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Environmental health conditions in the transitional stage of forcible displacement: A systematic scoping review

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Abstract

In 2019, 30,000 people were forced to leave their homes due to conflict, persecution, and natural disaster each day. Eighty-five percent of refugees live in developing countries, and they often face underfunded and inadequate environmental health services. Many displaced persons live in camps and other temporary settlements long after the displacement event occurs. However, there is little evidence on environmental health conditions in the transitional phase—defined by the United Nations High Commissioner for Refugees as six months to two years after displacement. To address this gap in research, we conducted a systematic scoping review of environmental health conditions, exposures, and outcomes in transitional displacement settings, as well as reported obstacles and recommendations for improvement. Eighty-eight publications met the inclusion criteria. Water supply was the most frequently discussed environmental health topic. Overcrowding was the most common risk factor reported, *Vibrio cholerae* was the most common pathogen reported, and diarrhea was the most commonly reported health outcome. Obstacles and recommendations were categorized as institutional, political or implementation-based. Identified knowledge gaps included minimal information on setting logistics and on topics such as menstrual hygiene, oral hygiene and fomite contamination. In order to improve environmental health conditions in transitional displacement settings, all levels of government and non-governmental organizations should increase collaboration to improve resource provision. This study is the first to report on environmental health conditions in this important time of transition between the emergency and protracted stages of displacement.

Keywords: refugee; internally displaced; migration; humanitarian; development

1. Introduction

By the end of 2019, there were 79.5 million forcibly displaced people worldwide, and 30,000 people were forcibly displaced every day (UNHCR, 2019; USA for UNHCR, 2020a) (see **Table 1** for definitions). Settlements for displaced populations are primarily designed to provide rapid onset emergency support, such as basic shelter, medical care, nutrition, and water, sanitation and hygiene (WaSH) facilities. However, they often fail to meet minimum environmental health standards, and are ill-suited to longer-term displacement (Behnke et al., 2020; Cronin et al., 2008; Sphere Association, 2018; van der Helm et al., 2017).

Ensuring adequate environmental health services for displaced persons is critical for human health and development, and is fundamental to achieving Sustainable Development Goal 6, which calls for "availability and sustainable management of water and sanitation for all" (Cronk et al., 2015; United Nations General Assembly, 2015). Most humanitarian crises persist for several years; less than one in forty refugee crises is resolved within three years, and more than 80% last more than a decade. Displaced populations' needs for environmental health services evolve even as international attention and initial spikes in funding subside (Crawford et al., 2015; Mason and Mosello, 2016). This can result in inadequate and unsustainable environmental health services, leading to a heightened risk of communicable diseases and increased morbidity and mortality (Cronin et al., 2008; Schuller and Levey, 2014).

The United Nations High Commissioner for Refugees (UNHCR) WaSH manual categorizes crises into phases based on the length of time that a population is displaced: "emergency" (0-6 months), "transitional" (6 months – 2 years), or "protracted" (2+ years) (UNHCR, 2017). While the priority in the emergency stage is to save lives through rapid interventions, environmental health interventions in the transitional stage should shift to more

66 cost-efficient, sustainable solutions to protect the health of displaced populations in the long-
67 term (Sphere Association, 2018; UNHCR, 2017). The needs of forcibly displaced populations
68 change over time, and environmental health services should be adapted gradually as stakeholders
69 transition from emergency response to sustainable development. Best practices for facilitating
70 this transition, however, are poorly understood (Mosel and Levine, 2014). The three phases of
71 displacement differ in terms of standards of environmental health services and their costs, yet
72 there is little literature on how to manage environmental health conditions in the transitional
73 phase.

74 To characterize the evidence on changes in environmental health conditions in forcibly
75 displaced populations over time, we conducted a systematic scoping review on environmental
76 health in the transitional phase of displacement. We explored environmental conditions,
77 exposures, and outcomes; obstacles to improvement; and recommendations for improvement
78 related to environmental health in these settings. This review is one of a set of systematic
79 scoping reviews examining environmental health conditions in each of the three response phases
80 (Behnke et al., 2020; Shackelford et al., 2020; UNHCR, 2017). The purpose of this review is to
81 build a better understanding of the environmental health services in the transitional phase of
82 forced displacement, and to contextualize these findings within the transition from emergency
83 response to sustainable development.

