

## RESEARCH ARTICLE

# Water, sanitation, and women's empowerment: A systematic review and qualitative metasynthesis

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## Abstract

Historically, water and sanitation programs have focused on women's instrumental value in improving conditions and behaviors. No reviews have synthesized evidence on water and sanitation and women's and girls' empowerment. This review a) identified empirical water and sanitation research that engaged empowerment and/or empowerment-related domains; b) reported empowerment-related terminology used, research locations, methods leveraged, if water and/or sanitation was the focus; and c) synthesized evidence. A conceptual model of women's and girls' empowerment, which includes three interrelated domains (agency, resources, institutional structures), informed the search and analysis. We searched MEDLINE, EMBASE, CABI Global Health, PsycINFO, CINAHL and AGRICOLA for peer-reviewed sources presenting research on water and/or sanitation and either empowerment and/or related terms from the model (4 May 2020). We identified 12,616 publications; 257 were included, representing over 1,600,000 participants. We used the Mixed-Methods Appraisal Tool (MMAT) and followed the 'best-fit framework synthesis' analysis approach, using the model domains and sub-domains as codes. We inductively identified two additional sub-domains relevant to water and sanitation: privacy and freedom of movement. Thematic analysis guided synthesis of coded text. The majority of research took place in Asia (46%; 117) or Africa (40%; 102), engaged adults (69%; 177), and was published since 2010; (82%; 211). The greatest proportion of studies focused on water (45%; 115). Over half of studies used the term empowerment, yet only 7% (17) provided a clear definition or conceptualization. Agency was the least commonly engaged domain (47%; 122); the Resources domain was dominant (94%; 241). Measures for assessing empowerment are limited. Inclusion of only peer-reviewed sources in English is a main limitation. Well-conceptualized water and sanitation research that engages women's and girls' empowerment is limited. A more comprehensive 'transformative WASH' that includes gender-transformative

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approaches to challenge and reduce systemic constraints on women's and girls' resources and agency is long overdue.

## Introduction

Water, sanitation, and hygiene (WASH) access, behaviors, experiences, and physical and social environments have been shown to influence multiple outcomes, including diarrheal disease, soil transmitted helminth and protozoa infection, active trachoma and schistosomiasis, pneumonia, anemia, mental health and general well-being, economic productivity, school absence, and child growth and cognitive development [1–14]. This demonstrated importance of WASH underlies Sustainable Development Goal (SDG) 6, which aims to “Ensure availability and sustainable management of water and sanitation for all” [15]. Still, water and sanitation access remain out of reach for large proportions of the global population: 26% of the global population lacks access to water that is available when needed and free from chemical and fecal contamination, and 46% lacks access to household sanitation facilities that safely manage excreta [16]. Furthermore, while SDG Target 6.2 emphasizes “paying special attention to the needs of women and girls,” who are recognized as WASH duty-bearers globally, [17–20] data often fail to reflect the gender-specific benefits and harms of WASH conditions, behaviors, and interventions. Despite recognition of WASH ‘as a pathway to gender equality’, [21] a full understanding of the gendered effects of WASH remains limited, prompting calls for improved gender measurement, data, and learning [19, 22–25].

While historically WASH programs focused on women's contributions to improving effectiveness and impact of programs, this focus has been evolving to consider how WASH programming may contribute to positive gender outcomes [26] and, more specifically, to women's empowerment [27–30]. Research on women's empowerment has flourished across multiple disciplines in the past two decades, argued to be propelled by the foundational work of Naila Kabeer (1999), who defined empowerment as ‘the expansion in people's ability to make strategic life choices in a context where this ability was previously denied to them’ [31]. Kabeer further conceptualized empowerment as having three dimensions: *resources*, or the human, material, and social pre-conditions to exercising choice; *agency*, which is “the ability to define one's goals and act upon them,” and *achievements*, which are the possible outcomes of exercising agency [31]. While several other definitions, frameworks, and measures exist, women's empowerment is widely recognized to be multi-dimensional and a process that is valuable both intrinsically for its own sake and instrumentally for its link to varied life outcomes, including nutrition, access to care, contraception use, vaccination, and exposure to violence [32–36]. Global recognition of the importance of women's empowerment is evidenced by its prominent role in SDG 5, which seeks to ‘empower all women and girls’ [37].

Recent reviews have examined WASH and gender, with variable explicit engagement with empowerment [38–42]. In their scoping review, Dery et al. (2020) explored how empowerment was used in WASH. Among the 13 included articles, of which four focused on women's access to WASH and empowerment, five interrelated dimensions of empowerment were identified: access to information, participation, capacity building, leadership and accountability, and decision-making [38]. MacArthur and colleagues (2020) conducted a critical review of WASH-gender literature from 2008–2018 and sought to understand how WASH studies engaged gender equality. Their distant-reading analysis of the 155 included articles, which focused only on assessment of titles and abstracts, revealed that few engaged with gender transformational-aspects of gender equality [39]. A mixed-method systematic review protocol

outlines another study's planned aim and approach to synthesize evidence on gender and social equality outcomes that are specific to complex WASH interventions [43]. However, the two reviews that have been completed (Dery et al. and MacArthur et al.) have used methods that are limited in their scope and rigor, [44] and a need has remained for a more comprehensive synthesis of the evidence.

To date there have been no rigorous systematic reviews to assess and synthesize evidence on WASH and women and girls' empowerment. Such a comprehensive review could benefit various actors, including researchers, by determining which domains of empowerment are well-studied and which require further attention; practitioners and policy makers, by identifying programs, interventions, and approaches that have contributed to (or hampered) women's empowerment; and donors, by distinguishing what facets of WASH-related empowerment may require further investment. To that end, the primary aims of this literature review were to: a) identify empirical water and sanitation research that engaged empowerment and/or empowerment-related domains; b) tabulate and report how empowerment-related terms were used, where and when research was conducted, what methods were leveraged, and if water and/or sanitation was the primary focus; c) synthesize findings by empowerment domain and water and/or sanitation focus.

## Methods

We report our review using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria (See S1- PRISMA Checklist in [S1 Table](#)).

## Conceptual foundation

Our literature search and subsequent analyses were guided by the conceptual model of empowerment outlined by van Eerdewijk et al. (2017), [45] which extended work by Naila Kabeer, [46] the World Bank, [47] and CARE [48]. The authors define empowerment of women and girls as 'the expansion of choice and strengthening of voice through the transformation of power relations, so women and girls have more control over their lives and futures' (p. 13). Their conceptualization of empowerment, which they consider to be both a process and an outcome, involves the interaction of three domains—agency, resources, and institutional structures—each of which includes several sub-domains. The authors elucidate this interaction, noting that the 'Transformation of power relations occurs through women and girls exercising agency and taking action, through the redistribution of resources towards women and girls, and through shifting the institutional structures that shape women and girls' choice and voice, and ultimately their lives and futures' (p.14). Definitions for empowerment and each of the domains and subdomains included in the model, all of which guided our search, analyses, and presentation of findings, are provided in [Table 1](#).

The conceptual model was developed in partnership with the Bill & Melinda Gates Foundation (BMGF) as a means of providing conceptual clarity and a common language for empowerment-related work across the Foundation. It was developed after a review of over 115 resources in research and development representing over 50 organizations and underwent extensive peer review from a team of gender experts representing the Foundation and 12 external organizations [45]. The authors note that it can be used to analyze contexts, inform intervention design, and guide monitoring and measurement activities. Given that our systematic review was part of a BMGF-funded project to develop and validate measures to assess women's empowerment in urban sanitation, [50] we elected to use the same model for consistency. While van Eerdewijk et al. also discuss the importance of engaging men and boys in

**Table 1. Definitions of empowerment and related domains and sub-domains from Van Eerdewijk et al. (2017).**

Term	Definition
<b>Empowerment</b>	The expansion of choice and strengthening of voice through the transformation of power relations so women and girls have more control over their lives and futures.
<b>1. Agency</b>	Women and girls pursuing goals, expressing voice and influencing and making decisions free from violence and retribution
<b>a. Decision-Making</b>	Women and girls influencing and making decisions, and establishing and acting on goals
<b>b. Leadership</b>	Women and girls leading, inspiring social change and effectively participating in governance
<b>c. Collective Action</b>	Women and girls gaining solidarity and taking action collectively on their interests to enhance their position and expand the realm of what is possible
<b>2. Resources</b>	The tangible and intangible capital and sources of power that women and girls have, own or use, individually or collectively, in the exercise of agency
<b>a. Bodily Integrity</b>	Women and girls' security and control over their bodies, and physical and mental well-being
<b>i. Safety &amp; Security<sup>1</sup></b>	Women and girls' freedom from acts or threats of violence, coercion or force
<b>ii. Health</b>	Women and girls' complete physical, mental and social well-being and not merely the absence of disease or infirmity
<b>b. Critical Consciousness</b>	Women and girls identifying and questioning how inequalities in power operate in their lives, and asserting and affirming their sense of self and their entitlement ('power-within')
<b>c. Assets</b>	Women and girls' control over tangible or intangible economic, social or productive resources that include (1) financial and productive assets, (2) knowledge and skills, (3) time and (4) social capital
<b>i. Financial &amp; Productive Assets</b>	Women and girls' control over economic resources such as income, credit or savings, as well as long-term stocks of value like land, equipment, housing or livestock that can be owned, controlled or used by a person
<b>ii. Knowledge &amp; Skills</b>	Women and girls' knowledge and skills (including life skills), and their abilities to apply knowledge to situations, obtained through high-quality formal or informal education, training or information
<b>iii. Social Capital</b>	Women and girls' relations and social networks that provide tangible and intangible value and support
<b>iv. Time</b>	Women and girls' control over their time and labor, which is key to time poverty and work burden
<b>3. Institutional Structures</b>	The social arrangements of formal and informal rules and practices that enable and constrain the agency of women and girls, and govern the distribution of resources
<b>a. Formal Laws &amp; Policies</b>	Formally recognized rules of conduct or procedures established by nation states, international treaties and conventions, or local governance authorities that govern the rights and entitlements of women and girls
<b>b. Norms</b>	Collectively held expectations and beliefs of how women, men, girls, and boys should behave and interact in specific social settings and during different stages of their lives
<b>c. Relations</b>	The interactions and relations with key actors that women and girls experience in their daily lives

1. In our analysis, we use the definition of sexual violence used by Van Eerdewijk et al. (2017) which comes from Krug et al. (2002): "any sexual act, attempt to obtain a sexual act, unwanted sexual comments or advances, or acts to traffic, or otherwise directed, against a person's sexuality using coercion, by any person regardless of their relationship to the victim, in any setting, including but not limited to home and work" (p. 149) [49]. Forms of sexual violence included in this definition include: rape within marriage or relationships; rape by strangers; systematic rape during armed conflict; unwanted sexual advances or sexual harassment; sexual abuse of mentally or physically disabled people; sexual abuse of children; forced marriage or cohabitation including child marriage; denial of the right to use contraception or to adopt other measures to protect against sexually transmitted diseases; forced abortion; female genital mutilation and obligatory inspections for virginity; forced prostitution and trafficking of people for the purpose of sexual exploitation.

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empowerment work, we chose to retain the core focus on women and girls in line with the aims of our larger project.

### Search strategy

Our search strategy aimed to identify studies that engaged with and reported on water, sanitation, and empowerment, including associated domains and sub-domains of empowerment. We completed our search on 4 May 2020 for articles published in English in peer-reviewed sources on any date in the following databases: MEDLINE (PubMed), EMBASE, CABI Global Health, PsycINFO (EBSCOhost), CINAHL (EBSCOhost) and AGRICOLA (EBSCOhost) ([S2 Table](#) for terms). One co-author identified additional articles by reviewing the reference lists of each included article (ancestry search) and by using Google Scholar to identify articles that cited each included article (descendancy search). Finally, additional articles known by the authors that were not captured in the search were included.

### Study eligibility

Any peer-reviewed article presenting primary or secondary research related to water and/or sanitation and either empowerment and/or one of the domains of empowerment from the conceptual model was eligible for inclusion. We included all countries, settings, human populations, and study designs; we excluded articles not in English.

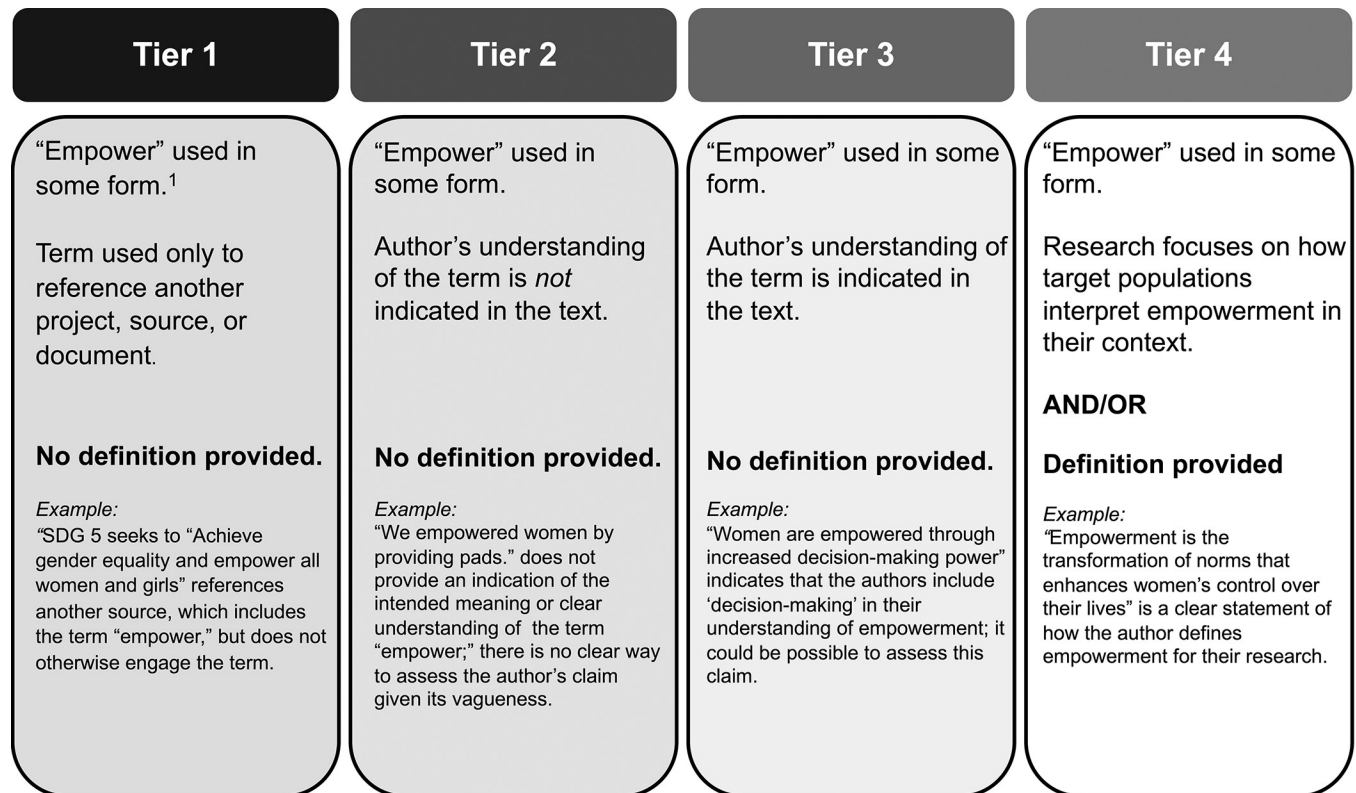
To determine inclusion, one team member independently reviewed all titles and abstracts from the database search. Three other team members then split all titles and abstracts to complete a second review. When a consensus decision could not be made from the title and abstract, the full article was reviewed by two reviewers. When reviewers disagreed on eligibility, six members of the broader study team met to reach consensus on inclusion or exclusion.

### Analysis

Our analysis proceeded in multiple stages. First, to better understand the body of work included in the review, one team member extracted and collated study design, setting, population, and relevant water and sanitation information from each study. Second, to assess if papers engaged 'empowerment' and like terms, we conducted a word search on all papers for 'empow,' which enabled identification of 'empowerment' and similar terms (e.g. empower, disempowered). We then classified how papers engaged empowerment-related terms using a four-tier classification tool we created; see [Fig 1](#) for tier classifications.

