samoa" or angola or "antigua and barbuda" or antigua or barbuda or argentina or armenia or armenian or aruba or azerbaijan or bahrain or bangladesh or barbados or republic of belarus or belarus or byelarus or belorussia or byelorussian or belize or "british honduras" or benin or dahomey or bhutan or bolivia or "bosnia and herzegovina" or bosnia or herzegovina or botswana or bechuanaland or brazil or brasil or bulgaria or "burkina faso" or "burkina fasso" or "upper volta" or burundi or urundi or "cabo verde" or "cape verde" or cambodia or kampuchea or "khmer republic" or cameroon or cameron or cameroun or "central african republic" or "ubangi shari" or chad or chile or china or colombia or comoros or "comoro islands" or "iles comores" or mayotte or "democratic republic of the congo" or "democratic republic congo" or congo or zaire or "costa rica" or "cote divoire" or "cote d ivoire" or "cote divoire" or "cote d ivoire" or "ivory coast" or

croatia or cuba or cyprus or "czech republic" or czechoslovakia or djibouti or "french somaliland" or dominica or "dominican republic" or ecuador or egypt or "united arab republic" or "el salvador" or "equatorial guinea" or "spanish guinea" or eritrea or estonia or eswatini or swaziland or ethiopia or fiji or gabon or "gabonese republic" or gambia or "georgia (republic) " or georgian or ghana or "gold coast" or gibraltar or greece or grenada or guam or guatemala or guinea or "guinea bissau" or guyana or "british guiana" or haiti or hispaniola or honduras or hungary or india or indonesia or timor or iran or iraq or "isle of man" or jamaica or jordan or kazakhstan or kazakh or kenya or "democratic peoples republic of korea" or "republic of korea" or "north korea" or "south korea" or korea or kosovo or kyrgyzstan or kirghizia or kirgizstan or "kyrgyz republic" or kirghiz or laos or "lao pdr" or "lao people's democratic republic" or latvia or lebanon or "lebanese republic" or lesotho or basutoland or liberia or libya or "libyan arab jamahiriya" or lithuania or macau or macao or "republic of north macedonia" or macedonia or madagascar or "malagasy republic" or malawi or nyasaland or malaysia or "malay federation" or "malaya federation" or maldives or "indian ocean islands" or "indian ocean" or mali or malta or micronesia or "federated states of micronesia" or kiribati or "marshall islands" or nauru or "northern mariana islands" or palau or tuvalu or mauritania or mauritius or mexico or moldova or moldovian or mongolia or montenegro or morocco or ifni or mozambique or "portuguese east africa" or myanmar or burma or namibia or nepal or "netherlands antilles" or nicaragua or niger or nigeria or oman or muscat or pakistan or panama or "papua new guinea" or "new guinea" or paraguay or peru or philippines or philipines or phillipines or philippines or poland or "polish people's republic" or portugal or "portuguese republic" or "puerto rico" or romania or russia or "russian federation" or ussr or "soviet union or union of soviet socialist republics" or rwanda or ruanda or samoa or "pacific islands" or polynesia or "samoan islands" or "navigator island" or "navigator islands" or "sao tome and principe" or "saudi arabia" or senegal or serbia or seychelles or "sierra leone" or slovakia or "slovak republic" or slovenia or melanesia or "solomon island" or "solomon islands" or "norfolk island" or "norfolk islands" or somalia or "south africa" or "south sudan" or "sri lanka" or ceylon or "saint kitts and nevis" or "st. kitts and nevis" or "saint lucia" or "st. lucia" or "saint vincent and the grenadines" or "saint vincent" or "st. vincent" or grenadines or sudan or suriname or surinam or "dutch guiana" or "netherlands guiana" or syria or "syrian arab republic" or tajikistan or tadjikistan or tadjhikistan or tadjhik or tanzania or tanganyika or thailand or siam or "timor leste" or "east timor" or togo or "togolese republic" or tonga or "trinidad and tobago" or trinidad or tobago or tunisia or turkey or turkmenistan or turkmen or uganda or ukraine or uruguay or uzbekistan or uzbek or vanuatu or "new hebrides" or venezuela or vietnam or "viet nam" or "middle east" or "west bank" or gaza or palestine or yemen or yugoslavia or zambia or zimbabwe or "northern rhodesia" or "global south" or "africa south of the sahara" or "sub-saharan africa" or "subsaharan africa" or "africa, central" or "central africa" or "africa, northern" or "north africa" or "northern africa" or magreb or maghrib or sahara or "africa, southern" or "southern africa" or "africa, eastern" or "east africa" or "eastern africa" or "africa, western" or "west africa" or "western africa" or "west indies" or "indian ocean islands" or caribbean or "central america" or "latin america" or "south and central america" or "south america" or "asia, central" or "central asia" or "asia, northern" or "north asia" or "northern asia" or "asia, southeastern" or "southeastern asia" or "south eastern