84 *Definitions*

85 **Table 1 - Terms and definitions used in a systematic scoping review of environmental**
86 **health in transitional displacement**

Term	Definition
Asylum seeker	Person awaiting refugee status
Emergency Phase	Up to six months after displacement (UNHCR, 2017)

Forcibly displaced	Forced to leave home due to "persecution, conflict or generalized violence." Natural disasters were also included. Includes refugees, IDPs and asylum-seekers (UNHCR, 2018).
Internally Displaced Person	A person who has been forced to flee their home but has not crossed an international border (Global Protection Cluster, 2010).
Protracted Phase	More than two years after displacement (UNHCR, 2017).
Refugee	A person who has been forced to flee his or her country because of persecution, war or violence (USA for UNHCR, 2020b) or natural disaster.
Transitional Phase	Six months to two years after displacement (UNHCR, 2017).

2. Methods

We used PRISMA guidelines to conduct a systematic scoping review of studies from peer-reviewed and grey literature databases that reported data on environmental health during the transitional phase of forcible displacement (Moher et al., 2009; Peters et al., 2015). We sought to answer three research questions:

1. What are the environmental health conditions, exposures, and outcomes in the transitional phase of forcible displacement?
2. What obstacles are reported to impede improvements in environmental health in these settings?
3. What recommendations do studies give to improve environmental health in these settings?

2.1 – Search strategy

Studies from both peer-reviewed and grey literature sources were searched using the strategy described by Behnke et al. (2020). Peer-reviewed studies were identified through the following databases: PubMed, Web of Science, Scopus and EBSCOhost Global Health. Grey literature was identified through DisasterLit, International Rescue Committee, United Nations Children's Fund (UNICEF) WaSH, UNHCR, RAND, Centers for Disease Control and

Prevention (CDC) WaSH, Water Engineering and Development Centre (WEDC), International Committee of the Red Cross, and World Bank Water. The peer-reviewed literature search was conducted on 12 October 2017 and the grey literature search was conducted on 6 January 2018.

Table 2 lists the themes and examples of the search terms, and *S1* lists the complete search terms used for the peer-reviewed literature search. The same search terms were used for the grey literature search, modified to accommodate differences in the databases' search systems (e.g. character limits). *S2* shows the grey literature search terms and results.

Table 2 - Examples of environmental health and displaced person terms used to search for peer-reviewed literature in a systematic scoping review of environmental health in transitional displacement

Theme	Examples
Environmental health	
Water	"water"
Sanitation	"sanitation"; "plumbing"; "latrine"
Hygiene	"hygiene"; "soap"; "shower"; "menstrual hygiene"
Waste management	"waste management"; "landfill"; "wastewater"
Energy	"electricity"; "generator"; "lighting"
Vector control	"vector control"; "rodent"; "infestation"
Air pollution	"indoor air"; "ventilation"; "mold"
Food safety	"food safety"; "undercooked"; "foodborne"
Cleaning	"fomite"; "disinfect"; "cleanliness"
Other environmental health issues	"environmental health"; "environmental exposure"; "lead poisoning"; "overcrowding"
Displaced populations	
Refugees	"refugee"; "refugees"
Internally displaced persons	"internally displaced person"; "internally displaced people"
Other displaced populations	"immigrant"; "asylum seeker"

Abstracts and titles of retrieved studies were screened by a team of five reviewers using Cochrane's Covidence online software. Studies that were approved by two reviewers as meeting the inclusion criteria were included in full text review. When the same study was included by one reviewer and excluded by another, a third reviewer made the decision. The same screening method was used for full text review.

121 *2.2 – Study eligibility criteria*

122 Peer-reviewed and grey literature meeting one or more of the criteria shown in **Table 3**
123 were excluded. The same exclusion criteria were used in two scoping reviews of environmental
124 health conditions in emergency and protracted displacement settings (Behnke et al., 2020;
125 Shackelford et al., 2020). Literature that did not address the transitional phase was excluded.