Third, to classify and synthesize evidence on water, sanitation, and empowerment, we used the 'best-fit framework synthesis' approach [51]. Using this method, themes are identified to use as codes *a priori* from pre-existing, guiding frameworks or models. This synthesis approach allows for the guiding framework or conceptual model to be modified as themes emerge inductively from the data. We created and defined codes based on the definitions of the empowerment subdomains in the conceptual model by Van Eerdewijk et al. [45] ([Table 1](#)), and included two additional codes for empowerment-related subdomains identified iteratively through analysis, thus expanding the existing model: *Privacy* (Resources domain) and *Freedom of Movement* (Agency domain) ([Fig 2](#)). Other codes included water and sanitation to identify the focal topics engaged, as well as menstruation, which was engaged in many of the sources identified.

All eligible papers were imported into MaxQDA (version 12) [52] qualitative analysis software. Following best practice, [53] line-by-line coding of the results sections of eligible papers, which present the empirical data from the studies, was carried out independently by two team



1. Any word including “empow” in some form, including (dis)empower, (dis)empowering, or (dis)empowerment were included in the search. Examples of “empow” that were located in the reference section were excluded.

**Fig 1. Four tier classification schema for article engagement of ‘empowerment’.**

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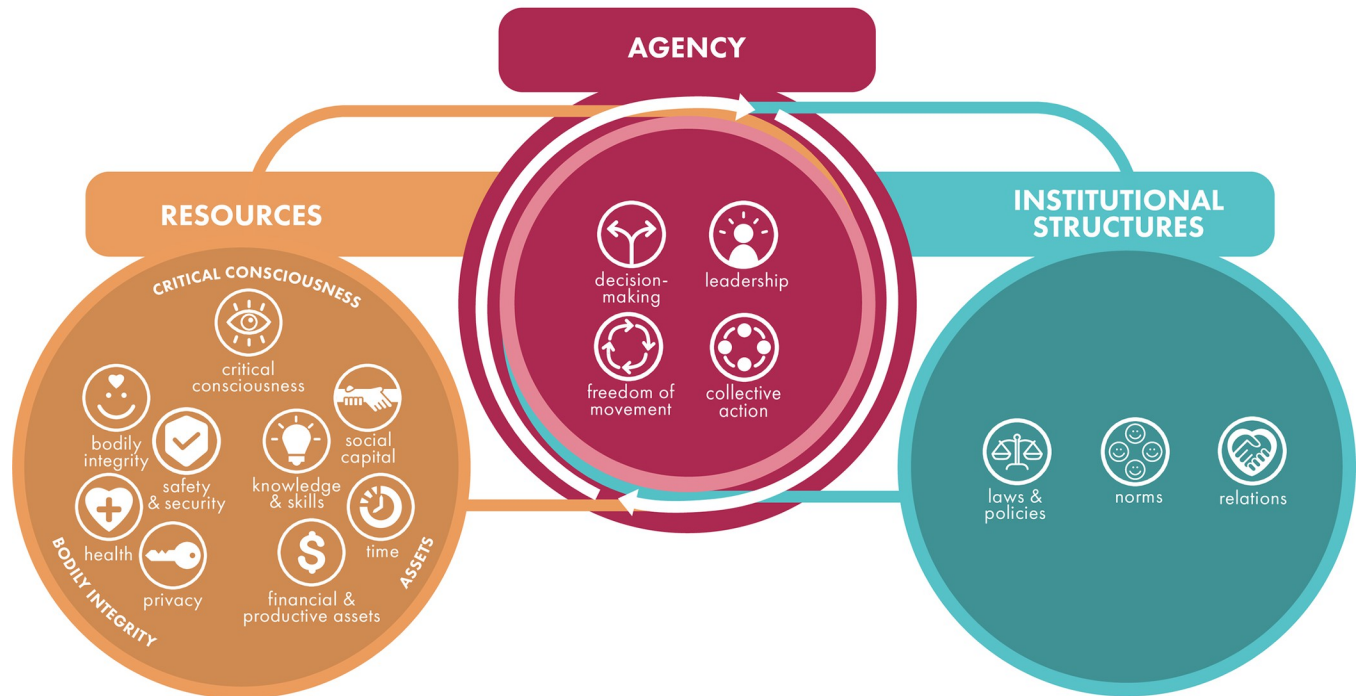
members, who first coded two papers independently and compared to assess inter-coder agreement.

Using thematic analysis, two team members generated descriptive themes for each empowerment code based on the relevant coded texts. All coded segments containing both an empowerment-related code and a sanitation/water code (e.g. ‘safety’ and ‘sanitation’) were exported into an Excel file and analyzed further. Each subdomain of empowerment (e.g. ‘safety,’ ‘privacy’) was analyzed separately. Themes were refined into a smaller set of descriptive themes that outlined how experiences with water and sanitation related to the various subdomains of empowerment. Descriptive themes were then used to describe how each domain/subdomain of empowerment has been researched in the literature.

### Study quality appraisal

We assessed all studies using the Mixed-Method Appraisal Tool (MMAT) 2018 developed by Pluye et al. [54] and updated in 2018 [55] for the appraisal of qualitative, quantitative, and mixed-methods studies. One team member performed quality appraisals of all studies and a second team member performed a quality appraisal agreement check on 10% of studies. Qualitative and most quantitative studies were assessed using the five-criteria questionnaire; one criterion was dropped for randomized control trials because we did not consider it indicative of quality (‘Did participants adhere to the assigned intervention?’). Mixed-methods studies were assessed using the relevant independent questionnaires for qualitative and quantitative work

## WOMEN'S AND GIRLS' WATER- AND SANITATION-RELATED EMPOWERMENT



**Fig 2. Domains and sub-domains of women's and girls' water and sanitation-related empowerment (adapted from Van Eerdewijk et al. (2017).**

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and a five-criteria questionnaire for mixed-methods; the lowest of the three scores was used as the quality score. Possible scores were 0–5 across study types (5 is the best). Because the primary aim of this work is to understand if and how research engaged water and sanitation and empowerment themes, all studies were retained regardless of scores.

In their meta-synthesis of sanitation and well-being, Sclar et al. (2018) [14] note that qualitative research is explicitly unblinded, subjective, and self-reported, and thus likely to produce poor scores from bias assessment tools. Because this review is exploratory, we excluded bias assessment, reasoning that qualitative studies would have low bias scores by default (despite rich insights), and therefore the activity would introduce bias.

## Results

### Included articles

Fig 3 shows the review strategy, including reasons for exclusion. We included 257 articles—129 qualitative, 54 quantitative, and 74 mixed methods—representing an estimated 1,600,348 participants (S3 Table describes all included studies). Articles largely featured research from Asia (48%) and Africa (42%), and focused on adult participants (69%) (Table 2). The earliest paper was published in 1989; 82% (211) of articles were published since 2010 and 60% (153) since 2015 (S1 Fig).

### Study quality

S4 Table presents study quality scores for each included article. Mean study quality was 4.2 overall indicating good quality, 4.8 for qualitative studies, 4.1 for quantitative studies, and 3.3 for mixed methods studies (5 is maximum) (Table 2).

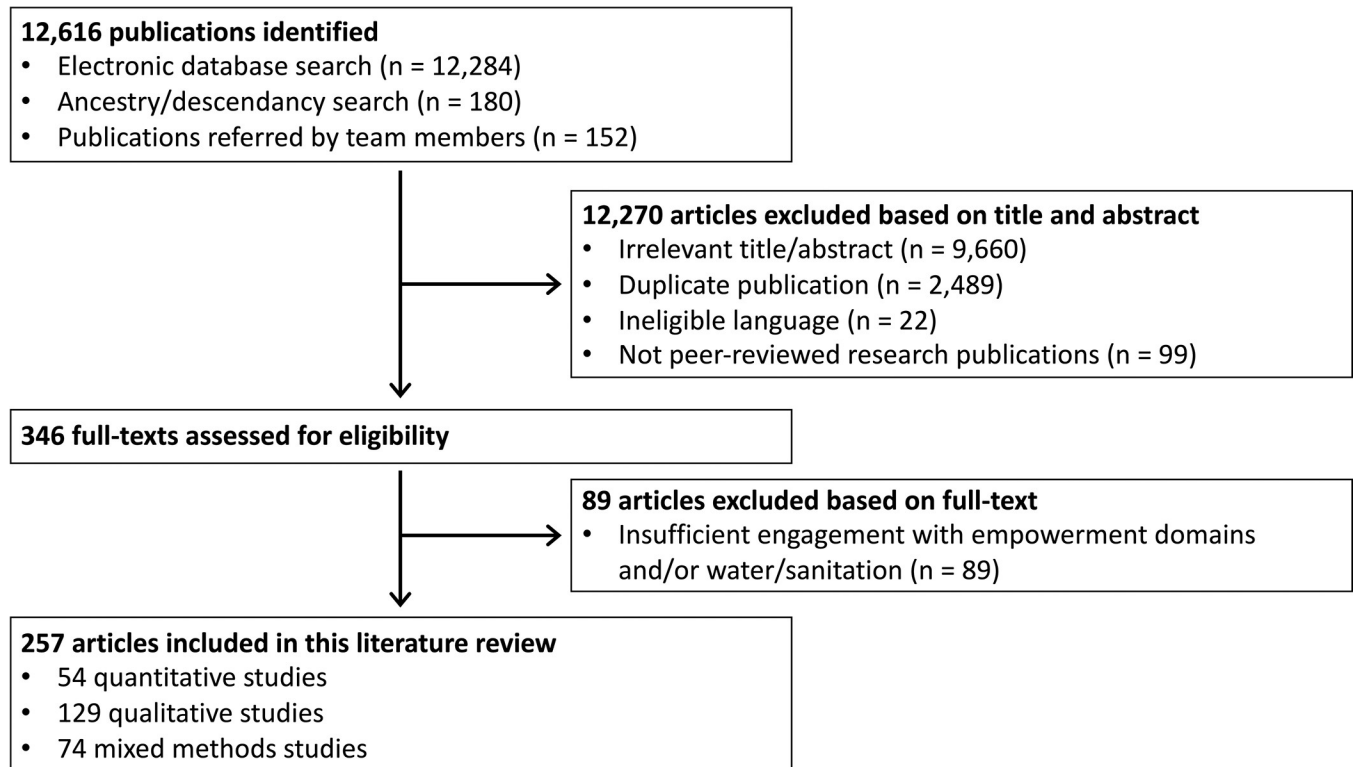


Fig 3. PRISMA flow diagram of publications considered for the review.

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## Water and sanitation research engaging empowerment and associated domains

The terms “empower,” “empowerment,” “empowering,” “disempowerment,” or “disempowering” featured in the text of 133 (52%) articles. Only 17 (7%) articles included a specific definition or conceptualization of empowerment to inform their research (see [Table 2](#); [S5 Table](#) for specific definitions used); [\[30, 56–71\]](#) 12 (5%) had a specific aim or research question focused broadly on empowerment [\[30, 56, 57, 59, 64, 66, 68, 70, 72–75\]](#).

One hundred fifteen (45%) articles focused on water, 57 (22%) on sanitation, 85 (33%) on both; 34 (13%) engaged menstruation. [Table 3](#) summarizes which studies contributed to each domain or subdomain; [S6 Table](#) collates all menstruation-related articles by domain and subdomain. Of the domains of empowerment, the resources domain was the most represented (241 articles; 94%); 181 (70%) articles engaged at least two of the empowerment domains and 113 (44%) engaged all three ([S2 Fig](#)).

## Synthesis by empowerment domain and sub-domain

The sections that follow synthesize findings from water and sanitation research by the domains and subdomains of women’s empowerment as defined by our guiding conceptual model. The order we present domain and sub-domain findings is consistent with the order in [Table 3](#), which includes all the domains and sub-domains from [Table 1](#) as well as the two additional, iteratively-identified sub-domains (Freedom of Movement and Privacy). The synthesis below focuses on high-level findings related to each domain and sub-domain. We guide readers throughout to additional information in a [S1 Text](#).



Table 2. Summary information about included sources (N = 257).

		Total		Qualitative		Quantitative		Mixed Methods	
Total Number of Articles		257		129	50%	54	21%	74	29%
Region									
	Africa	102	40%	44	34%	26	48%	32	43%
	Asia	117	46%	64	50%	20	37%	33	45%
	Europe	3	1%	2	2%	0	0%	1	1%
	Latin America/Caribbean	9	4%	5	4%	0	0%	4	5%
	Middle East	0	0%	0	0%	0	0%	0	0%
	North America	11	4%	10	8%	1	2%	0	0%
	Oceania	5	2%	2	2%	1	2%	2	3%
	Multiple Regions	10	4%	2	2%	6	11%	2	3%
	Unspecified	0	0%	0	0%	0	0%	0	0%
Location within Country									
	Urban	69	27%	32	25%	18	33%	19	26%
	Peri-Urban	7	3%	6	5%	0	0%	1	1%
	Rural	131	51%	67	52%	20	37%	44	59%
	Refugee camps	1	0%	0	0%	0	0%	1	1%
	Multiple Locations	39	15%	19	15%	15	28%	5	7%
	Unspecified	10	4%	5	4%	1	2%	4	5%
Sex of Primary Research Population									
	Female	103	40%	47	36%	31	57%	25	34%
	Male	0	0%	0	0%	0	0%	0	0%
	Both Male and Female	140	54%	75	58%	21	39%	44	59%
	Non-Binary/Transgender/Other	0	0%	0	0%	0	0%	0	0%
	Unspecified	14	5%	7	5%	2	4%	5	7%
Life Stage of Primary Research Population									
	Children (0–9)	0	0%	0	0%	0	0%	0	0%
	Adolescents (10–19)	14	5%	6	5%	5	9%	3	4%
	Adults (20–59)	177	69%	90	70%	33	61%	54	73%
	Elderly (60+)	0	0%	0	0%	0	0%	0	0%
	Multiple Populations	56	22%	26	20%	14	26%	16	22%
	Unspecified	10	4%	7	5%	2	4%	1	1%
Primary Research Focus									
	Sanitation	57	22%	28	22%	15	28%	14	19%
	Water	115	45%	54	42%	27	50%	34	46%
	Sanitation and Water	85	33%	47	36%	12	22%	26	35%
Articles Engaging Menstruation by Research Focus									
	All	34	13%	21	16%	3	6%	10	14%
	Sanitation	9	4%	6	5%	2	4%	1	1%
	Water	2	1%	0	0%	1	2%	1	1%
	Sanitation and Water	23	9%	15	12%	0	0%	8	11%
Study Quality: Mean Score (Range) <sup>2</sup>		4.2	(1–5)	4.8	(2–5)	4.1	(2–5)	3.3	(1–5)
Article Engagement of Empowerment <sup>1</sup> by Tier									
	No Engagement of Empowerment Terms	124	48%						
	Tier 1	20	8%						
	Tier 2	65	25%						
	Tier 3	31	12%						

(Continued)

Table 2. (Continued)

	Total		Qualitative	Quantitative	Mixed Methods
Tier 4	17	7%			

1. Engagement of empowerment also includes engagement of like terms of empowerment (e.g. empower, disempower, etc.).

2. Number in parentheses is actual score range. One quantitative study is not included in the mean; it had a max score of 4, not 5, because one criteria was removed. The paper scored a 4 (the max score). 11 studies were not assessed because the methods employed did not suit assessment, including 1 qualitative study, 4 quantitative studies, and seven mixed methods studies.

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## 1. Agency

Women reported exercising water and sanitation-related agency, including engagement in decision-making inside and outside the household, formal and informal leadership, and collective action. Women experienced constraints on their movement, which impacted their access to water and sanitation resources and to public water and sanitation related activities.

### 1.a Decision-making

Women have varied roles related to intra- and extra- household water and sanitation making, though seem to have the greatest power related to decisions within the household related to water. Women in Guatemalan savings groups reported having at least equal participation in household WASH decisions, with many reporting greater decision-making power than their husbands [73]. Women in Bangladesh, [110] Ethiopia, [108] and India [60] reported decision-making power over water collection and allocation, though some studies from India found men to make water collection decisions that did not account for women's priorities [101, 119]. A water security study from Nepal reported that some women found individual decision-making stressful and that seeking support from in-laws and husbands was culturally valued [59]. With respect to sanitation, in India, the odds of having a latrine was significantly higher in households where women were the main decision makers [136] and in Kenya, the likelihood of a household owning an improved sanitation facility was significantly higher when women had at least some input on decisions about major household purchases [134].