asia" or "southeast asia" or "south east asia" or "asia, western" or "western asia" or "europe, eastern" or "east europe" or "eastern europe" or "developing country" or "developing countries" or "developing nation*" or "developing population*" or "developing world" or "less developed countr*" or "less developed nation*" or "less developed population*" or "less developed world" or "lesser developed countr*" or "lesser developed nation*" or "lesser developed population*" or "lesser developed world" or "under developed countr*" or "under developed nation*" or "under developed population*" or "under developed world" or "underdeveloped countr*" or "underdeveloped nation*" or "underdeveloped population*" or "underdeveloped world" or "middle income countr*" or "middle income nation*" or "middle income population*" or "low income countr*" or "low income nation*" or "low income population*" or "lower income countr*" or "lower income nation*" or "lower income population*" or "underserved countr*" or "underserved nation*" or "underserved population*" or "underserved world" or "under served countr*" or "under served nation*" or "under served population*" or "under served world" or "deprived countr*" or "deprived nation*" or "deprived population*" or "deprived world" or "poor countr*" or "poor nation*" or "poor population*" or "poor world" or "poorer countr*" or "poorer nation*" or "poorer population*" or "poorer world" or "developing econom*" or "less developed econom*" or "lesser developed econom*" or "under developed econom*" or "underdeveloped econom*" or "middle income econom*" or "low income econom*" or "lower income econom*" or "low gdp" or "low gnp" or "low gross domestic" or "low gross national" or "lower gdp" or "lower gnp" or "lower gross domestic" or "lower gross national" or lmic or lmics or "third world" or "lami countr*" or "transitional countr*" or "emerging economies" or "emerging nation*"))

8.2 Appendix B: Example data extraction template

The following template is an example of the types of data that will be extracted from impact evaluations included in this systematic map. Alternative versions will be used for systematic reviews and quantitative observational studies.

Code	Subcode
Study Information	Study EPPI internal ID
	Coder name
	Title name
	Foreign Title
	Short title
	Language
Author Information	Author's Name
	Author's Affiliation Institution
	Author's Affiliation Country
Publication Information	Publication Type
	DOI
	Study status
	Abstract

	Keywords
	Journal name
	Other journal name
	Journal volume
	Journal issue
	Pages
	Year of Publication
	URL
	Publisher location
	Open access
Sector Information	Sector name
	Sub-sector name
	WB first theme
	WB first sub-theme
	WB second theme
	WB second sub-theme
	WB third theme
	WB third sub-theme
	DAC rank
	Primary DAC Code
	Secondary DAC Code
	CRS-Voluntary (tertiary) Code
	SDGs
	Other topics
	Equity focus
	Equity dimension
Equity description	
Transparency, Reproducibility, and Ethics	Primary dataset available
	Primary dataset location
	Primary dataset URL
	Primary dataset format
	Secondary dataset disclosure
	Secondary dataset name
	Secondary dataset location
	Additional dataset information
	Analysis code availability
	Analysis code format
	Study materials availability
	Study materials list
	Pre-Registration
	Pre-Registration location
	Pre-Registration URL
	Protocol pre-analysis plan