126 **Table 3 - Exclusion criteria for peer-reviewed and grey literature in a systematic scoping**
127 **review of environmental health in transitional displacement**

Exclusion Criteria	Sub-criteria
Not the population of interest	Not a displaced population; Refugees/IDPs who have been officially resettled; Single patient or household rather than a population; Animal migration; Pathogen/biological migration; Epidemiological migration
Reason for displacement not of interest	Not forced migration; Economically-driven migration; Voluntary migration
Setting not of interest	Study subjects/participants living in a setting that was originally meant to be permanent; Study subjects/participants do not live in the same geographic community or setting
Not about environmental health	Not applicable
Study type not of interest	Documents that do not provide new data or analysis (e.g. news articles, letters to the editor, opinion pieces, or newsletters)
Published before 1945*	Not applicable
Not in English	Not applicable
Duplicate	Not applicable
Inaccessible	Not applicable

* The Convention of the Status on Refugees was established in 1951; however, 1945 marked the start of the negotiations that led to the Convention, prompted by the millions of people displaced during and after World War II (Barnett, 2002; Keely, 2001)

128

129 Grey literature studies were excluded if they did not comply with the credibility criteria
130 established by the Accuracy, Authority, Coverage, Objectivity, Date, and Significance
131 (AACODS) checklist (Tyndall, 2010).

132 *2.3 – Data extraction*

The data listed in **Table 4** were extracted from included papers. After extraction, data were tabulated to identify trends across studies and synthesize results.

Table 4 - Data extracted from papers included in a systematic scoping review of environmental health conditions in transitional displacement

Category of data extracted	Example data
Metadata	Paper title, year of study, study type
Contextual characteristics	Study country/countries, Fragile State Index rank (The Fund for Peace, 2017), stage of displacement at time of study
Population characteristics	Origin of refugee/IDP population, reason for displacement
Setting characteristics	Setting establishment date, total setting population, managing authority, funder(s)
Environmental conditions as applicable	Water source(s); sanitation service(s); animal vector(s); crowding
Environmental health exposures and threats	Toxins; risk factors; disease transmission route(s)
Outcomes	Health outcomes; livelihood outcomes; developmental outcomes
Proposed or implemented interventions	Behavioral interventions, policy/governance interventions; infrastructure interventions
Other major themes	Climate/season/natural disaster; resilience; relevant country policies
Major obstacles to improvement	Not applicable
Knowledge gaps	Not applicable
Recommendations	Not applicable

Environmental health condition categories that were documented during data extraction included water supply, water storage, sanitation, hand hygiene, menstrual hygiene, oral hygiene, other hygiene and cleaning, animal vector(s), waste management, surfaces/fomites, crowding, and energy. Studies that reported water quantity provided, available, or used in settings were contextualized with the water standards reported and the amount recommended. Study countries were classified according to the World Bank list of economies (World Bank, 2018). Obstacles to improving environmental health conditions, as well as related recommendations, were divided into the following categories: institutional, political, and implementation.