Women have both participated in and been prevented from a range of extra-household water and sanitation decision-making situations. In Indonesia, women exercised independent choice in selecting WASH-related jobs [66]. In India, women became a part of decision-making processes in village-level sanitation meetings, [139] water user committees, [89] and other sanitation projects, [127] and men believed women could speak up in meetings and expressed happiness that they could make joint decisions [145]. Women have voiced opinions about proposed activities and offered suggestions during informal water and sanitation meetings (Egypt), [78] and both men and women noted that women are likely to speak out in public settings and take action on water-related issues given their role as household water managers (Mexico) [93]. Both men and women in Hmong communities in Vietnam agreed that women were likely to be listened to when they participated in water management meetings [97]. In Bolivia, although women were rarely able to contribute in water-focused meetings, their contributions often shifted community conversations in important ways and women often had strong influence over water-related decisions, even when men had formal decision-making authority [114]. Conversely, women also have been barred from extra-household water and sanitation decision-making. Women reported being listed as water management group members, but never attending meetings (Bangladesh [109]), instructing husbands to relay water concerns to committees (Sri Lanka [56]), having husbands or sons attend meetings and make

Table 3. Summary of studies that engage water and/or sanitation by domain and sub-domains of empowerment (N = 257).

Domains & Sub-Domains	Articles that Engage the Domain/Sub-Domain		
	Water (N = 116)	Water and Sanitation (N = 83)	Sanitation (N = 58)
<b>I. AGENCY (N = 137)</b>	(n = 76)	(n = 24)	(n = 37)
<b>I.a</b>	(n = 53)	(n = 16)	(n = 21)
<b>Decision-making (N = 90)</b>	Abu 2019:[76] Aguilar 2005:[63] Akolgo 2020:[77] Aladuwaka 2016:[56] Assaad 1994:[78] Bastidas 2005:[79] Bastola 2015; [80] Bhandari 2009; [81] Bisung 2014; [82] Boateng 2013a; [83] Boateng 2013b; [84] Cairns 2017; [72] Carmi 2019; [85] Chipeta 2009; [86] Clement 2018; [87] Coulter 2018; [87] Crow 2012; [88] Das 2014; [89] Devasia 1998a; [90] Devasia 1998b; [91] DeVries 2015; [73] El Katsha 1989a; [92] Ennis-McMillan 2005; [93] Gate 2001; [94] Ge 2011; [95] Grant 2019; [30] Harris 2017; [96] James 2002; [67] Leahy 2017; [58] Lebel 2015; [97] Leder 2017; [59] Mandara 2013; [98] Mandara 2017; [99] Mason 2012; [100] Mehta 2015; [101] Naiga 2017; [102] O'Reilly 2006; [69] Padmaja 2020; [103] Prokopy 2004; [104] Sijbesma 2009; [105] Singh 2006b; [106] Singh 2018; [107] Stevenson 2012; [108] Sultana 2009a; [109] Sultana 2009b; [110] Thai 2019; [111] Torri 2010; [75] Tortajada 2003; [112] Trinitis 2011; [113] Varua 2018; [60] Wutich 2012; [114] Yerian 2014; [61] Yuerlita 2017 [115]	Ali 2013; [116] BeBe 2015; [117] Bisung 2019; [64] Halvorson 2004; [118] Indarti 2019; [66] Jha 2012; [119] Makoni 2004; [120] Oluwemo 2012; [70] Rautanen 2005; [121] Reddy 2008; [122] Remigios 2011; [123] Routray 2017b; [124] Scott 2017a; [125] Scott 2017b; [126] Sijbesma 2012; [127] Tam 2012 [71]	Azeez 2019; [128] Baluchova 2017; [129] Bhatt 2019; [130] Czerniewska 2019; [131] Dwpayanti 2019; [132] Elledge 2020; [133] Htrai 2016; [134] Khanna 2016; [135] Lee 2017; [136] Mannan 2018; [137] Mohankumar 2017; [138] O'Reilly 2010; [62] Pardeshi 2009; [139] Routray 2017a; [140] Shahid 2015; [141] Simiyu 2017; [142] Thuita 2017; [143] Varickanical 2019; [144] von Medeazza 2015; [145] Waterkeyn 2005; [146] Winter 2019b* [147]
<b>I.b</b>	(n = 40)	(n = 7)	(n = 9)
<b>Leadership (N = 56)</b>	Aguilar 2005; [63] Aladuwaka 2016; [56] Assaad 1994; [78] Bastidas 2005; [79] Bastola 2015; [80] Bhandari 2009; [81] Boateng 2013a; [83] Bustamante 2005; [148] Cairns 2017; [72] Carmi 2019; [85] Clement 2018; [87] Coulter 2018; [87] Das 2014; [89] Delgado 2007; [149] Devasia 1998a; [90] Devasia 1998b; [91] DeVries 2015; [73] Ennis-McMillan 2005; [93] Ge 2011; [95] Leahy 2017; [58] Lebel 2015; [97] Leder 2017; [59] Makoni 2004; [120] Mandara 2017; [99] Mmbengwa 2017; [68] Mommen 2017; [150] Naiga 2017; [102] O'Reilly 2006; [69] Panda 2012; [74] Prokopy 2004; [104] Sam 2020; [151] Singh 2006a; [152] Singh 2006b; [106] Singh 2018; [107] Sultana 2009a; [109] Thai 2019; [111] Tortajada 2003; [112] van Houweling 2016; [153] Wutich 2012; [114] Yerian 2014 [61]	Bisung 2019; [64] Indarti 2019; [66] Jha 2012; [119] O'Reilly 2014; [154] Scott 2017a; [125] Scott 2017b; [126] Sijbesma 2012 [127]	Elledge 2020; [133] Hoque 1994; [155] Pardeshi 2008; [156] Pardeshi 2009; [139] Smith 2004; [157] Thuita 2017; [143] von Medeazza 2015; [145] Waterkeyn 2005; [146] Winter 2019b* [147]
<b>I.c</b>	(n = 36)	(n = 6)	(n = 13)
<b>Collective Action (N = 55)</b>	Acey 2010; [158] Aladuwaka 2016; [56] Anderson 2013; [159] Assaad 1994; [78] Bastidas 2005; [79] Bhandari 2009; [81] Bisung 2014; [82] Bisung 2015b; [160] Bustamante 2005; [148] Cairns 2017; [72] Crow 2012; [88] Das 2014; [89] de Moraes 2013; [161] Devasia 1998a; [90] Devasia 1998b; [91] DeVries 2015; [73] Enabor 1994; [162] Ennis-McMillan 2001; [163] Ennis-McMillan 2005; [93] Gabrielson 2013; [65] Ge 2011; [95] Grant 2019; [30] Kernecker 2017; [164] Mandara 2017; [99] Mushavi 2020; [165] Naiga 2017; [102] Nerkar 2013; [166] Panda 2012; [74] Privott 2019; [167] Sijbesma 2012; [127] Singh 2018; [107] Torri 2010; [75] Varickanical 2019; [144] Wutich 2012; [114] Yerian 2014; [61] Yuerlita 2017 [115]	Bapat 2003; [168] Bisung 2015a; [169] Bisung 2016; [170] Gate 2001; [94] Rautanen 2005; [121] Tam 2012 [71]	Baluchova 2017; [129] Belur 2017; [171] El Kaisha 1989; [92] Hirve 2015; [172] Hoque 1994; [155] Joshi 2018; [173] Kulkarni 2017; [174] Pardeshi 2008; [156] Pardeshi 2009; [139] Routray 2017a; [140] Shiras 2018; [175] von Medeazza 2015; [145] Winter 2019b [147]
<b>I.d</b>	(n = 21)	(n = 7)	(n = 20)
<b>Freedom of Movement (N = 48)</b>	Abu 2019; [76] Assaad 2009; [78] Bastidas 2005; [79] Coles 2009; [176] Das 2014; [89] de Moraes 2013; [161] Faisal 2005; [177] Grant 2019; [30] Lebel 2015; [97] MacRae 2019; [178] Mehta 2015; [101] Naiga 2017; [102] O'Reilly 2006; [69] Pommells 2018; [179] Prokopy 2004; [104] Singh 2005; [180] Singh 2006a; [152] Singh 2006b; Sultana 2009b; [110] Torri 2010; [75] van Houweling 2016 [153]	Halvorson 2004; [118] Hulland 2015; [181] Indarti 2019; [66] Rautanen 2005; [121] Routray 2015; [182] Scott 2017b; [126] Sommer 2018 [183]	Azeez 2019; [128] Bapat 2003; [168] Belur 2017; [171] Caruso 2017b; [184] Ellis 2016; [185] Jha 2012; [119] Khanna 2016; [135] Kulkarni 2017; [174] Kviringira 2014; [186] Nallari 2015; [187] O'Reilly 2010; [62] Rheinländer 2019; [188] Routray 2017b; [124] Sahoo 2015; [189] Shahid 2015; [141] Sijbesma 2012; [127] Singh 2019; [190] von Medeazza 2015; [145] Waterkeyn 2005; [146] Winter 2018a [191]

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Table 3. (Continued)

Domains & Sub-Domains	Articles that Engage the Domain/Sub-Domain		
	Water (N = 116)	Water and Sanitation (N = 83)	Sanitation (N = 58)
<b>2. RESOURCES (N = 240)</b>	(n = 106)	(n = 77)	(n = 57)
<b>2.a</b>	(n = 38)	(n = 34)	(n = 42)
<b>Bodily Integrity (N = 114)</b>	<p>Aguilar 2005;[63] Aihara 2016;[192] Andjani-Sutabio 2015; [193] Arku 2010b;[194] Assaad 1994;[78] Baker 2017;[195] Bisung 2018;[196] Chew 2019;[197] Chipeta 2009;[86] Collins 2018;[198] Crow 2002;[199] Crow 2010;[200] Devasia 1998a; [90] El Katsha 1989;[92] Enabtor 1998;[162] Ennis-McMillan 2001;[163] Faisal 2005;[177] Halvorson 2004;[118] Hamrahan 2018;[201] Krumdieck 2016;[202] Malhotra 2016;[203] Mandara 2013;[98] Mason 2012;[100] Mushavi 2020;[165] Oluwemo 2012;[70] Pommells 2018;[179] Remigios 2011;[123] Singh 2005;[180] Stevenson 2012;[108] Thai 2019;[111] Trinites 2011;[204] Tsai 2016;[205] van Houweling 2012;[206] Wall 2018;[207] Wood 2012;[208] Wutich 2009;[209] Yerian 2014; [61] Zolnikov 2016[210]</p>	<p>Abu 2019;[76] Bisung 2016;[170] Boosey 2014;[211] Bora 2016; [212] Caruso 2017b;[184] Connolly 2013;[213] Datta 2020; [214] Hall 2018;[215] Hirve 2015;[172] Jewitt 2014;[216] Joshi 2012;[217] Joshi 2018;[173] Joshi 2019;[218] Karin 2020;[219] Kulkarni 2017;[174] MacRae 2019;[178] Mbatha 2011;[220] McMahon 2011;[221] Nalugya 2020;[222] Norling 2016; [223] O'Reilly 2014;[154] Rajagopal 2017;[224] Rajbangshi 2020;[225] Reddy 2008;[122] Reddy 2011;[226] Reddy 2019; [227] Routray 2015;[182] Sahoo 2015;[189] Schmitt 2017; [228] Silva 2020;[229] Sommer 2010;[230] Thompson 2017; [231] Trinites 2015;[113] Wutich 2008[232]</p>	<p>Abrahams 2006;[233] Alam 2017;[234] Anyaravor 2019;[235] Bapat 2003;[168] Belur 2017;[171] Bhatt 2019;[130] Camenga 2019;[236] Carolini 2012;[237] Caruso 2017a;[238] Corburn 2015;[239] Corburn 2016;[240] Coswosk 2019;[241] Dudgeja 2016;[242] Ellis 2016;[185] Girod 2017;[243] Hulland 2015; [181] Jha 2012;[119] Khanna 2016;[135] Kher 2015;[244] Kookana 2016;[245] Krusz 2019;[246] Kwiringira 2015;[186] McCammon 2020;[247] Nagpal 2019;[248] Nallari 2015;[187] Ngila 2014;[249] O'Reilly 2010;[62] Pardeshi 2009;[139] Rajaraman 2013;[250] Rheinlander 2019;[188] Scorgie 2016; [251] Senior 2014;[252] Shahid 2015;[141] Shiras 2018;[175] Singh 2019;[190] Sommer 2015a;[253] von Medaazza 2015; [145] Whale 2018;[254] Winter 2018a;[191] Winter 2019a; [255] Winter 2019c;[256] You 2020[257]</p>
<b>2.a.i</b>	(n = 25)	(n = 4)	(n = 53)
<b>Safety and Security (N = 82)</b>	<p>Acey 2010;[158] Asaba 2013;[258] Carmi 2019;[85] Chipeta 2009;[86] Collins 2018;[198] Crow 2002;[199] Das 2014;[89] Faisal 2005;[177] Fonjong 2014;[259] Karim 2012;[260] Kher 2015;[164] Krumdieck 2016;[202] Mason 2012;[100] Mushavi 2020;[165] Pommells 2018;[179] Remigios 2011;[123] Stevenson 2012;[108] Sultana 2009b;[110] Thai 2019;[111] Thompson 2017;[231] Torri 2010;[75] van Houweling 2015; [261] van Houweling 2016;[155] Varickanical 2019;[144] Yerian 2014[61]</p>	<p>Abu 2019;[76] Barchi 2020;[262] Norling 2016;[223] Sommer 2018[183]</p>	<p>Abrahams 2006;[233] Adrianessens 2019;[263] Anyaravor 2019;[235] Azeez 2019;[128] Bangdiwala 2004;[264] Bapat 2003;[168] Belur 2017;[171] Caruso 2017a;[238] Caruso 2018; [2] Corburn 2015;[239] Corburn 2016;[240] Coswosk 2016; [241] Datta 2020;[214] Elledge 2020;[185] Ellis 2016;[185] Girod 2017;[243] Gonsalves 2015;[265] Hassan 2004;[266] Hennegan 2018;[267] Hirve 2015;[172] Hulland 2015;[181] Jadhav 2016;[268] Jha 2012;[119] Joshi 2012;[217] Joshi 2018; [173] Khanna 2016;[135] Kulkarni 2017;[174] Kwiringira 2014; [186] Mohanakumar 2017;[138] Nallari 2015;[187] Nalugya 2020;[222] Oluwemo 2012;[70] O'Reilly 2010;[62] Pardeshi 2009;[139] Reddy 2011;[226] Reddy 2019;[227] Rheinlander 2019;[188] Routray 2015;[182] Sahoo 2015;[189] Schmitt 2017; [228] Scorgie 2016; [251] Senior 2014; [252] Shiras 2018; [175] Silva 2020;[229] Singh 2019;[190] Thuita 2017;[143] Winter 2015;[269] Winter 2018a;[191] Winter 2019a;[255] Winter 2019b;[147] Winter 2019c;[270] Winter 2019f;[256] You 2020 [257]</p>
<b>2.a.ii</b>	(n = 51)	(n = 33)	(n = 32)
<b>Health (N = 116)</b>	<p>Acey 2010;[158] Aguilar 2005;[63] Aihara 2015;[271] Aihara 2016;[192] Asaba 2013;[258] Assaad 1994;[78] Bastidas 2005; [79] Bisung 2015b;[160] Brewis 2018;[272] Buor 2003;[273] Carolini 2012;[237] Chew 2019;[197] Chipeta 2009;[86] Collins 2018;[198] Cooper-Vince 2017;[274] Cooper-Vince 2018;[275] Crow 2010;[200] Devasia 1998a;[90] Ennis-McMillan 2001; [163] Fonjong 2014;[259] Geere 2018;[276] Hamrahan 2018; [201] Harris 2017;[96] Krumdieck 2016;[202] Leder 2017;[59] Makoni 2004;[120] Mason 2012;[100] Mbatha 2011;[220] McMahon 2011;[221] Mehreru 1992;[277] Mehta 2015;[101] Mushavi 2020;[165] Nankinga 2019;[278] Narain 2014;[279] Pommells 2018;[179] Siddiqui 2003;[280] Stevenson 2012;[108] Stevenson 2016;[281] Sultana 2009b;[110] Thai 2019;[111] Trinites 2011;[204] Tsai 2016;[205] van Houweling 2012;[206] van Houweling 2015;[261] van Houweling 2016;[153] White 2016;[282] Winter 2020;[283] Wood 2012;[208] Wutich 2008; [232] Wutich 2009;[209] Zolnikov 2016[210]</p>	<p>Abu 2019;[76] Baker 2017;[195] Bapat 2003;[168] Bhandari 2009;[81] Bisung 2015a;[169] Bisung 2016;[170] Caruso 2017b; [184] Cheng 2012;[284] Corburn 2015;[239] Das 2015;[285] El Katsha 1989;[92] Faisal 2005;[177] Gabriësson 2013;[65] Halvorson 2004;[118] Hirve 2015;[172] Hulland 2015;[181] Kher 2015;[244] Klugman 2019;[286] MacRae 2019;[178] Nagpal 2019;[248] Nallari 2015;[187] Nerkar 2013;[166] Oluwemo 2012;[70] Rajagopal 2017;[224] Rajbangshi 2020; [225] Reddy 2011;[226] Remigios 2011;[123] Silva 2020;[229] Sommer 2015b;[287] Thompson 2017;[231] Varickanical 2019;[144] Winter 2019d;[288] Winter 2019e[289]</p>	<p>Azeez 2019;[128] Caruso 2017a;[238] Caruso 2018;[2] Coswosk 2019;[241] Crow 2002;[199] Datta 2020;[214] Ellis 2016;[185] Jannohamed 2016;[290] Joshi 2018;[173] Khanna 2016;[135] Kulkarni 2017;[174] Kwiringira 2014;[186] McCammon 2020; [247] Ngila 2014;[249] Norling 2016;[223] O'Reilly 2010;[62] O'Reilly 2014;[154] Rajaraman 2013;[250] Reddy 2008;[122] Reddy 2019;[227] Rheinlander 2019;[188] Routray 2017a;[140] Sahoo 2015;[189] Schmitt 2017;[228] Shahid 2015;[141] Shiras 2018;[175] Singh 2019;[190] Thuita 2017;[143] von Medaazza 2015;[145] Winter 2018a;[191] Winter 2019f;[256] You 2020 [257]</p>