	Ethics approval
Geographic Information	First year of intervention
	Continent name
	Country name
	Additional country
	Country income level
	Region name
	State/province name
	District name
	City/town name
	Location name
Target population and cost data	Age
	Sex
	Setting
	Sexual orientation
	Specific population group
	Cost data
	Type of cost data
Methodological information	Evaluation Design
	Evaluation Method
	Mixed Method
	Additional Methods
	Unit of Observation
Program, Funding and Implementation Information	Project Name
	Implementation Agency Category
	Implementation Agency Name
	Program Funding Agency Category
	Program Funding Agency Name
	Research Funding Agency Category
	Research Funding Agency Name
Intervention Information	Treatment group/Arm 1
	Treatment group/Arm 1 Description
	Intervention group/Arm 2
	Treatment group/Arm 2 Description
	Create 3 different treatment options in case there is more than one intervention group.
	Outcome
Outcome Information	Outcome description

8.3 Appendix C: Systematic review critical appraisal tool

Checklist for making judgments about how much confidence to place in a systematic review of effects.

This checklist has been adapted from Supporting the Use of Research Evidence (SURE) Collaboration. SURE, checklist for making judgements about how much confidence to place in a systematic review. In SURE guides for preparing and using policy briefs. www.evipnet.org/sure

Question	Criteria
Section A: Methods used to identify, include and critically appraise studies	
<p>A.1 Were the criteria used for deciding which studies to include in the review reported?</p> <p>Did the authors specify:</p> <ul style="list-style-type: none"> ▪ Types of studies ▪ Participants/ settings/ population ▪ Intervention(s) ▪ Outcome(s) 	<p>Yes; partially; no; can't tell</p> <p>Coding guide - check the answers above</p> <p>YES: All four should be yes</p> <p>NO: All four should be no</p> <p>PARTIALLY: Any other</p>
<p>A.2 Was the search for evidence reasonably comprehensive?</p> <p>Were the following done:</p> <ul style="list-style-type: none"> ▪ Language bias avoided (no restriction of inclusion based on language) ▪ No restriction of inclusion based on publication status ▪ Relevant databases searched (<u>Minimum criteria</u>: All reviews should search at least one source of grey literature such as Google; for health: Medline/ Pubmed + Cochrane Library; for social sciences IDEAS + at least one database of general social science literature and one subject specific database) ▪ Reference lists in included articles checked ▪ Authors/experts contacted 	<p>Yes; partially; no; can't tell</p> <p>Coding guide - check the answers above:</p> <p>YES: All five should be yes</p> <p>PARTIALLY: Relevant databases and reference lists are both reported</p> <p>NO: Any other</p>
<p>A.3 Does the review cover an appropriate time period?</p> <p>Is the search period comprehensive enough that relevant literature is unlikely to be omitted?</p>	<p>Yes; can't tell (only use if no information about time period for search); no; unsure</p> <p>Coding guide:</p> <p>YES: Generally, this means searching the literature at least back to 1990</p> <p>NO: Generally, if the search does not go back to 1990</p> <p>CAN'T TELL: No information about time period for search</p> <p>Note: With reference to the above – there may be important reasons for adopting different dates for the search, e.g. depending on the intervention. If you think there are limitations with the timeframe adopted for the search which have not been noted and justified by the authors, you should code this item as a NO and specify your reason for doing so in the comment box below. Older reviews should not be downgraded, but the fact that the search was conducted some time ago should be noted in the quality assessment. Always report the time period for the search in the comment box.</p>