3. Results

3.1 Search results and study characteristics

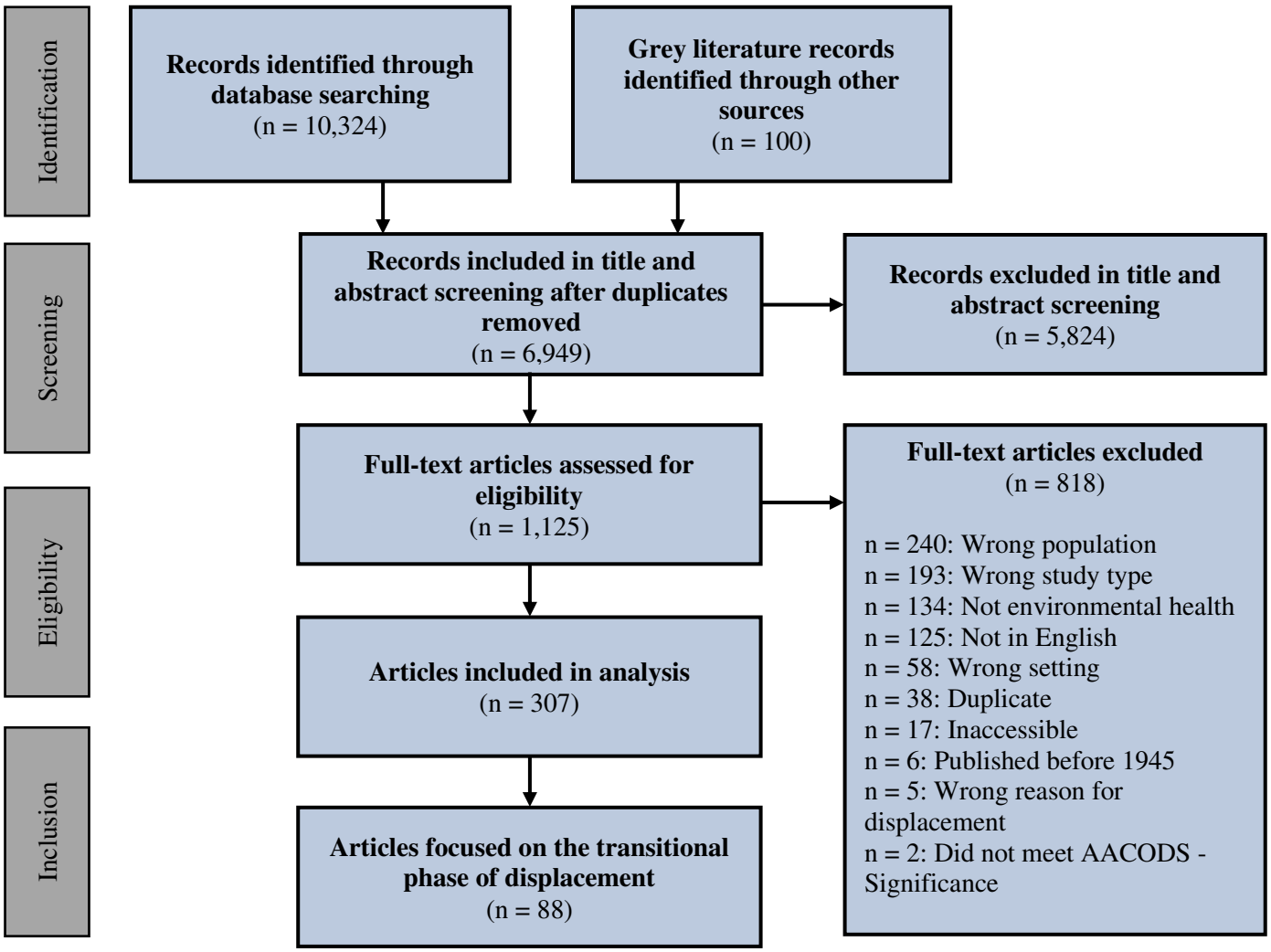

Figure 1 – Search strategy for peer-reviewed and grey literature of a systematic scoping review of environmental health in transitional displacement.

The literature searches yielded 10,324 peer-reviewed and 100 grey literature studies (**Figure 1**). After duplicates were removed, 6,949 studies were included in title and abstract screening and 1,125 full-text articles were assessed. For this review, 88 transitional phase studies were included (**Figure 1**). Of the 88 transitional phase studies, four were grey literature records. **Figure 2** illustrates the distribution of publication years for the 88 studies. The earliest was published in 1946. Forty-one studies (47%) were published between 2010 and 2017.