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Table 3. (Continued)

Domains & Sub-Domains	Articles that Engage the Domain/Sub-Domain		
	Water (N = 116)	Water and Sanitation (N = 83)	Sanitation (N = 58)
<p><i>2.a.iii</i></p> <p>Privacy (N = 71)</p>	<p>(n = 7)</p> <p>Bhandari 2009; [81] Das 2014; [89] Girod 2017; [243] O'Reilly 2006; [69] Sultana 2009b; [110] van Houweling 2016; [153] Yuerlita 2017; [115]</p>	<p>(n = 11)</p> <p>Caruso 2017b; [184] Connolly 2013; [213] Crow 2002; [199] Faisal 2005; [177] Joshi 2012; [217] MacRae 2019; [178] Malhotra 2016; [203] Nallari 2015; [187] O'Reilly 2014; [154] Reddy 2011; [226] Sommer 2018; [183]</p>	<p>(n = 53)</p> <p>Abrahams 2006; [233] Anyaroy 2019; [235] Azeez 2019; [128] Bapat 2003; [168] Bhatt 2019; [130] Bisung 2016; [170] Boosey 2014; [211] Camenga 2019; [236] Caruso 2017a; [238] Corburn 2016; [240] Elledge 2020; [185] Ellis 2016; [185] Hennegan 2018; [267] Hirve 2015; [172] Hullah 2015; [181] Jewitt 2014; [216] Joshi 2018; [173] Khanna 2016; [135] Kher 2015; [244] Kulkarni 2017; [174] Kwiringira 2014; [186] Mbaatha 2011; [220] McCammon 2020; [247] McMahon 2011; [221] Nagpal 2019; [248] Nalugya 2020; [222] Ngila 2014; [249] Norling 2016; [223] Oluyemo 2012; [70] O'Reilly 2010; [62] Pardeshi 2009; [139] Rajaraman 2013; [250] Reddy 2019; [227] Rheinländer 2019; [188] Routray 2015; [182] Routray 2017a; [140] Sahoo 2015; [189] Schmitt 2017; [228] Scorgie 2016; [251] Senior 2014; [252] Shiras 2018; [175] Silva 2020; [229] Sommer 2015a; [253] Tegegne 2014; [291] Thompson 2017; [231] Thuita 2017; [143] Trinius 2015; [113] von Medeazza 2015; [145] Wall 2018; [207] Winter 2018a; [191] Winter 2019a; [255] Winter 2019b; [147] Winter 2019f; [256]</p>
<p><i>2.b.</i></p> <p>Critical Consciousness (N = 44)</p>	<p>(n = 27)</p> <p>Aguilar 2005; [63] Aladuwaka 2010; [56] Assaad 1994; [78] Bustamente 2005; [148] Carmi 2019; [85] Das 2014; [89] de Moraes 2013; [161] Devasia 1998a; [90] Devasia 1998b; [91] De Vries 2015; [73] Ennis-McMillan 2001; [163] Gate 2001; [94] Grant 2019; [30] Leahy 2017; [58] Lebel 2015; [97] Leder 2017; [59] Naiga 2017; [102] O'Reilly 2006; [69] Panda 2012; [74] Prokopy 2004; [104] Thai 2019; [111] Torri 2010; [75] van Houweling 2016; [153] Varicknickal 2019; [144] Wutch 2008; [232] Wutch 2012; [114] Yuerlita 2017; [115]</p>	<p>(n = 4)</p> <p>Indarti 2019; [66] Nerkar 2013; [166] Rautanen 2005; [121] Remigios 2011; [123]</p>	<p>(n = 13)</p> <p>Baluchova 2017; [129] Bhatt 2019; [130] Camenga 2019; [236] El Katsba 1989; [92] Kwiringira 2014; [186] Malhotra 2016; [203] Norling 2016; [223] Routray 2017b; [124] Shahid 2015; [141] Thompson 2017; [231] Thuita 2017; [143] Waterkeyn 2005; [146] Winter 2019b; [147]</p>
<p><i>2.c</i></p> <p>Assets (N = 186)</p>	<p>(n = 111)</p>	<p>(n = 26)</p>	<p>(n = 49)</p>
<p><i>2.c.i</i></p>	<p>(n = 72)</p>	<p>(n = 12)</p>	<p>(n = 34)</p>

(Continued)

Table 3. (Continued)

Domains & Sub-Domains	Articles that Engage the Domain/Sub-Domain		
	Water (N = 116)	Water and Sanitation (N = 83)	Sanitation (N = 58)
<p><i>Financial and Productive Assets</i> (N = 118)</p>	<p>Abu 2019;[76] Akey 2010;[158] Aguilar 2005;[63] Aihara 2016; [192] Aladuwa 2010;[56] Andajani-Sutjahjo 2015;[193] Arku 2010b;[194] Assaad 1994;[78] Bastidas 2005;[79] Bhandari 2009;[81] Bisung 2016;[170] Bisung 2018;[196] Boateng 2013a; [83] Boateng 2018;[292] Cairns 2017;[72] Chew 2019;[197] Chipeta 2009;[86] Clement 2018;[57] Collins 2018;[198] Crow 2002;[199] Crow 2010;[200] Daniel 2019;[293] Das 2014;[89] Delgado 2007;[149] de Moraes 2013;[161] Devasia 1998a;[90] Devasia 1998b;[91] Enabor 2010;[162] Ennis-McMillan 2001; [163] Ennis-McMillan 2005;[93] Faisal 2005;[177] Fiasorgbor 2013;[294] Fonjong 2014;[259] Gabrielson 2013;[65] Gate 2001;[94] Grant 2019;[30] Hanrahan 2018;[201] Harris 2017; [96] Ilahi 2000;[295] James 2002;[67] Kher 2015;[244] Krumdieck 2016;[202] Leder 2017;[59] Mandara 2013;[98] Mason 2012;[100] Mommen 2017;[150] Mushavi 2020;[165] Nagpal 2019;[248] Naiga 2017;[102] Nerkar 2013;[166] O'Reilly 2006;[69] Panda 2012;[74] Pommells 2018;[179] Prokopy 2004;[104] Sijbesma 2009;[105] Sijbesma 2012;[127] Singh 2005;[180] Singh 2018;[107] Thai 2019;[111] Tortajada 2003;[112] Trmies 2011;[204] van Houweling 2012;[206] van Houweling 2015;[261] van Houweling 2016;[153] Varicknickal 2019;[144] Varua 2018;[60] Wood 2012;[208] Wutich 2008;[232] Wutich 2009;[209] Wutich 2012;[114] Yerian 2014;[61] Yuerlita 2017;[115]</p>	<p>Bapat 2003;[168] Belur 2017;[171] Bisung 2019;[64] Carolini 2012;[237] Halvorson 2004;[118] Indarti 2019;[66] Jha 2012; [119] Joshi 2012;[217] Nallari 2015;[187] Rautanen 2005;[121] Reddy 2008;[122] Scott 2017b;[126]</p>	<p>Adrianness 2019;[263] Azeez 2019;[128] Caruso 2017a;[238] Corburn 2015;[239] Corburn 2016;[240]; Czerniewska 2019; [131] Htrai 2016;[134] Joshi 2018;[173] Khanna 2016;[135] Kulkarni 2017;[174] Kwoiringira 2014;[186] Lee 2017;[136] Mohankumar 2017;[138] Oluwemo 2012;[70] O'Reilly 2010; [62] O'Reilly 2014;[154] Pardeshi 2009;[139] Prasad 2015;[296] Prasad 2018;[297] Rajaraman 2013;[250] Reddy 2011;[226] Reddy 2019;[227] Routray 2017b;[124] Shahid 2015;[141] Shiras 2018;[175] Singh 2019;[190] Smith 2004;[157] Thuita 2017;[143] von Medeazza 2015;[145] Winter 2018a;[191] Winter 2019b;[147] Winter 2019c;[270] Winter 2019e;[256] You 2020;[257]</p>
<p><i>2.c.ii Knowledge &amp; Skills</i> (N = 95)</p>	<p>(n = 60)</p> <p>Abu 2019;[76] Aguilar 2005;[63] Aladuwa 2010;[56] Anderson 2013;[159] Assaad 1994;[78] Bapat 2003;[168] Bastidas 2005;[79] Bhandari 2009;[81] Bisung 2014;[82] Bisung 2015b;[160] Boateng 2013a;[83] Boateng 2013b;[84] Carmi 2019;[85] Carolini 2012;[237] Chew 2019;[197] Crow 2012;[88] Daniel 2019;[293] Das 2014;[89] de Moraes 2013;[161] Devasia 1998a;[90] Devasia 1998b;[91] DeVries 2015;[73] El Katsha 1989;[92] Enabor 1998;[162] Faisal 2005;[177] Gate 2001;[94] Ge 2011;[95] Grant 2019;[30] Halvorson 2004;[118] Harris 2017;[96] Kernecker 2017;[164] Kodjebacheva 2019;[298] Leahy 2017;[58] Lebel 2015;[97] Leder 2017;[59] Leventhal 2016;[299] Mandara 2013;[98] McCammon 2020;[247] McMahon 2011;[221] Mehta 2015;[101] Naiga 2017;[102] Nerkar 2013;[166] Oluwemo 2012;[70] O'Reilly 2006;[69] Padmaja 2020;[103] Panda 2012;[74] Prokopy 2004;[104] Remigos 2011;[123] Singh 2018;[107] Stevenson 2012;[108] Suliana 2009a;[109] Thai 2019;[111] Torri 2010;[75] Tortajada 2003;[112] Trmies 2011;[204] Winter 2019d;[288] Wood 2012; [208] Wutich 2012;[114] Yuerlita 2017;[115] Zolnikov 2016 [210]</p>	<p>(n = 11)</p> <p>Bisung 2015a;[169] Bisung 2019;[64] Dreibelbis 2013;[300] Indarti 2019;[66] Jha 2012;[119] Nallari 2015;[187] O'Reilly 2014;[154] Rautanen 2005;[121] Sijbesma 2012;[127] Tam 2012;[71] Tegegne 2014* [291]</p>	<p>(n = 24)</p> <p>Boosey 2014;[211] Ellis 2016;[185] Girod 2017;[243] Htrai 2016;[134] Hirve 2015;[172] Hoque 1994;[155] Joshi 2012; [217] Khanna 2016;[135] Lee 2017;[136] Mannan 2018;[137] Ngila 2014;[249] Pardeshi 2009;[139] Prasad 2015;[296] Prasad 2018;[297] Rheinlander 2019;[188] Routray 2017a;[140] Routray 2017b;[124] Schmitt 2017;[228] Shahid 2015;[141] Smith 2004;[157] Thuita 2017;[143] von Medeazza 2015;[145] Winter 2019f;[256] You 2020;[257]</p>
<p><i>2.c.iii</i></p>	<p>(n = 7)</p>	<p>(n = 15)</p>	<p>(Continued)</p>

Table 3. (Continued)

Domains & Sub-Domains	Water (N = 116)	Water and Sanitation (N = 83)	Sanitation (N = 58)
<p><i>Social Capital</i> (N = 64)</p>	<p>Acey 2010;[158] Aguilari 2005;[63] Aladuwa 2010;[56] Assaad 1994;[78] Bastidas 2005;[79] Bisung 2015b;[160] Bustamante 2005;[148] Cairns 2017;[72] Clement 2018;[57] Collins 2018; [198] Delgado 2007;[149] de Moraes 2013;[161] Devasia 1998a; [90] Faisal 2005;[177] Gabriellson 2013;[65] Ge 2011;[95] Grant 2019;[30] Hanrahan 2018;[201] Kernecker 2017;[164] Kher 2015;[244] Lebel 2015;[97] Leder 2017;[59] MacRae 2019;[178] Mason 2012;[100] Mushavi 2020;[165] Narain 2014;[279] O'Reilly 2006;[69] Pommells 2018;[179] Singh 2005; [180] Sultana 2009a;[109] Sultana 2009b;[110] Tortajada 2003; [112] Trinites 2011;[204] van Houweling 2012;[206] van Houweling 2015;[261] van Houweling 2016;[153] Varickanical 2019;[144] Wood 2012;[208] Wutich 2012;[114] Yerian 2014;[61] Yuerlita 2017;[115] Zolnikov 2016[210]</p>	<p>Indarti 2019;[66] Nerkar 2013;[166] Rautanen 2008;[121] Reddy 2008;[122] Reddy 2011;[226] Scott 2017a;[125] Scott 2017b;[126]</p>	<p>Azeez 2019;[128] Bhatt 2019;[130] Joshi 2018;[173] Khanna 2016;[135] Kwiringira 2014;[186] McCammon 2020;[247] Nallari 2015;[187] Norling 2016;[223] O'Reilly 2010;[62] Rheinlander 2019;[188] Routray 2015;[182] Sahoo 2015;[189] Shiras 2018;[175] Silva 2020;[229] Singh 2019[190]</p>
<p><i>2.c. iv</i></p>	<p>(n = 92)</p>	<p>(n = 13)</p>	<p>(n = 17)</p>
<p><i>Time</i> (N = 122)</p>	<p>Abu 2019;[76] Acey 2010;[158] Agesa 2019; Aguilari 2005;[63] Aihara 2016;[192] Aladuwa 2010;[56] Andajani-Sufjahjo 2015;[193] Arku 2010a;[301] Arku 2010b;[194] Asaba 2013; [258] Assaad 1994;[78] Bastidas 2005;[79] Bhandari 2009;[81] Bisung 2015b;[160] Bisung 2016;[170] Bisung 2018;[196] Boateng 2013a;[83] Boateng 2018;[292] Bnor 2003;[273] Cairns 2017;[72] Carmi 2019;[85] Carolini 2012;[237] Chew 2019; [197] Chipeta 2009;[86] Clement 2018;[57] Collins 2018;[198] Coulter 2018;[87] Crow 2002;[199] Crow 2010;[200] Crow 2012;[88] Das 2014;[89] de Moraes 2013;[161] Devasia 1998a; [90] Dreibeibis 2013;[300] El Katsha 1989;[92] Ennis-McMillan 2005;[93] Faisal 2005;[177] Fiasorboor 2013;[294] Fonjong 2014;[259] Gabriellson 2013;[65] Graham 2016;[18] Grant 2019;[30] Halvorson 2004;[118] Harris 2017;[96] Ilahi 2000; [295] Irianti 2019;[302] James 2002;[67] Joshi 2012;[217] Karim 2012;[260] Kher 2015;[244] Krundieck 2016;[202] Lebel 2015;[97] Leder 2017;[59] MacRae 2019; [178] Makoni 2004;[120] Mandara 2013;[98] Mason 2012;[100] Mbatha 2011; [220] McMahon 2011; [221] Mehretu 1992;[277] Mehta 2015; [101] Mushavi 2020;[165] Narain 2014;[279] Nerkar 2013;[166] Oluverno 2012;[70] Padmaja 2020;[103] Pommells 2018;[179] Porter 2011;[303] Prokopy 2004;[104] Ramanaik 2018;[304] Remigios 2011;[123] Sijbesma 2009;[105] Silva 2020;[229] Singh 2006b;[106] Sorenson 2011;[20] Stevenson 2012;[108] Thai 2019;[111] Thompson 2017;[231] Torri 2010;[75] Tortajada 2003;[112] van Houweling 2012;[206] van Houweling 2015;[261] van Houweling 2016;[153] Varickanical 2019;[144] Varua 2018;[60] Willetts 2010;[26] Wutich 2008;[232] Wutich 2009;[209] Wutich 2012;[114] Yerian 2014;[61] Yuerlita 2017;[115] Zolnikov 2016[210]</p>	<p>Baker 2017;[195] Bapat 2003;[168] Bisung 2019;[64] Caruso 2017b; [184] Corburn 2015;[239] Corburn 2016;[240] Indarti 2019;[66] Nagpal 2019;[248] Rautanen 2005;[121] Reddy 2008; [122] Routray 2015;[182] Scott 2017a;[125] Sijbesma 2012;[127]</p>	<p>Azeez 2019;[128] Camenga 2019;[236] Dwipayanti 2019;[132] Elledge 2020;[185] Ellis 2016;[185] Gonsalves 2015;[265] Joshi 2018;[173] Khanna 2016;[135] Kulkarni 2017;[174] Mohankumar 2017;[138] Nallari 2015;[187] Rajaraman 2013; [250] Reddy 2011;[226] Sahoo 2015;[189] Schmitt 2017; [228] Shahid 2015;[141] Winter 2019[256]</p>
<p><b>3. INSTITUTIONAL STRUCTURES</b> (N = 173)</p>	<p>(n = 104)</p>	<p>(n = 27)</p>	<p>(n = 42)</p>
<p><b>3.a</b></p>	<p>(n = 11)</p>	<p>(n = 4)</p>	<p>(n = 6)</p>
<p><b>Formal Laws &amp; Policies</b> (N = 21)</p>	<p>Bastola 2015;[80] Boateng 2013a;[83] Devasia 1998a;[90] Grant 2019;[30] Mandara 2013;[98] Naiga 2017;[102] Padmaja 2020; [103] Panda 2012;[74] Singh 2005;[180] Torri 2010;[75] van Houweling 2016[153]</p>	<p>Bapat 2003;[168] Bisung 2019;[64] Remigios 2011;[123] Scott 2017b;[126]</p>	<p>Belur 2017;[171] Mannan 2018;[137] O'Reilly 2014;[154] Prasad 2015;[296] Shahid 2015;[141] von Medeazza 2015[145]</p>
<p><b>3.b</b></p>	<p>(n = 91)</p>	<p>(n = 21)</p>	<p>(n = 28)</p>