<p>A.4 Was bias in the selection of articles avoided?</p> <p>Did the authors specify:</p> <ul style="list-style-type: none"> ▪ Independent screening of full text by at least 2 reviewers ▪ List of included studies provided ▪ List of excluded studies provided 	<p>Yes; partially; no</p> <p>Coding guide:</p> <p>YES: All three should be yes, although reviews published in journals are unlikely to have a list of excluded studies (due to limits on word count) and the review should not be penalised for this.</p> <p>PARTIALLY: Independent screening and list of included studies provided are both reported</p> <p>NO: All other. If list of included studies provided, but the authors do not report whether or not the screening has been done by 2 reviewers review is downgraded to NO.</p>
<p>A.5 Did the authors use appropriate criteria to assess the quality and risk of bias in analysing the studies that are included?</p> <ul style="list-style-type: none"> ▪ The criteria used for assessing the quality/ risk of bias were reported ▪ A table or summary of the assessment of each included study for each criterion was reported ▪ Sensible criteria were used that focus on the quality/ risk of bias (and not other qualities of the studies, such as precision or applicability/external validity). “Sensible” is defined as a recognised quality appraisal tool/ checklist, or similar tool which assesses bias in included studies. Please see footnotes for details of the main types of bias such a tool should assess. 	<p>Yes; partially; no</p> <p>Coding guide:</p> <p>YES: All three should be yes</p> <p>PARTIALLY: The first and third criteria should be reported. If the authors report the criteria for assessing risk of bias and report a summary of this assessment for each criterion, but the criteria may be only partially sensible (e.g. do not address all possible risks of bias, but do address some), we downgrade to PARTIALLY.</p> <p>NO: Any other</p>
<p>A.6 Overall – how much confidence do you have in the methods used to identify, include and critically appraise studies?</p> <p>Summary assessment score A relates to the 5 questions above.</p> <p>High confidence applicable when the answers to the questions in section A are all assessed as ‘yes’</p> <p>Low confidence applicable when any of the following are assessed as ‘NO’ above: not reporting explicit selection criteria (A1), not conducting reasonably comprehensive search (A2), not avoiding bias in selection of articles (A4), not assessing the risk of bias in included studies (A5)</p> <p>Medium confidence applicable for any other – i.e. section A3 is assessed as ‘NO’ or ‘can’t tell’ and remaining sections are assessed as ‘partially’ or ‘can’t tell’</p>	<p>Low confidence (limitations are important enough that the results of the review are not reliable)</p> <p>Medium confidence (limitations are important enough that it would be worthwhile to search for another systematic review and to interpret the results of this review cautiously, if a better review cannot be found)</p> <p>High confidence (only minor limitations)</p>
<p>Section B: Methods used to analyse the findings</p>	
<p>B.1 Were the characteristics and results of the included studies reliably reported?</p> <p>Was there:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Independent data extraction by at least 2 reviewers <input checked="" type="checkbox"/> A table or summary of the characteristics of the participants, interventions and outcomes for the included studies <input checked="" type="checkbox"/> A table or summary of the results of all the included studies 	<p>Yes; no; partially; not applicable (e.g. no included studies)</p> <p>Coding guide:</p> <p>YES: All three should be yes</p> <p>PARTIALLY: Criteria one and three are yes, but some information is lacking on second criteria.</p> <p>NO: None of these are reported. If the review does not report whether data was independently extracted by 2 reviewers (possibly a reporting error), we downgrade to NO.</p> <p>NOT APPLICABLE: if no studies/no data</p>

<p>B.2 Are the methods used by the review authors to analyse the findings of the included studies clear, including methods for calculating effect sizes if applicable?</p>	<p>Yes; partially; no; not applicable Coding guide: YES: Methods used clearly reported. If it is clear that the authors use narrative synthesis, they don't need to say this explicitly. PARTIALLY: Some reporting on methods but lack of clarity NO: Nothing reported on methods NOT APPLICABLE: if no studies/no data</p>
<p>B.3 Did the review describe the extent of heterogeneity?</p> <p>Did the review ensure that included studies were similar enough that it made sense to combine them, sensibly divide the included studies into homogeneous groups, or sensibly conclude that it did not make sense to combine or group the included studies?</p> <p>Did the review discuss the extent to which there were important differences in the results of the included studies?</p> <p>If a meta-analysis was done, was the I², chi square test for heterogeneity or other appropriate statistic reported? If no statistical test was reported, is a qualitative justification made for the use of random effects?</p>	<p>Yes; partially; no; not applicable Coding guide: YES: First two should be yes, and third category should be yes if applicable should be yes PARTIALLY: The first category is yes NO: Any other NOT APPLICABLE: if no studies/no data</p>
<p>B.4 Were the findings of the relevant studies combined (or not combined) appropriately relative to the primary question the review addresses and the available data?</p> <p>How was the data analysis done?</p> <ul style="list-style-type: none"> ▪ Descriptive only ▪ Vote counting based on direction of effect ▪ Vote counting based on statistical significance ▪ Description of range of effect sizes ▪ Meta-analysis ▪ Meta-regression ▪ Other: specify ▪ Not applicable (e.g. no studies or no data) <p>How were the studies weighted in the analysis?</p> <ul style="list-style-type: none"> ▪ Equal weights (this is what is done when vote counting is used) ▪ By quality or study design (this is rarely done) ▪ Inverse variance (this is what is typically done in a meta-analysis) ▪ Number of participants (sample size) ▪ Other: specify ▪ Not clear ▪ Not applicable (e.g. no studies or no data) <p>Did the review address unit of analysis errors?</p> <ul style="list-style-type: none"> ▪ Yes - took clustering into account in the analysis (e.g. used intra-cluster correlation coefficient) ▪ No, but acknowledged problem of unit of analysis errors ▪ No mention of issue ▪ Not applicable - no clustered trials or studies included 	<p>Yes; partially; no; not applicable (e.g. no studies or no data); can't tell. Coding guide: YES: If appropriate table, graph or meta-analysis AND appropriate weights AND unit of analysis errors addressed (if appropriate). PARTIALLY: If appropriate table, graph or meta-analysis AND appropriate weights AND unit of analysis errors not addressed (and should have been). NO: If narrative OR vote counting (where quantitative analyses would have been possible) OR inappropriate reporting of table, graph or meta-analyses. NOT APPLICABLE: if no studies/no data CAN'T TELL: if unsure (note reasons in comments below)</p>