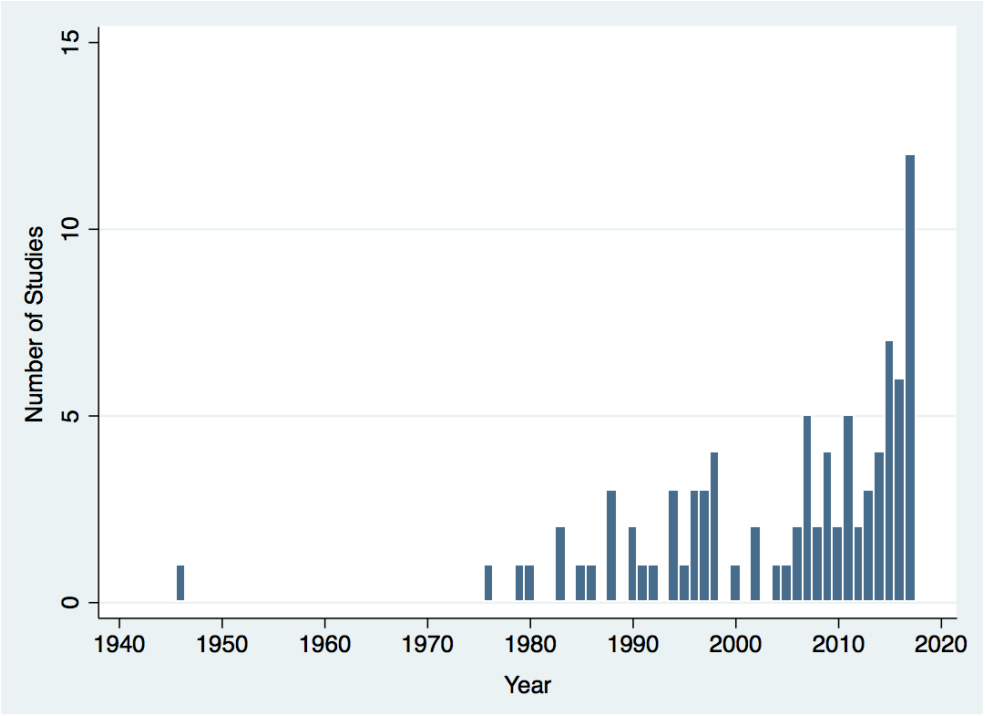

Figure 2 – Distribution of publication years for studies included in a systematic scoping review of environmental health in transitional displacement

We identified 32 quantitative studies, of which 20 were cross-sectional, three were cohort, three were case control, two were retrospective cross-sectional, and one was a controlled trial. We also included 19 descriptive studies, 18 literature reviews, 11 mixed methods studies, six qualitative studies, three conference papers, two feasibility studies, two guidelines, and one simulation (**Table 5**).

Table 5 - Study characteristics for a systematic scoping literature review of environmental health conditions in transitional displacement

Characteristic	Count	Percentage
Paper source		
Peer-reviewed database	84	95%
Grey literature	4	5%

Study type*		
Quantitative	32**	36%
Cross-sectional	20	23%
Cohort	3	3%
Case control	3	3%
Retrospective cross-sectional	2	2%
Controlled trial	1	1%
Descriptive studies	19	22%
Literature review	18	20%
Mixed methods	11	13%
Qualitative	6	7%
Conference paper	3	3%
Feasibility studies	2	2%
Guidelines	2	2%
Simulation	1	1%
*** Study type percentages do not add up to 100% because some studies were classified as more than one study type. ** Some studies could not be classified beyond quantitative, explaining why the studies do not add up to 32.**		

3.2 Setting characteristics

Forty-four countries and the Occupied Palestinian Territories (OPT) were represented. One paper focused on the Sahel region, which comprises several countries, rather than a specific country. All Sustainable Development Goal (SDG) regions, with the exception of Oceania, were represented (United Nations, 2017). The breakdown of study count by country and SDG region is shown **Table 6**.

Table 6 – Sustainable Development Goals region and country classification for studies included in a systematic scoping review of environmental health in transitional displacement

SDG Region	Total count (n)*	Percentage
Sub-Saharan Africa	**26**	**30%**
Kenya	7	8%
South Sudan	6	7%
Ethiopia	5	6%
Somalia	4	5%
Democratic Republic of the Congo	4[1]	5%
Malawi	3	3%

[1] One study took place in Zaire, now known as the Democratic Republic of the Congo.