(Continued)

Table 3. (Continued)

Domains & Sub-Domains	Articles that Engage the Domain/Sub-Domain		
<p><b>Norms (N = 140)</b></p> <p>Abu 2019;[76] Acey 2010;[158] Aguilar 2005;[63] Akolgo 2020; [77] Aladuwaka 2010;[56] Andajani-Sutiadjio 2015;[193] Anderson 2013;[159] Arku 2010a;[301] Arku 2010b;[194] Asaba 2013;[258] Assaad 1994;[78] Bastidas 2005;[79] Bhandari 2009;[81] Boateng 2013a;[83] Buor 2003;[273] Bustamante 2005;[148] Cairns 2017;[72] Carmi 2019;[85] Chew 2019;[197] Chipeta 2009;[86] Clement 2018;[57] Coles 2009;[176] Collins 2018;[198] Coulter 2018;[87] Crow 2002; [199] Crow 2010;[200] Crow 2012;[88] Das 2014;[89] de Moraes 2013;[161] Delgado 2007;[149] Devasia 1998a;[90] Dreibeis 2013;[300] Ennis-McMillan 2001;[163] Ennis-McMillan 2005;[93] Faisal 2005;[177] Fonjong 2014;[259] Gabriellson 2013;[65] Gate 2001;[94] Ge 2011;[95] Graham 2016;[18] Grant 2019;[30] Hanrahan 2018;[201] Harris 2017; [96] Irianti 2019;[302] James 2002;[67] Karim 2012;[260] Kher 2015;[244] Kookana 2016;[245] Krumdieck 2016;[202] Lebel 2015;[97] Leder 2017;[59] MacRae 2019;[178] Makoni 2004; [120] Mandara 2013;[98] Mason 2012;[100] Mbatha 2011;[220] McLean 2019;[305] Mehretu 1992;[277] Mehta 2015;[101] Mushavi 2020;[165] Naiga 2017;[102] Nallari 2015;[187] Narain 2014;[279] O'Reilly 2006;[69] Padmaja 2020;[103] Panda 2012;[74] Pommells 2018;[179] Prokopy 2004;[104] Ramanaiik 2018;[304] Singh 2005;[180] Singh 2006a;[152] Singh 2006b;[106] Sorenson 2011;[20] Stevenson 2012;[108] Sultana 2009a;[109] Sultana 2009b;[110] Thai 2019;[111] Thompson 2017;[231] Torri 2010;[75] Tortajada 2003;[112] van Houweling 2012;[206] van Houweling 2015;[261] van Houweling 2016;[153] Varua 2018;[60] Wall 2018;[207] White 2016;[282] Wutich 2009;[209] Wutich 2012;[114] Yerian 2014;[61] Yuerlita 2017;[115] Zolnikov 2016[210]</p> <p>(n = 72)</p>	<p><b>Water (N = 116)</b></p> <p>Bisung 2019;[64] Caruso 2017b; [184] Czerniewska 2019;[131] El Katsha 1989;[92] Halvorson 2004;[118] Hulland 2015;[181] Jha 2012;[119] Joshi 2012;[217] Joshy 2019;[218] O'Reilly 2014; [154] Rautanen 2008;[121] Reddy 2008;[122] Reddy 2011;[226] Remigios 2011;[123] Schmitt 2017; [228] Scott 2017a;[125] Scott 2017b;[126] Sijbesma 2012;[127] Silva 2020;[229] Sommer 2018;[183] Tam 2012[71]</p>	<p><b>Water and Sanitation (N = 83)</b></p>	<p><b>Sanitation (N = 58)</b></p> <p>Aluko 2018;[306] Bhatt 2019;[130] Camenga 2019;[236] Datta 2020;[214] Dwipayanti 2019;[132] Ellis 2016; [185] Joshi 2018; [173] Khanna 2016;[135] Kulkarni 2017;[174] Kwiringira 2014; [186] Mannan 2018;[137] Mohankumar 2017;[138] Nagpal 2019;[248] Nalugya 2020; [222] O'Reilly 2010; Pardeshi 2009; [139] Prasad 2015;[296] Rajaraman 2013;[250] Rheinlander 2019;[188] Routray 2017a;[140] Routray 2017b;[124] Sahoo 2015;[189] Shahid 2015;[141] Singh 2019;[190] Thuita 2017; [143] von Medeazza 2015;[145] Winter 2018a;[191] Winter 2019[256]</p>
<p><b>3.c</b></p>	<p>(n = 12)</p> <p>Ali 2013;[116] BeBe 2015;[117] Belur 2017; [171] Indarti 2019; [66] Jha 2012;[119] Joshi 2012;[217] Kher 2015;[244] Nallari 2015;[187] Nerkar 2013;[166] Rautanen 2005;[121] Scott 2017a;[125] Scott 2017b;[126]</p>	<p>(n = 34)</p> <p>Adrienssens 2019;[263] Azeez 2019; [128] Baluchova 2017; [129] Bisung 2015a;[169] Bisung 2016;[170] Caruso 2017b; [184] Ellis 2016;[185] Hirve 2015;[172] Hoque 1994;[155] Joshi 2018;[173] Khanna 2016;[135] Kulkarni 2017;[174] McCammon 2020;[247] Mohankumar 2017;[138] Nalugya 2020; [222] Norling 2016;[223] O'Reilly 2010;[62] O'Reilly 2014;[154] Pardeshi 2009;[139] Prasad 2015;[296] Prasad 2018; [297] Reddy 2011;[226] Rheinlander 2019;[188] Routray 2015; [182] Routray 2017a;[140] Routray 2017b; [124] Sahoo 2015; [189] Shahid 2015;[141] Shiras 2018;[175] Simiyu 2017; Singh 2019;[190] Thuita 2017;[143] Waterkeyn 2005;[146] Winter 2019[256]</p>	
<p><b>Relations (N = 118)</b></p>	<p>Abu 2019;[76] Acey 2010;[158] Aguilar 2005;[63] Aihara 2015; [270] Aladuwaka 2010;[56] Asaba 2013;[258] Assaad 1994;[78] Bapat 2003; [168] Bastidas 2005;[79] Bhandari 2009;[81] Bisung 2015b;[160] Boateng 2013a;[83] Buor 2003;[273] Bustamante 2005;[148] Cairns 2017;[72] Carmi 2019;[85] Clement 2018; [57] Coles 2009;[176] Collins 2018;[198] Crow 2002;[199] Crow 2012;[88] Das 2014;[89] de Moraes 2013;[161] Delgado 2007;[149] Devasia 1998a;[90] Devasia 1998b; El Katsha 1989; [92] Ennis-McMillan 2001;[163] Ennis-McMillan 2005;[93] Faisal 2005;[177] Fonjong 2014;[259] Gate 2001;[94] Ge 2011; [95] Grant 2019;[30] Hanrahan 2018;[201] Karim 2012;[260] Kernecker 2017;[164] Krumdieck 2016;[202] Leahy 2017;[58] Lebel 2015;[97] Leder 2017;[59] Mushavi 2020;[165] Narain 2014;[279] O'Reilly 2006;[69] Panda 2012;[74] Pommells 2018; [179] Prokopy 2004;[104] Remigios 2011;[123] Sijbesma 2009; [105] Sijbesma 2012;[127] Silva 2020;[229] Singh 2005;[180] Singh 2006b;[106] Stevenson 2012;[108] Stevenson 2016;[281] Sultana 2009a;[109] Sultana 2009b;[110] Thai 2019;[111] Thompson 2017; Torri 2010;[75] Tortajada 2003;[112] Trinius 2011;[204] van Houweling 2015;[261] van Houweling 2016; [153] Varicknickal 2019;[144] Willetts 2010;[26] Wood 2012; [208] Wutich 2009;[209] Wutich 2012; Yerian 2014;[61] Yuerlita 2017;[115] Zolnikov 2016[210]</p>	<p>(n = 72)</p> <p>Ali 2013;[116] BeBe 2015;[117] Belur 2017; [171] Indarti 2019; [66] Jha 2012;[119] Joshi 2012;[217] Kher 2015;[244] Nallari 2015;[187] Nerkar 2013;[166] Rautanen 2005;[121] Scott 2017a;[125] Scott 2017b;[126]</p>	<p>(n = 34)</p> <p>Adrienssens 2019;[263] Azeez 2019; [128] Baluchova 2017; [129] Bisung 2015a;[169] Bisung 2016;[170] Caruso 2017b; [184] Ellis 2016;[185] Hirve 2015;[172] Hoque 1994;[155] Joshi 2018;[173] Khanna 2016;[135] Kulkarni 2017;[174] McCammon 2020;[247] Mohankumar 2017;[138] Nalugya 2020; [222] Norling 2016;[223] O'Reilly 2010;[62] O'Reilly 2014;[154] Pardeshi 2009;[139] Prasad 2015;[296] Prasad 2018; [297] Reddy 2011;[226] Rheinlander 2019;[188] Routray 2015; [182] Routray 2017a;[140] Routray 2017b; [124] Sahoo 2015; [189] Shahid 2015;[141] Shiras 2018;[175] Simiyu 2017; Singh 2019;[190] Thuita 2017;[143] Waterkeyn 2005;[146] Winter 2019[256]</p>

\* Articles marked with an asterisk (\*) engage menstruation/menstrual hygiene management/menstrual health.



decisions in their place (India [106]), and deferring to men to speak during water-related meetings even though they bore water collection responsibility (Kenya [76]). In northern Kenya—where women primarily collect water for domestic use and men for livestock—women were not actively involved in decision-making around water source utilization and their needs were not prioritized [61]. Women play increasingly greater roles in water committees in rural Malawi, but they remain dominated by men in urban areas [86].

Factors that have influenced women's involvement in intra- and extra-household water and sanitation decision-making are described in the [S1 Text \(SX\)](#).

WASH programs have both promoted and discouraged women's voices in WASH-related decision-making processes. Nongovernmental organizations (NGOs) have encouraged women to speak up in culturally appropriate ways [26, 126]. Trainings, information, and technical knowledge provided to women have contributed to the improvement of communication between men and women and led to women having a voice in household and community decision-making [26, 58, 75, 129]. WASH programs have increased trust, acceptance, and respect for women as community decision-makers (India [129] and Sri Lanka [56]), increased women's roles in household decision-making (India [139] and Vietnam [58]), and improved women's reported ability to express themselves (Costa Rica [63]). WASH programs also have inhibited women's decision-making participation by targeting men [102, 124] or reinforcing gender norms [71, 126]. In India, women were included in public forums because they are responsible for children's health, while men were involved because they could demand improvements and travel outside the village [126]. Additionally, women in India reported being provided water and sanitation, without consultation, resulting in services not meeting their needs [122]. In Timor Leste, women's participation in water and sanitation projects has been limited to activities like cleaning or preparing food [71].

### 1.b. Leadership

Women have served as formal and informal leaders in water and sanitation initiatives, resulting in both programmatic benefits and to the women themselves. Formal positions include leadership on water and sanitation committees; leadership or management of WASH businesses, value chain companies, and organizations; leading community-level projects; and fundraising for and monitoring community-based water and sanitation initiatives [59, 66, 83, 85, 89, 93, 112, 120, 126, 133, 139, 149, 154]. Women's formal leadership has led to increased confidence among and toward women leaders [26, 56, 73, 126, 146, 157]. In rural Vanuatu, water user committees with women in key posts met more regularly, functioned better, and collected more revenue than those with only men in these roles [150]. Still, while quotas have resulted in more women in leadership positions, [151] women remained underrepresented in committees and leadership [83, 102, 137]. Documented informal leadership activities included arbitrating local disputes, [69] disseminating water and sanitation information, [154, 160] motivating family members to use latrines, [155] and leading protests, like those during the “water wars” in Bolivia [148]. Select water and sanitation programs in Costa Rica, [63] Guatemala, [73] India, [126, 145] Sri Lanka, [56] and Vietnam [58] positively influenced the growth of women's leadership and support for women leaders. In India, women's participation in a community-led total sanitation campaign led to the emergence of female leaders who expanded their influence to other villages and activities [145].

Social and demographic factors have influenced women's engagement and acceptance in water and sanitation leadership positions and are summarized in the [S1 Text \(SX\)](#).

### 1.c. Collective action

Women have engaged in varied forms of collective action that has positively influenced water and sanitation access, conditions, experiences, and opportunities. Women's collective action has led to

funding, demand, construction, repair, and maintenance of water services [56, 61, 73, 78, 89, 91, 125, 129, 163, 165, 168, 169, 193, 296] and latrines [129, 139, 147, 168, 170, 174, 175]. Women have organized to form lending groups to support women-led WASH businesses, [66] provide community education about water safety, [56, 61, 73, 78, 89, 91, 125, 129, 163, 165, 168, 169, 193, 296] monitor open defecation, [145] and respond to sanitation-related harassment. [174] Indigenous women in Bolivia and the U.S. have collectively defended water access. [148, 167] Women's involvement in WASH-related collective action has led to sustained involvement in water and sanitation issues [89, 163] as well as collective action around non-WASH issues, [56, 126, 145] and also has encouraged respect from community members, including men [26, 56, 89, 166].

Social and demographic factors facilitated or barred women's involvement in collective action, which are detailed in the [S1 Text](#) (SX).