<p>B.5 Does the review report evidence appropriately? The review makes clear which evidence is subject to low risk of bias in assessing causality (attribution of outcomes to intervention), and which is likely to be biased, and does so appropriately Where studies of differing risk of bias are included, results are reported and analysed separately by risk of bias status</p>	<p>Yes; partially; no; not applicable Coding guide: YES: Both criteria should be fulfilled (where applicable) NO: Criteria not fulfilled PARTIALLY: Only one criterion fulfilled, or when there is limited reporting of quality appraisal (the latter applies only when inclusion criteria for study design are appropriate) NOT APPLICABLE: No included studies Note on reporting evidence and risk of bias: For reviews of effects of 'large n' interventions, experimental and quasi-experimental designs should be included (if available). For reviews of effects of 'small n' interventions, designs appropriate to attribute changes to the intervention should be included (e.g. pre-post with assessment of confounders)</p>
<p>B.6 Did the review examine the extent to which specific factors might explain differences in the results of the included studies? Were factors that the review authors considered as likely explanatory factors clearly described? Was a sensible method used to explore the extent to which key factors explained heterogeneity?</p> <ul style="list-style-type: none"> ▪ Descriptive/textual ▪ Graphical ▪ Meta-analysis by sub-groups ▪ Meta-regression ▪ Other 	<p>Yes; partially; no; not applicable Coding guide: YES: Explanatory factors clearly described and appropriate methods used to explore heterogeneity PARTIALLY: Explanatory factors described but for meta-analyses, sub-group analysis or meta-regression not reported (when they should have been) NO: No description or analysis of likely explanatory factors NOT APPLICABLE: e.g. too few studies, no important differences in the results of the included studies, or the included studies were so dissimilar that it would not make sense to explore heterogeneity of the results</p>
<p>B.7 Overall - how much confidence do you have in the methods used to analyse the findings relative to the primary question addressed in the review? Summary assessment score B relates to the 5 questions in this section, regarding the analysis. High confidence applicable when all the answers to the questions in section B are assessed as 'yes'. Low confidence applicable when any of the following are assessed as 'NO' above: critical characteristics of the included studies not reported (B1), not describing the extent of heterogeneity (B3), combining results inappropriately (B4), reporting evidence inappropriately (B5). Medium confidence applicable for any other: i.e. the "Partial" option is used for any of the 6 preceding questions or questions and/or B.2 and/ or B.6 are assessed as 'no'.</p>	<p>Low confidence (limitations are important enough that the results of the review are not reliable) Medium confidence (limitations are important enough that it would be worthwhile to search for another systematic review and to interpret the results of this review cautiously, if a better review cannot be found) High confidence (only minor limitations)</p>
<p>Section C: Overall assessment of the reliability of the review</p>	
<p>C.1 Are there any other aspects of the review not mentioned before which lead you to question the results?</p>	<ul style="list-style-type: none"> ▪ Additional methodological concerns - only one person reviewing ▪ Robustness ▪ Interpretation ▪ Conflicts of interest (of the review authors or for included studies) ▪ Other ▪ No other quality issues identified