Central African Republic	2	2%
Chad	2	2%
Ghana	2	2%
Sierra Leone	2	2%
Tanzania	2	2%
Uganda	2	2%
Angola	1	1%
Benin	1	1%
Djibouti	1	1%
Liberia	1	1%
Republic of the Congo	1	1%
Rwanda	1	1%
Sahel Region	1	1%
Zimbabwe	1	1%
Northern Africa and Western Asia	**16**	**18%**
Sudan	7	8%
Iraq	2	2%
Jordan	3	3%
Lebanon	2	2%
Azerbaijan	1	1%
Occupied Palestinian Territory	1	1%
Sahel Region	1	1%
Tunisia	1	1%
Turkey	1	1%
Central and Southern Asia	**14**	**16%**
Bangladesh	7	8%
Pakistan	3	3%
Nepal	2	2%
Sri Lanka	2	2%
India	1	1%
Latin America and the Caribbean	**8**	**9%**
Haiti	7	8%
El Salvador	1	1%
Guatemala	1	1%
Honduras	1	1%
Nicaragua	1	1%
Eastern and South-Eastern Asia	**6**	**7%**
Thailand	4	5%
Indonesia	1	1%
Myanmar	1	1%
Philippines	1	1%
Europe and Northern America	**5**	**6%**
Greece	2	2%
France	1	1%
Germany	1	1%
Ukraine	1	1%

*** Twenty-four studies are not included in Table 6: n=10 (11%) that did not receive a country classification and n=14 (16%) that had a global focus. Global studies referenced multiple countries with brief data for each country. Additionally, several studies received more than one country classification, explaining why the counts do not always add up to the total.**

The most represented region was Sub-Saharan Africa (n=26, 30%), followed by Northern Africa and Western Asia (n=16, 18%) and Central and Southern Asia (n=14, 16%). The least represented regions were Latin America and the Caribbean (n=8, 9%), Eastern and South-Eastern Asia (n=6, 7%) and Europe and Northern America (n=5, 6%). Of the eight studies that were conducted in Latin America and the Caribbean, seven concerned Haiti (**Table 6**).

The majority of studies took place in low-income (n=30, 34%) and lower middle-income countries (n=30, 34%) (**Table 7**). Nine (10%) studies took place in upper middle-income countries and four (5%) in high income countries (World Bank, 2017).

Table 7 - Income level classifications for studies included in a systematic scoping review of environmental health conditions in transitional displacement (World Bank, 2017)

Income level (WB)	Count	Percentage
Low-income	30	34%
Lower-middle income	30	34%
Upper-middle income	9	10%
High-income	4	5%

Seventy-four (84%) studies described conditions in settings that the study authors referred to as camps. Twenty-one (24%) described conditions in settings named using other terms such as “hosting facilities” (Mellou et al., 2017), “informal tented settlements” (UNHCR, 2016) and “evacuation sites” (Brown et al., 1988).

The managing authority of the displacement setting was not provided in 70 (80%) studies. For studies that reported the managing authority, UNHCR (n=8, 9%); non-profit organizations (n=2, 2%); non-governmental organizations (NGOs) (n=3, 3%); government bodies (n=4, 5%); or other (n=4, 5%) were responsible for administration.

3.3 Population characteristics

The study populations were described as refugees in 57 (65%) studies and IDPs in 28 (32%) studies. Eleven (13%) studies used both terms. In five (6%) studies, an alternative term was used, such as "climate migrant" (Ahsan et al., 2011), "asylum seeker" (Mellou et al., 2017) or "climate refugee" (Ahsan et al., 2011). One study (not included in the tally above) classified the population as refugees, even though they did not move across borders (Katraschuk et al., 2016). **Figure 3** shows which terminology was most frequently used in each SDG region.