### 1.d. Freedom of movement

Women have described benefits of and preference for water and sanitation activities that require leaving the home, yet many also reported restrictions on movement and therefore their access to basic water and sanitation needs. In Bangladesh, younger women enjoyed fetching water from distant water sources, providing opportunities to leave home and socialize [110]. In rural India, some women who owned latrines preferred going for open defecation to visit friends and escape their home, mothers-in-law, and chores [182]. Movement restrictions influenced women and girls' access to water [101, 110, 178] and defecation, urination, and menstrual management locations, and are most widely reported in India [62, 135, 174, 181, 182, 184, 187], [101, 110, 187, 189–191]. Research in India found that family members (often husbands, fathers, and in-laws) restricted water fetching and sanitation-related movements, most intensely for unmarried daughters [174, 182, 190] and recently married and pregnant women, [178, 182, 189] (less intensely for women of lower castes [135] and widows [174]). Families have built latrines specifically to restrict movement, [62, 174] though women do not always have access when needed if situated in spaces controlled by men [62]. In India and Bangladesh, where women's freedom of movement is restricted or being seen in public is considered shameful, women reported difficulty navigating public spaces for water or sanitation needs, experiencing stress, harm to reputations, or risked beatings [101, 110, 187, 189]. To prevent shaming family members (Bangladesh [110]) or suffering beatings by men (India [101]), women collected water from closer, polluted sources rather than cleaner sources in male-dominated public spaces.

Women's freedom of movement influenced participation in community-level water and sanitation activities. Women in India, [89, 101] Nepal, [59] and Kenya [76] reported needing permission from men or elders to participate in meetings outside the home, [76, 89, 101] which limited their involvement in water and sanitation committees and access to information, [89, 101] impacted their knowledge about water sources, [101] and constrained water access and decision-making. [59, 101] Restricted movement has limited women's access to training opportunities and therefore engagement in piped water enterprises (Cambodia [30]), and has posed barriers to women's WASH businesses (Indonesia [66]). Women in India experienced in development projects reported more spatial mobility and were more likely to participate in water committees. [89] One program (India) intentionally aimed to enhance mobility by engaging women in sanitation promotion outside the home; yet, the very latrines promoted were found to increase women's confinement [62].

## 2. Resources

As described in the sections that follow, water and sanitation circumstances and conditions contribute to the deprivation of resources, particularly to bodily integrity, which includes

health, safety and security, and privacy. Further, women's control over resources, notably financial and productive assets, social capital, and time, influence their access to water and sanitation and, conversely, water and sanitation conditions influence women's access to and control over resources.

## 2.a. Bodily integrity

Women's and girls' bodily integrity, which includes choices about and control over their bodies, has been constrained in a number of ways due to water and sanitation conditions. Specifically, women limited bathing and washing hands, clothes, menstrual materials, and bathrooms; [76, 86, 98, 100, 123, 144, 165, 197, 198, 200, 202, 229, 232, 281] restricted food and water to avoid defecation and urination; [135, 168, 174, 179, 184, 192, 212, 224] suppressed defecation and urination urges; [2, 62, 181, 184, 188, 190, 191, 214, 217, 229, 235, 236, 238, 241, 247, 248, 250, 270] delayed changing menstrual materials; [224, 240, 241, 247, 250] and took anti-diarrheal medicines [174] when lacking sufficient, safe or clean water and sanitation. The specific water and sanitation conditions that influence women's ability to meet their preferences, which is fundamental to bodily integrity, are detailed in the [S1 Text \(SX\)](#). Bodily integrity also includes safety and security, health, and privacy—an inductively identified subdomain—which are described in the following sections.

**2.a.i Safety and security.** *General fears and perceptions of safety.* General safety concerns were widely noted, [100, 119, 123, 139, 143, 147, 171, 177, 182, 186, 188, 191, 201, 202, 223, 226–229, 233, 238, 240, 241, 251, 255, 257] including feeling unsafe collecting water, [100, 119, 177] or using sanitation facilities at night, [168, 171, 190, 229, 255–257] and when toilets lack doors, locks, lighting, or are far [171, 190, 214, 223, 239–241, 252, 255]. Safety issues were described as particularly intense for adolescent girls, young women, and minorities [2, 135, 174, 179, 181]. Research describing perceptions of improved safety all focuses on sanitation [139, 222, 227, 257, 267]. Additional details about specific sanitation attributes that have been linked to fear and perceived safety are described in the [S1 Text \(SX\)](#).

*Harassment.* General harassment, including taunting, teasing, name calling, and throwing things at women or girls is more frequently observed in sanitation [138, 168, 174, 175, 181, 187, 190, 263] than water research [168, 199]. Sexual harassment, including verbal harassment, peeping, flashing, and male masturbation is also more frequently documented in sanitation [171–174, 189, 190, 214, 217, 226, 231, 233] than water research [144, 214, 231, 259]. Women doing manual scavenging reported verbal abuse [138].

*Physical violence.* All research describing fear or experience of non-partner physical violence focused on sanitation, while all articles focusing on intimate partner physical violence and most focusing on interpersonal conflict focused on water ( \_(((xxx)))\_ ) [61, 62, 76, 86, 89, 101, 110, 111, 123, 135, 143, 144, 171, 173–175, 177, 179, 181, 182, 188, 189, 191, 198, 201, 243, 251, 255, 257, 258, 260, 262, 264, 266, 269].

The majority of non-partner physical violence research focused on women's general fear of physical attack by men or boys, [62, 86, 123, 135, 143, 171, 173–175, 177, 181, 182, 188, 189, 191, 198, 201, 251, 257, 269] including “drunkards,” [191] “bandits,” [175] “idle youth” [255] or “thieves” [255] when accessing sanitation, with sanitation location emerging as important. Limited research documented actual experiences of physical violence from a non-partner. Research using Kenya Demographic and Health Survey data found women who defecated in the open had 40% greater odds of having experienced non-partner sexual and/or physical violence in the previous year compared to women who did not [269]. In urban environments in sub-Saharan Africa, a greater association was found for women using a toilet shared with multiple households and experiencing non-partner violence than for women using private

facilities [262]. Women in India [135] and Kenya [76] shared stories of boys attacking and murdering girls who left home for defecation.

Inadequate water provision and collection behaviors were reported to influence intimate partner violence [26, 75, 101, 108, 111, 153, 165, 179, 198, 231, 260, 264, 266]. Women reported violence from husbands if they did not provide water for bathing needs (Kenya, [198] Ethiopia, [108] Vietnam, [111] Cameroon [231]), did not have water in the home (East Africa [179]), went to cleaner water sources considered too far (India [101]), did not prepare food on time because of water collection duties (Uganda [165] and Mozambique [153]), or attended water-focused community meetings (India [75]). Due to an improved water source, a man in Vanuatu reported no longer hitting his wife because she stopped asking for his help to fetch water [26].

Almost all articles documenting physical violence from interpersonal conflicts focused on water [89, 110, 198, 243, 258]. Women in India experienced intrahousehold conflicts and beatings due to participation in a water supply project; [89] young women in Bangladesh, especially new brides, suffered verbal and physical abuse from mothers-in-law when they failed to collect water quickly or did not collect enough; [110] children and women in Uganda reported quarrels, including physical fights, while waiting in long water queues; [258] and schoolgirls in Kenya reported that the school janitor would beat them if the toilet was unclean [243].

*Sexual violence.* Fear and experiences of sexual violence were reported by women and girls who had to leave home for water and sanitation needs ( \_(((xxx)))\_ ) [70, 76, 108, 123, 135, 143, 153, 171, 173–175, 177, 179, 181, 183, 184, 186–189, 191, 198, 214, 231, 233, 238–240, 255, 258, 259, 261, 265, 268–270] Research from India, [181, 268] Kenya, [269] and Nigeria [70] found women openly defecating were particularly vulnerable to non-partner sexual violence compared to those using latrines. Fear of sexual assault was reported to be greatest at night, [123, 186, 238, 239, 255] leading some women to use bags and buckets for sanitation needs [175, 255, 270]. In India, those in urban settings reported greater fear of sexual assault when accessing sanitation than those in rural settings [181, 189]. Qualitative research described how men in India hid to watch for, attack, and molest women openly defecating alone, [174] and how a young woman in a Kenyan slum experienced an attempted rape when she walked ten minutes to the latrine [239]. Some Kenyan women mentioned rape as a stressor (specifically during menstruation, which compels toilet use) [255]. Related to water, walking long distances and collecting from certain sources reportedly exposed women and girls to sexual violence, [76, 153, 179, 231, 258, 259] particularly as men studied women's patterns [179]. In refugee settings in Ethiopia and the Democratic Republic of Congo, caregivers advised girls to not bathe at the river or in community showers to avoid rape [183].

**2.a.ii Health.** Women reported different health concerns, mostly negative, based on life stage and circumstance. Notably, pregnant women expressed health fears related to sanitation-related superstitions (India [184, 189]), women with trouble controlling urination or defecation stressed about accessing sanitation sites (India [2]), women reliant on bags, buckets, or open defecation had substantially lower odds of reporting good health compared to other women (Kenya [256]), and circumcised women who had recently given birth found it difficult and painful to defecate and urinate (Kenya [143]).

*Bodily harm.* Women and girls feared, risked, or experienced, varied harms related to their water and sanitation circumstances and activities ( \_(((xxx)))\_ ) [62, 63, 78, 90, 101, 135, 141, 143, 144, 158, 168–170, 172–174, 177–179, 181, 182, 184, 186, 187, 189–191, 197–199, 201, 214, 226, 231, 244, 257, 258, 261, 276, 277, 296]. Many noted exacerbated experiences for women who were pregnant or elderly, had pre-existing conditions, and/or perform activities in harsh weather [135, 143, 144, 169, 174, 177, 179, 181, 182, 184, 187, 189, 199, 231]. Reported risks of and actual harm linked to water and sanitation ranged widely, with reported water fetching

related harms in particular resulting in serious and long-term consequences. Specific immediate water fetching harms included general and localized pain; [63, 90, 101, 123, 187, 198, 229, 231, 244, 276] headaches and head injury; [229] and injury from falls, trucks, and/or car accidents [144, 158, 168, 198, 231]. Fears or experiences of harm from domestic and wild animals and insects were reported for both water collection and sanitation activities [62, 135, 143, 170, 172–174, 177–179, 184, 187, 189–191, 198, 201, 214, 226, 229, 257, 258, 296]. Women and girls reported fear and actual experiences of injury at and when accessing sanitation locations, regardless of sanitation type [135, 168, 172, 174, 184, 186, 189–191, 226, 257]. Women doing manual scavenging reported backaches (India) [141].

*Illness and infirmity.* Women and girls' experiences of illness and infirmity related to water and sanitation conditions are well documented ( \_(((xxx)))\_ ) [63, 65, 70, 76, 81, 86, 111, 118, 122, 123, 135, 141, 144, 154, 168, 172–174, 177, 178, 184, 186, 188–191, 195, 197–199, 202, 208, 214, 220, 223, 225, 226, 231, 239–241, 247, 256, 259, 272, 273, 278, 284, 285, 287, 288, 290].

Water and sanitation access have been linked to women's reproductive health, nutrition, and cardiovascular health outcomes. Two global studies (with data from 193 [284] and 144 [286] countries) and one focused on sub-Saharan Africa [287] found increased access to improved water and sanitation to be significantly associated with decreased maternal mortality. In India, reproductive tract infections were more common among women who changed their menstrual materials outdoors rather than in a private room or latrine [285]. Studies in Cambodia [290] and India [248] have observed associations between women's access to sanitation facilities and body mass index (BMI). Studies have also examined associations between sanitation (Cambodia [290]) or water (Uganda [278]) and anemia. Women in Kenya consumed poorer quality foods and a less diverse diet as a result of water insecurity [198]. In Nepal, having intermediate and low water access was associated with higher systolic and diastolic blood pressure levels in women, while men's blood pressure was not statistically different; elevated levels of blood pressure were highest for women with the least water access [272].

Women qualitatively reported perceived linkages between various illnesses and their water and sanitation environments and experiences. Women reported experiencing or fearing diarrhea, vomiting, dysentery, cholera, hepatitis, schistosomiasis, and skin diseases due to polluted water, [65, 70, 86, 111, 144, 177, 178, 197, 199, 214, 220, 225, 231, 248, 259, 273, 288] and experiencing diarrhea due to limitations on hygiene in times of water scarcity [70, 123, 202]. Women in India worried about spreading disease if limited water constrained their ability to wash their hands during menstruation, [226] and were concerned about fungal diseases when using dirty water inside sanitation facilities [190]. When interventions improved water availability or treatment, women reported experiencing fewer vaginal infections [63] and seeing fewer illnesses in their families [81, 208]. Women who withheld food and water or suppressed urination and defecation when lacking access to safe, clean latrines reported experiencing urinary tract infections, headaches, stomach aches, constipation, diarrhea, and other illnesses [135, 168, 172–174, 184, 190, 214, 248]. In India, women working in manual scavenging reported experiencing sickness, fever, and nausea [141]. Women and girls identified multiple sanitation-related factors they linked to illness, infection, and disease spread, which are detailed in the [S1 Text \(SX\)](#).

*Mental health.* Studies have increasingly examined mental health outcomes in relation to water [76, 90, 96, 100, 108, 123, 163, 165, 170, 177, 192, 198, 201, 202, 205, 209, 271, 274, 275, 280, 289] and sanitation [2, 139, 168, 172, 173, 175, 178, 185, 188, 189, 229, 283, 289].

Water-related stress, anxiety, depression, or fear were reported by women in Ethiopia regarding water-related illnesses; [108] in Bolivia, [232] Brazil, [229] India, [280] Kenya, [76, 170, 198] Mexico [163] and Uganda [165, 205] due to water insecurity; in Kenya [198] and

Canada [201] due to interpersonal relations related to water; and in Bangladesh when collecting water after dark [177].

Women reported myriad sanitation-related stressors, including fear of being attacked by men or ghosts, [177, 181, 184, 189, 229, 238] being shamed for using open defecation sites, [172] suppressing urination or defecation, [184] withholding food and water, [184] needing help to meet sanitation needs, [184] being hurried while using shared facilities, [168, 185, 188] sanitation-related costs, [170, 240] and lacking privacy or being seen by others, [178] especially men, [184, 189] while openly defecating [170, 172, 173, 184, 189, 238, 240]. Women working as manual scavengers in India reported feeling undignified and unworthy. [141] Women coped with sanitation stressors by seeking social support, withholding food or drink, or changing the timing of sanitation behaviors, though adaptations could also cause stress [168, 177, 184, 189]. Access to sanitation facilities was associated with mental well-being. Ownership of functional household latrines and enclosed bathing spaces were significantly associated with well-being among women in rural India [2]. Toilet access in Kenya was associated with better mental health and well-being among women [289]. Women who received latrines in Mozambique reported that they decreased their stress, [175] and women in India reported that private latrines helped them to overcome the embarrassment, shame, and anxiety of open defecation [139].

**2.a.iii Privacy.** Women reported challenges related to privacy and water, specifically concerning hygiene. Women and girls in Bangladesh, [199] India, [184, 189, 226] Indonesia, [115] and Mozambique [175, 261] described challenges obtaining privacy at water sources used for bathing, post-defecation cleansing, and washing, particularly during menstruation. In Mozambique, newly constructed handpumps provided women with easier, more reliable water access, but made achieving privacy for bathing and menstrual hygiene more difficult than at sources like rivers [261].

Sanitation facilities often enable privacy, though privacy can be challenging to obtain for those without sanitation facilities and for some using household or shared facilities. In India, women with latrines reported a greater sense of privacy, [139] and adolescent girls and women found latrines particularly useful for maintaining privacy during menstruation and defecation, especially during the rainy season [182, 222]. Women in Nigeria with lockable latrines were significantly more likely to report that their latrine was private (86% versus 64%) [267]. In urban India, privacy for open defecation is especially hard to obtain [226]. Women in Nairobi, Kenya who rely on bags, buckets, or open defecation had lower odds of experiencing privacy [256]. Household or shared toilets do not always prevent women from being seen or heard while defecating [123, 184, 186]. Women reported privacy concerns in shared sanitation facilities in Zimbabwe, [123] Mozambique, [175] Kenya, [191] India, [130] and South Africa, where limited privacy at community ablution blocks was also noted. [251] Privacy of household and shared latrines is compromised by broken [189] or missing doors, [184, 248] missing locks, [175, 191, 248, 251] and poor construction [175, 191, 240, 251]. Furthermore, women worried about being seen walking to latrines; [189, 227] waiting in queues; [130] having others hear or smell their activity; [175] or the proximity of latrines to houses, main roads, or public spaces [69, 175, 227].

The [S1 Text](#) provides additional details of how privacy concerns vary by gender and life stage, about the specific privacy concerns women and girls face when away from the home for work or school, and about the various strategies women and girls employ to cope with poor privacy conditions.