<p>C.2 Are there any mitigating factors which should be considered in determining the reviews reliability?</p>	<ul style="list-style-type: none"> ▪ Limitations acknowledged ▪ No strong policy conclusions drawn (including in abstract/ summary) ▪ Any other factors
<p>C.3 Based on the above assessments of the methods how would you rate the reliability of the review?</p> <p>Low confidence in conclusions about effects: Medium confidence in conclusions about effects: The systematic review has the following limitations... High confidence in conclusions about effects: If applicable: The review has the following minor limitations... Coding guide: High confidence in conclusions about effects: high confidence noted overall for sections A and B, unless moderated by answer to C1. Medium confidence in conclusions about effects: medium confidence noted overall for sections A or B, unless moderated by answer to C1 or C2. Low confidence in conclusions about effects: low confidence noted overall for sections A or B, unless moderated by answer to C1 or C2. Limitations should be summarised above, based on what was noted in Sections A, B and C.</p>	

8.4 Appendix D: Systematic map advisory group

To ensure that the proposed evidence gap map is of utmost policy relevance, throughout the review process, 3ie draws on feedback and inputs from a wide range of stakeholders. This is typically done through two streams of engagement: an external advisory group (EAG) comprised of a diverse group of stakeholders, and a group of representatives from within the key policy partner ([USAID’s Bureau for Resilience and Food Security](#)). The terms of reference for the EAG are outlined below. We draw on the advisory group at key points throughout the process to ensure that the systematic map meets the policy needs of the partner, while the EAG brings a broader perspective to ensure that key thinking in the field is captured and drawn on and that there is a wider audience for the review findings. At certain points, engagement or approval is only required from the key policy partner(s) rather than the larger advisory group. The advisory group, which is expected to draw on a set of colleagues from relevant departments and teams, is asked to provide input and engagement particularly during the initial scoping process; on the draft protocol; and through a presentation of the draft findings. The key policy partner(s) from RFS/USAID is further requested to provide final approval of the protocol, blog post and report.

The external advisory group members for this systematic map are the following:

Advisory group member	Affiliation(s)
Dr. Sue Cavill	Water, sanitation and hygiene sector specialist, Independent Consultant
Dr. Guy Howard	Director of the Cabot Institute for the Environment, Cabot Institute for the Environment

	Global Research Chair Environmental and Infrastructure Resilience, Department of Civil Engineering, University of Bristol
Dr. Dennis Mwanza	Chief of Party, DT Global
Shreena Patel	Senior Director, Evaluation, Millennium Challenge Corporation
Dr. Ian Ross	Research Fellow, Health Economics, London School of Hygiene and Tropical Medicine

Terms of reference for WaSH systematic map external advisory group

Authors of evidence gap maps (EGM) and systematic reviews establish stakeholder advisor groups to help them determine the parameters of their proposed research and to provide inputs throughout the process. The input from the advisory group helps to ensure that the final product is policy relevant, meets the needs of different end users, and has an audience of policy and practice actors that understand the product and that are interested in using the findings. The involvement of advisory group members from different organisations and regions of the world can also help to support the dissemination of the final product to a broad audience.

Members of the advisory group can be policymakers, practitioners, influencers, researchers, and other stakeholders with an interest in the EGM. Members of the advisory group will be asked to provide inputs on various aspects of the EGM throughout the research process. The role is voluntary. The total time commitment is not likely to exceed two days. The tasks of the advisory group members may include:

- Advise on key decisions regarding the scope of the EGM, including refining the intervention and outcome framework.
- Define key concepts.
- Suggest relevant background literature and studies for inclusion.
- Participate in up to 3 teleconferences for the duration of the research (e.g. scoping stage; draft protocol; draft EGM report).
- Provide written comments on draft protocol and draft EGM report.
- Help the team draw the policy implications from the EGM findings. This can involve participating in a brainstorm or focus group meeting to review the lessons and implications of the EGM in terms of policy and practice.
- Assist the study team with policy engagement. This can involve advising the team on key stakeholders with whom to communicate to build interest in and understanding of the EGM, contribute to developing a communication and uptake plan, facilitate engagement with key audiences and communicate findings.