## 2.b. Critical consciousness

The concept 'critical consciousness' was not explicitly engaged, though many engaged sub-constructs, including self-confidence and the identification and questioning of inequalities. Improved self-confidence, including willingness to speak up, was reported regarding women's participation in WASH programs and campaigns in India, [89, 139, 145] Sri Lanka, [56] and Vietnam [58]. Women in India reported improvements in self-confidence, dignity, and work and life circumstances due to improvements in water supply [129, 279]. In Indonesia, some women reported feeling confident to challenge traditional gender roles and become leaders in the water sector [66].

Awareness of their unequal position in society was reported to influence how women approached resolving water issues in Sri Lanka [56] and Mexico, [163] and sanitation issues in India [145]. Women in rural India were aware of men's unequal decision-making power, which was reinforced by NGOs; they noted that NGOs only approached male household heads as part of a national campaign to build household latrines [124]. Women in Kenya raised complaints about service provision to government officials, but leaders ignored them because there are "no consequences for their inaction"[144].

## 2.c Assets

**2.c.i Financial and productive assets.** Women's access to assets has influence their water and sanitation access and ability to engage in water and sanitation initiatives. Further, water and sanitation have influenced women's income generation and financial assets.

When women lacked control over income and assets, they had limited decision-making power over improving or accessing water sources [65, 76, 86, 118, 123, 194, 199, 201, 258, 292]. Constrained finances limited women's access to preferred water sources, [64, 86, 111, 158, 170, 194, 197–199] desired water quantity, [86, 192] and water treatment methods [86, 111, 118, 204, 293]. Women reported spending money to access water sources with shorter wait times [61, 198] or higher quality, [98, 198] or to compensate male neighbors, laborers, or drivers for water collection [165, 201]. Water was a major expense for many women [65, 86, 111, 198, 200, 292]. In Uganda, women were four times more willing to contribute funds to water provision than men [102]. In Kenya, purchasing water during the dry season limited money available for food [198]. In Nigeria, women with water access issues found alternative sources, or purchased, bartered, or obtained water through credit [158]. Furthermore, limited control over assets like carts, bicycles, and wheelbarrows made water collection more time-consuming, [98, 123, 258] or, in sub-Arctic communities where women lack snowmobiles and guns for defense against bears, more dangerous [201].

Similarly, limited income and asset access and control, including over land, constrained women's access to sanitation [119, 124, 125, 135, 147, 168, 171, 174, 186, 187, 191, 217, 239, 240, 270] and limited independent decision-making about latrine construction [119, 124, 135]. Women reported using public pay-per-use toilets [168, 171, 174, 227, 239, 270] and incurring higher costs than men due to more frequent need [186, 191, 270]. Limited household income has forced women to prioritize needs like food over sanitation, whether investing in or paying to use toilets [135, 147, 186]. Women in Kenya [240, 270] and India [187] adapted by using preferred pay-per-use locations less often or strategically, like for defecation only [187, 240, 270]. Women have faced difficulties accessing government subsidies [125, 135] or loans large enough for latrine construction [131] and reported willingness to make financial sacrifices, like paying higher rent [191] or accepting a lower wage job, [174, 217] to gain toilet access. In India, even women with economic and decision-making power could not build latrines without land ownership [124, 187, 190]. In Nairobi, women reported that greater financial stability and more control over resources would help them access sanitation [147].

Finances and assets have influenced women's representation or participation in community water and sanitation initiatives. Women have faced financial or asset-related barriers to participation in community-level initiatives, including a lack of land ownership for water committees (Peru [149] and Uganda [102]), an inability to sustain required monetary contributions for self-help groups (India [72]), and a lack of financial incentive and opportunity costs (India [69, 89, 125] and Ecuador [79]). In India, some families pushed women to attend watershed development meetings because of perceived monetary benefit [72].

Water and sanitation have both supported and constrained women's income generation. Specifically, women have engaged in job opportunities, like water vending, [89] meter reading and water tank cleaning, [56] water management, [30, 121] water filter and toilet pan selling, [66] and rainwater harvesting container construction [121, 161]. They have also engaged in water-dependent income-generating activities, like horticulture or pottery-making, [59, 206, 261] or sanitation-related activities, like toilet cleaning, [217] latrine construction, [121] serving as toilet attendants, [263] or doing scavenging work [138, 141, 297]. Finally, water and sanitation improvements have freed up time for other income-generating activities [56, 67, 105, 174, 194, 210, 295]. Conversely, women's income generation has been constrained by poor water access, limited employment opportunities, or by WASH initiatives themselves. Specifically, inadequate water access constrains income generation when time is needed instead for collecting water, or when water available is insufficient for income-generating activities [30, 56, 67, 81, 86, 100, 105, 166, 174, 194, 198, 200, 202, 206, 210, 231, 244, 259, 295]. In some cases, women have not been able to get water and sanitation-related jobs, or have only had access to stigmatized or minimum wage jobs; further details provided in the [S1 Text](#) (SX).

The [S1 Text](#) also details how poor water and sanitation conditions have indirect adverse effects on women's financial assets, often by impacting health.

**2.c.ii Knowledge and skills.** Studies have documented women's specific household-level water and sanitation-related knowledge [118, 124, 159]. In Kenya, women's roles as primary water collectors instilled knowledge about water access, quality, and quantity [76]. In Pakistan, mothers and grandmothers were a source of knowledge and influenced household decision-making about water and hygiene, [118] while in indigenous communities in Canada and the U.S., older women were responsible for teaching younger generations about water-related responsibilities [159, 167].

Women noted various types and sources of knowledge that influenced engagement in community-level activities. They reported the importance of knowledge related to village council processes to acquire toilet subsidies, [135] community meetings and events to enable participation, [71, 104, 109, 115] community members' needs to evaluate water requests, [114] and technical and business-related expertise to manage water enterprise businesses. [30] Perceived limited knowledge has inhibited women's participation in community decision-making bodies, collective action, and WASH businesses, or advantaged more educated women [30, 74, 76, 79, 81, 82, 84, 97, 102–104]. Women reported acquiring knowledge from other women at public meetings about water issues (Vietnam [111]) and from close friends about WASH activities (Indonesia [66]).

Water and sanitation initiatives have enabled women to gain awareness, knowledge, or practical skills, while others have upheld gender norms by preventing or exploiting women's knowledge. Further details provided in [S1 Text](#).

**2.c.iii Social capital.** Women formed and maintained social connections when collecting water [57, 78, 110, 115, 153, 279] and relied on social capital from family, friends, and community members for multiple water needs. They leveraged social capital to access water when queues were long or water was scarce, [61, 110, 114, 164, 165, 179, 198, 279] jump water queues, [168, 179] get water from private wells, [279] haul water using carts, [229] receive



improved home water access, [59] wait on water deliveries, [100] or get water during menstruation [178]. In India, water management was found to be a cooperative task with men collecting water while women made decisions about quantity, quality, and use [180]. Male partners in Kenya [198] and Mozambique [153] helped with the physical labor or cost of water collection in rare circumstances, such as pregnancy, illness, or birth. In Kenya, women faced difficulties collecting water when they lacked childcare assistance [144]. In Malawi, women were persuaded by friends and relatives to begin and maintain water treatment [208].

Social capital has facilitated sanitation access. Women and girls have formed and maintained social connections when accessing sanitation locations, [130, 182, 189] and sought social support to ensure privacy and safety and to protect reputations when urinating or defecating [173, 182, 184, 187–190, 223, 226]. In India, schoolgirls asked friends to clean the school toilets so they could use them without fear of illness, [247] yet women reported receiving scant sanitation-related cleaning support from men [226].

Women accessed social networks to address water and sanitation problems and take on roles [65, 79, 90, 95, 135, 149, 158, 193]. They used social networks to lobby officials to solve water problems (Thailand [193]), raise complaints with local authorities about water issues (Ecuador [79] and Nigeria [158]), leverage village council connections to access latrine construction subsidies (India [135]), and create strategic alliances with male household members to push their water-related priorities in the community (Bangladesh [109]). Women leveraged social support to assume public roles. Women needed or sought family support to take public water management roles (Vietnam [97]), disseminate water and sanitation knowledge as community facilitators (Costa Rica [63]), become masons and water technicians (Nepal [121]), establish water enterprises (Cambodia [30]), participate in WASH activities and operate WASH businesses (Indonesia [66]), attend trainings on cistern building (Brazil [161]), and gain water user association membership (Peru [149]). In Bolivia, a lack of spousal support curtailed women's participation in water and sanitation governance [72]. Participation in water management projects helped women in Sri Lanka expand their social networks [56] as did women's participation in water-focused mobilizations in Bolivia [148]. Some women in Indonesia chose jobs in the WASH sector and participated in WASH activities because they provide socializing opportunities [66].

**2.c.iv Time.** Women are the primary water-collectors globally, [18, 20] devoting considerably more time to water-related tasks than men. Men were more likely to collect from closer sources, [20] where queues were shorter [153, 261] or they had priority access, [61] or with assets like bicycles, motorcycles, wheelbarrows, or donkey carts to assist [98, 123, 153, 258]. Seasonal changes impacted time spent on water acquisition: during the dry season, women waited for often unpredictable and therefore disruptive water deliveries (Philippines [100]); spent extra time collecting water when sources dried up (Ghana [197]); slept or cooked at sources when lines were long (Mozambique [261]); and walked long distances in the dark (Mozambique [153]). Women in Vietnam relied on water sources that became more time consuming to access due to climate-related shortages [111]. Increasing urban population density in India has exacerbated water scarcity and time required for collection [244]. Constraints on women's time limit access to safe water or resources needed to treat or boil water [92, 118, 197, 199, 208]. Women also spend considerable time caring for family members ill with water-related diseases [26, 63, 111, 177, 193, 239, 240, 248, 259].

Women expended great amounts of time meeting sanitation needs and fulfilling sanitation-related responsibilities [64, 66, 121, 122, 125, 127, 128, 132, 133, 135, 138, 141, 168, 173, 174, 182, 184, 185, 187, 189, 190, 195, 219, 226, 228, 236, 239, 240, 248, 250, 256, 265]. Women in India, [125, 195] Kenya, [256] and South Africa [265] reported long walks to sanitation sites when they lacked private home toilets, and refugee women in Bangladesh [219] reported

waiting in long toilet queues. In urban India, women reported going for sanitation in early morning or late at night to avoid queues or ensure privacy, [168, 187, 190, 226, 248] or open defecated rather than walking to and queuing at latrines [168]. Time spent on sanitation has caused women to be late for work or suppress needs to avoid being late, [168, 173] work longer days if they needed to leave to use the toilet, [250] fail to complete household chores, [226] or be scolded or punished for taking too long. [189] Women spent time assisting others with sanitation-related needs [135] and cleaning toilets, sometimes rising early to balance domestic duties with wage labor [122, 127]. Women working as manual scavengers in India reported limited control over taking breaks, and not being able to take time off if ill or to participate in festivals, weddings, or other celebrations [138, 141].

Syntheses of opportunity costs related to time, as well as how women have reclaimed time related to water and sanitation are detailed in the [S1 Text \(SX\)](#).

### 3. Institutional structures

As outlined below, institutional structures—including formal laws and policies, norms, and relations—influence women's agency and resources related to water and sanitation.

#### 3.a Formal laws and policies

Women have participated in WASH governance to varying extents. In Bangladesh, [177] Ghana, [83] India, [80, 106, 145, 180] Kenya, [61] and Uganda, [102] governments and organizations that set up community water and sanitation committees have required the inclusion of women [61, 80, 83, 102, 106, 180] or encouraged and supported women's participation [145, 177]. In one project in India, rules mandated women be on water committees, but women did not always know they were on them [80]. Yet, inclusion does not guarantee participation, voice, or decision-making power. Women's participation in WASH-related governance has been constrained by a lack of awareness about the rules (Uganda [102]), a lack of transparency or distrust in political institutions (Kenya [87]), husbands or sons attending meetings in their place (India [106]), and being ignored by men (Kenya [61]). Committees with women have divided roles along gendered lines, with men in powerful positions, like president, and women in less powerful positions, like cleaner [83, 153]. Research in Uganda found women constituted less than a third of members and were rarely in leadership positions on water user committees despite guidelines to have women comprise 50% of membership and serve in influential positions [102].

WASH policies, and uneven policy awareness, implementation, and enforcement, have posed barriers to women. Female entrepreneurs in Cambodia found certain policies made it hard to run water enterprises [30]. Even when policies exist to address women's and girls' needs, they are not always known or enforced. In India, both men and women lacked awareness of policies, acts, and regulations that prioritized gender equitable access to resources and participation in a watershed intervention [103]. A comparative study in Tanzania, Ghana, Cambodia, and Ethiopia, found some countries mandated sex-segregated school toilets, but adherence was inconsistent [253]. Lack of clear responsibility and accountability has resulted in policy or guidance failure. Women Sanitary Complexes in India were reportedly not maintained according to guidelines due to disagreements over responsibility [139]. In refugee camps in Lebanon and Myanmar, a lack of detailed guidelines and clarity about responsibility affected government actors' ability to provide sufficient water and sanitation for female refugees, particularly to support menstruation-related needs [228].

### 3.b. Norms

Research described the social norms that govern men's and women's gendered water- and sanitation-related roles, focusing largely on gendered division of labor and roles in public life ([18, 20, 26, 59, 61, 62, 66, 76, 83, 88, 89, 97, 101–103, 110, 111, 123–126, 131, 132, 135, 140, 143, 153, 165, 179, 184–187, 190, 193, 198, 201, 209, 214, 220, 229, 243, 245, 258, 261, 273, 279, 282, 296, 301, 302, 304–306]).

Women and girls are largely responsible for household water collection ([18, 20, 26, 62, 76, 88, 89, 102, 103, 110, 111, 123, 131, 153, 165, 179, 187, 193, 198, 201, 209, 229, 245, 261, 273, 282, 296, 301, 302, 304, 305]). Providing sufficient water for the household was described as important to being a good wife; failure to do so has resulted in shame and violence [153, 179, 273]. Normative roles extended beyond the home; girls at school in Swaziland were expected to fetch water rather than boys [220]. Gender intersected with other social identities to result in further marginalization or disadvantage related to roles and expectations. In India, lower caste women were expected to give priority water access to women from upper castes, particularly when water was scarce, [279] and were reported to lack access to handpumps constructed within upper caste areas, even when tasked with repairing them [106, 152]. In Malawi, women with disabilities experienced difficulty collecting water, though they are often still expected to fulfill this role [282].

Norms have influenced the extent that men engage in water collection and how they are perceived [110, 198, 258, 279, 296]. Men in Uganda who assisted with water collection were deemed emotionally unstable or bewitched, [165, 258] and boys in India were reportedly embarrassed to be seen helping girls carry water [187]. In Rwanda, men preferred water collection over other traditionally female tasks, though still viewed it as a woman's task [305]. Norms of femininity and masculinity were found to be more fluid among lower castes in northwest India, enabling men to help women with water collection more easily than men in upper caste households [279]. When men or boys do collect water, it has been more acceptable when they consider it 'helping' women [261] or use technology-like bicycles, wheelbarrows, or motorcycles-while women and girls are expected to carry water [123, 165, 229, 258, 261]. Exceptionally, in Inuit communities, men are primary water collectors. They carry guns for protection against polar bears near water sources-something unacceptable for women to do; women experienced anxiety accessing water when men migrate for work [201].

Normative expectations affect women's and girls' sanitation-related practices. Rural Indian women reportedly suppressed urination and defecation urges when caregiving and household obligations were pressing [184] and were often responsible for assisting others, including children, adolescent girls, and elderly family members, with sanitation needs [62, 131, 135, 184, 190]. Women assumed more responsibilities for latrine cleaning than men because cleaning is typically considered women's work.[186, 306]

Norms govern public water and sanitation participation. In several countries, it was more acceptable for men to participate in the public sphere and serve in leadership roles, [66, 76, 103, 111, 123, 125, 126, 132, 140, 143] and to have technological jobs, like as handpump mechanics, while women were discouraged [66, 83, 261]. These normative beliefs are sometimes supported by men, women, and NGOs. In Thailand, women believed men were better suited for public leadership roles, and men questioned women's participation and problem-solving capacities related to village water resources [193]. In sanitation planning initiatives in Kenya, a man justified women's exclusion from participation in the sanitation initiatives stating, women's brains were "like that of a child." [143] NGOs have targeted men as household heads and ignored women in decision-making and public participation [124]. In rare cases,

cultural beliefs facilitated women's public participation; women were described as more trustworthy on water user committees in Uganda and Ghana [83, 102].

Normative societal and familial rules and restrictions have defined the boundaries of acceptable water and sanitation-related behaviors for women, including their engagement in the public sphere [61, 62, 66, 87, 89, 101–103, 110, 111, 124–126, 130, 140, 174, 177–179, 181, 182, 187–190, 197, 218, 234, 261]. Further details are provided in [S1 Text](#).

The [S1 Text](#) also describes women and girls' reported experiences of shame, specifically related to menstruation and sanitation, as well as how norms related to shame and honor have been leveraged to change water and sanitation conditions and behaviors.

*Shifting norms.* Water and sanitation-related norms, including roles, responsibilities, and restrictions, have shifted, but impacts are variable. Water initiatives have increased expectations and work for women: the introduction of piped water resulted in women having to fetch water for their husband's bathing needs (India) [279] and doing all the clothes washing, instead of sharing responsibility (Vietnam) [58]. Some water and sanitation initiatives have shifted norms and expectations in women's favor [26, 56, 125, 126]. WASH projects in Vanuatu resulted in men increasingly assisting with responsibilities like cooking and hygiene [26]. In Sri Lanka, a women's group's successful water project demonstrated women's capacity to conduct public WASH projects [56]. In India, NGOs used facilitators to challenge norms that limited women's ability to speak in village health committees that address WASH issues [125, 126]. However, initiatives that diverged from normative roles have faced resistance. When a project attempted to put household water connections in women's names, women objected (India) [89]. Men with new homestead water access did not like their increased involvement in what they perceived as women's work (Kenya) [88]. Norm change has emerged from changing circumstances; some displaced Syrian refugee girls did not face the same menstrual restrictions they did back home, though female refugees from Myanmar did not experience any shift [228].

### 3.c Relations

Relations have both facilitated and hindered water and sanitation-related behaviors and experiences. In India, social networks played an important role in women's decision to purchase new water filters [204] and aided women's water collection when queues were long [168]. In Bangladesh, [110] India, [279] and Uganda [165] women relied on social networks to access water, but noted that relationships could be strained or unreliable when water was scarce. Women avoided quarrels at collection sites in Kenya by waking early to get water [76]. Regarding sanitation, women frequently accompanied one another or asked men to accompany them for safety when open defecating, [135, 173–175, 182, 187, 189, 251] and to avoid harassment from community members when going to latrines and open defecation sites after dark [135, 143, 168, 182, 190, 228, 238]. Additionally, women in Kenya reported quarrels over contributions toward sanitation activities and maintenance of shared toilets, [170] and female toilet attendants in Europe reported poor treatment by patrons who refused payment [263]. Relations also influenced sanitation-related school experiences; girls reported bullying from boys if they were known to have defecated in the school toilet (Sweden [223]) and if boys knew girls were menstruating because of which toilets they used (India [247]).

Research identified both change agents, those who deviate from the status quo and enhance women and girls' empowerment, and gatekeepers, those who maintain the status quo and constrain women and girls' choice and voice, related to water and sanitation. Specific examples of change agents and gatekeepers are provided in the [S1 Text](#) (SX).

Water and sanitation conditions have strained both intra- and inter-household relations. In some cases, water collection responsibilities and having insufficient water to meet all

household members' needs have created tension and led to intra-household violence; further details are provided in [S1 Text](#). Household sanitation-related conflicts were reported specifically in India. Adolescent girls were scolded by parents for taking too long or talking to boys when going for urination/defecation; newly married women were scolded for not following household sanitation rules; [189] women with children were scolded for abandoning children to meet sanitation needs; and women across life stages worried about upsetting others if they asked for assistance meeting sanitation needs [238]. Regarding inter-household relations, disputes with neighbors at water collection locations were widely reported [61, 108, 144, 165, 168, 179, 189, 198, 209, 258]. Water collection sites could be places of tension and danger, including sexual exploitation, for women and girls in Zimbabwe [123] and Uganda [165, 179]. In Kenya, disputes arose among women competing for water access, and verbal and physical fights erupted when women collecting payments favored women in the queue [61]. In India, women reported that their participation in a water project led to intrahousehold conflict; some women reported experiencing beatings when they spoke up at meetings (cite) [89]. Inter-household sanitation-related conflicts were reported related to shared toilets, [187] where women practice open defecation, [189, 190] and accessing sanitation facilities [175].

Finally, water and sanitation initiatives have both negatively and positively affected relations. Negative effects in India included increased expectations of wives to bring water home, quarrels, and conflicts at water points. [279] Positive effects included increased respect and support for women by men, changed division of labor, and increased ability of women to negotiate with husbands (Vanuatu [26]); reduced conflict between husbands and wives (Mozambique [153], Kenya, [88] and Vanuatu [26]); improved relationships between men and women (India [105]) and in families (Kenya [210] and Vietnam [58]); heightened status of women in and outside the home and positive attitudes and support for women's collective work (India [56]); and greater acceptance of women performing WASH roles outside the home (India [129]).

## Discussion

We synthesized evidence on water, sanitation, and women and girls' empowerment from 257 peer-reviewed empirical research articles, resulting in the most comprehensive synthesis of gender-focused water and sanitation research to date. Our review is more expansive and rigorous than recent WASH and gender or empowerment-focused reviews that restricted inclusion based on publication date, [39] only extracted data from titles and abstracts, [39] or focused more narrowly on the intersection of gender, water, and health [40] or on identifying the dimensions of empowerment used in WASH research [38]. The majority (86%) of included research was from Africa and Asia and focused on adults (69%). No studies focused primarily on men or boys, or on transgender or non-binary individuals, revealing patterns of research inequities that should be addressed to include more diverse geographies and populations. Our search and synthesis was grounded in an existing model of empowerment [45] which we iteratively expanded based on our review to include 'freedom of movement' within the Agency domain and 'privacy' within the Resources domain. Agency was the least commonly engaged domain among included articles (122; 47%); the Resources domains was dominant (241; 94%). This review not only contributes insights to those working in the WASH sector, it also augments understanding of the role of water and sanitation in discourse on empowerment more broadly.

Water and sanitation research that engages empowerment and related domains is extensive and growing, yet clear conceptualization of empowerment remains limited. We found that 82% (211) of included articles were published since 2010, providing evidence that aligns with

previous anecdotal observations that empowerment is increasingly a focus in water and sanitation research [28, 39]. Both the large body of work identified and its growth, which is consistent with growth in the broader field of women's empowerment, [307] further justify the need to assess learning to date. Importantly, 124 (48%) included articles did not use 'empowerment' or related words (e.g. "empower") in their text, but were included because they specifically reported on empowerment sub-domains (e.g safety, decision-making) aligned with our guiding model. Of the 133 (52%) articles that did use empowerment or related terms in their text, only 17 (13%; or 7% of total) provided a definition or conceptualization of women's empowerment to inform their work. Our assessment aligns with a reflection by Dery et al. (2019) that the definition of empowerment in WASH research lacks clarity [38]. As this line of research continues, it is essential that researchers use empowerment-related terminology deliberately. Without solid conceptualization, whether by articulating a clear guiding definition or framework a priori, or by eliciting a local understanding of empowerment via the research (See Bisung and Dickin (2019) [64]), terms may be misused or become devoid of meaning [33]. The tool we created and used (Fig 1) can be adopted to assess engagement of empowerment concepts in future research.

We identified only one article that used a quantitative tool to assess women's empowerment related to WASH, the Empowerment in WASH Index, [308] highlighting an opportunity for future work. Additional tools are under development, such as the Agency, Resources, and Institutional Structures for Sanitation-related Empowerment (ARISE) Scales, [309] and Kayser et al. (2019) propose four priority areas for assessing gender equality and empowerment related to WASH [24] Adjacently related, another tool is under development focusing specifically on gender equality: the Water, Sanitation, and Hygiene Gender Equality Measure (WASH-GEM) [310]. The momentum around measuring empowerment and WASH, while exciting, merits caution. In her critical review of current practices for measuring women's empowerment, Richardson (2018) provides three recommendations to ensure sound measurement: measures should draw on theory; analytic methods should be used to minimize implicit judgement and bias; and comprehensive information should be collected (like data from men or complementary qualitative data) [33]. Yount et al. (2018) note that empowerment measures should rigorously assess validity and reliability [311]. Furthermore, research on empowerment from other sectors teaches that a multitude of measures can also hinder learning by limiting comparability between studies, [32] and that tools should be selected intentionally based on context and need [35]. If WASH-related empowerment is to be monitored at scale, a consensus on indicators and associated measures will be needed eventually. As tools emerge, there will be a need to review and assess the similarities, differences, strengths, weaknesses, specific uses, and gaps to continue strengthening this line of research.

Although existing measurement is limited, this review illuminates how water and sanitation circumstances and conditions have resulted in myriad negative impacts related to various sub-domains of women's empowerment that remain unmonitored and under-evaluated. Illustratively, considerable research shows how compromised water and sanitation environments have contributed to women's risk or experience of harassment or physical and sexual violence; [61, 62, 70, 76, 86, 89, 101, 108, 110, 111, 123, 135, 138, 143, 144, 153, 168, 171–175, 177, 179, 181–184, 186–191, 198, 199, 201, 214, 217, 226, 231, 233, 238–240, 243, 251, 255, 257–266, 268–270] compromised mental well-being; [2, 76, 90, 96, 100, 108, 123, 139, 163, 165, 168, 170, 172, 173, 175, 177, 178, 185, 188, 189, 192, 198, 201, 202, 205, 209, 229, 271, 274, 275, 280, 283, 289] resulted in illness, infirmity, and bodily harm [62, 63, 65, 70, 76, 78, 81, 86, 90, 101, 111, 118, 122, 123, 135, 141, 143, 144, 154, 158, 168–170, 172–174, 177–179, 181, 182, 184, 186–191, 195, 197–199, 201, 202, 208, 214, 220, 223, 225, 226, 231, 239–241, 244, 247, 256–259, 261, 272, 273, 276–278, 284, 285, 287, 288, 290, 296] or limiting of hygiene, food,

and water; [76, 86, 98, 100, 123, 135, 144, 165, 168, 174, 179, 184, 192, 197, 198, 200, 202, 212, 224, 229, 232, 281] and suppression of urination, defecation and menstrual hygiene needs, [2, 62, 181, 184, 188, 190, 191, 214, 217, 224, 229, 235, 236, 238, 240, 241, 247, 248, 250, 270] among other impacts. However, estimates of the burden of inadequate WASH remain focused on disease outcomes [8]. Our review shows that the true burden of inadequate WASH is likely far greater, supporting calls to collect and report sex-disaggregated and gender-specific data that also considers intersectionalities, [312, 313] and to not discount or ignore impacts predominantly or only experienced by women and girls [314]. Specifically, the bodily integrity, health, and safety and security sub-domains are particularly relevant when assessing the health-related burdens of inadequate WASH. Finally, this review confirms the need to set goals for measuring, monitoring, and reporting the specific impacts of WASH on women and girls, including impacts that extend beyond health (e.g. time, freedom of movement, privacy) [22].

Despite the numerous studies that have documented impacts of water and sanitation conditions on sub-domains of women and girls' empowerment, there has been scant action in response, warranting greater investment in programs and evaluations to create and assess change. For example, the Safety and Security domain is well-researched; 82 (32%) articles document links between WASH and safety and security, yet only one study evaluated a program that improved perceived safety [257]. Furthermore, WASH programs have the potential to catalyze change across domains of empowerment and to be transformative in the lives of women and girls, but only a few studies have documented these linkages and transformative change. Research in Ghana showed how a water project resulted in time savings, which further benefited well-being among women [194]. A water intervention in Kenya also enabled time savings, which led to improved intra-familial relationships [210]. WASH programming in Vietnam provided knowledge and skills, which women reported improved their decision-making, public participation, and relations [58]. Programs aiming to achieve transformative change should be evaluated to deepen the knowledge base on WASH and empowerment. To start, more research on Agency is warranted. Agency, which includes decision-making, leadership, collective action, and freedom of movement, is "the heart of empowerment" and transformation, [45] yet is the domain least studied. Research should aim to further understand Agency, including all sub-domains, in the context of WASH, including its relationship with other domains. Finally, political will and investment are necessary to ensure women and girls are prioritized in WASH initiatives. At a minimum, WASH initiatives should engage women meaningfully and not cause harm by bypassing them [102, 122, 124]. We summarize research and practice opportunities in text box 1.

### Box 1. Research and practice opportunities related to women's and girls' empowerment

- **Acknowledge importance of empowerment in water and sanitation research and practice.** This review elevates a substantial body of research that should be leveraged to inform research and practice moving forward.
- **Measure, monitor, and report.** Negative impacts on women and girls related to water, sanitation, and the sub-domains of empowerment are extensive, yet

underassessed, rendering them invisible. Further work to improve measurement, monitoring, and reporting is needed to assess and enable change via programmes and policies.

- **Act and Evaluate.** Initiatives are needed to address, challenge, and transform systemic constraints related to women's and girls' resources and agency. Relevant existing evidence should be considered from the design phase. Investment is needed to fund and evaluate such initiatives to assess impact and enable further learning.
- **Use empowerment terminology deliberately.** There is a need to deliberately define the term empowerment when used in research and practice, by leveraging an existing definition, model, or framework, or by eliciting a local understanding via research itself.
- **Expand populations engaged in research and programming.** The majority of research to date is in Asia and Africa and among adult women. There is an opportunity to learn from men, boys, transgender, and non-binary individuals, to do so across varied life stages and geographies, and to engage them in relevant programming.
- **Expand research focus.** The *Resources* domain in water and sanitation research is dominant. Further research across and between the other domains is warranted, specifically *Agency*, which is least represented, yet central to transformation. Research investigating the relationships between domains is also warranted.

## Strengths and limitations

This review has leveraged an existing model of empowerment to analyze full texts of an extensive volume of research, resulting in the most comprehensive and rigorous synthesis on women's and girls' empowerment and water and sanitation to date. This review only captures studies available in English, does not include grey literature, could have engaged additional databases—particularly those that engage disciplines beyond public health—and broadened search terms to capture more relevant work, and research has continued to emerge since the search—all factors that may limit this review's comprehensiveness. Further, other models of empowerment exist that could have framed the review. Still, this review provides a valuable base and resource from which to develop programming and further research, and does capture literature beyond public health because of our inclusion of ancestry and descendance search methodologies. While this review captures research on menstruation, it only does so in the context of water and sanitation research and cannot be considered a comprehensive review of menstruation and empowerment. Hygiene was not a focus and should be considered in future reviews. Finally, while we intended to register the review, we began extraction to inform other work prior to registering and recent revisions to guidelines now stipulate extraction should not have started prior to registration and thus we were no longer eligible.

## Conclusion

Water and sanitation research specifically engaging women's and girls' empowerment in a well-defined or conceptualized manner is limited. However, a substantial body of research examining domains and sub-domains of empowerment exists that should be leveraged to develop and evaluate programs focused on improving the life outcomes of women and girls. Importantly, the integration of a gender lens into WASH research, and program and policy planning and evaluation, can enable the identification of inequities and potential harms and



benefits, [312] and should be mainstreamed across the WASH sector [23]. Emergent discussions about 'transformative WASH' call for interventions that radically reduce fecal contamination [315] and chemicals [316] to impact health. However, our findings underscore the need for a more comprehensive 'transformative WASH,' which extends beyond reductions in contamination, to impact health and well-being more inclusively. Specifically, WASH researchers and practitioners should also integrate gender-transformative approaches that challenge and reduce systemic constraints on women's and girls' resources and agency, which is not only warranted but long overdue.

## Supporting information

**S1 Table.** PRISMA checklists for (a) abstract and (b) full manuscript.

(DOCX)

**S2 Table.** PubMed search strategy.

(DOCX)

**S3 Table.** Included studies and key characteristics.

(DOCX)

**S4 Table.** Quality appraisal of all included articles using the mixed methods appraisal tool.

(DOCX)

**S5 Table.** Articles that define or explore definitions of women's empowerment.

(DOCX)

**S6 Table.** Articles that engage menstrual hygiene management by domain and sub-domain.

(DOCX)

**S1 Fig.** Number of articles included in search by date of publication, through 4 May 2020

(N = 257).

(DOCX)

**S2 Fig.** Number of articles addressing each domain and sub-domain of empowerment, by water, sanitation, or water and sanitation focus.

(DOCX)

**S1 Text.** Supplemental results text.

(DOCX)

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