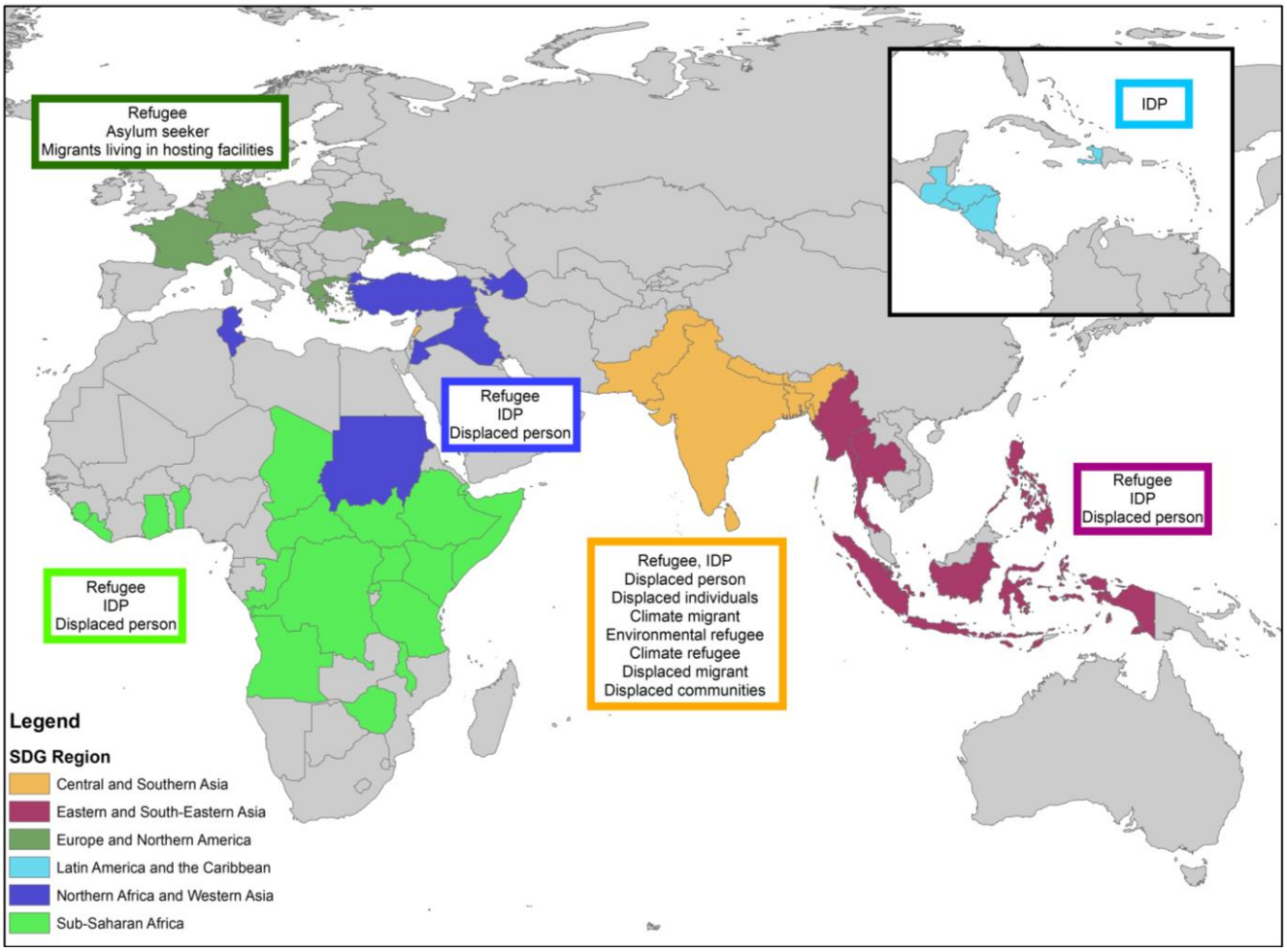

Figure 3 – Map of population terminology used to describe forcibly displaced populations by Sustainable Development Goals region for a systematic scoping review on environmental health in transitional displacement

The most common reason for displacement was conflict (n=39, 44%). Other reasons included natural disasters (n=17, 19%), famine (n=1, 1%) and closure of other camps (n=1, 1%). Natural disasters included earthquakes (n=8, 9%); droughts (n=5, 6%); tsunamis (n=4, 5%); cyclones (n=2, 2%); floods (n=2, 2%); river erosion (n=1, 1%); and hurricanes (n=1, 1%). Thirty-five studies did not report a reason for displacement (*S3*). Reasons for displacement are mapped by SDG region in **Figure 4**.

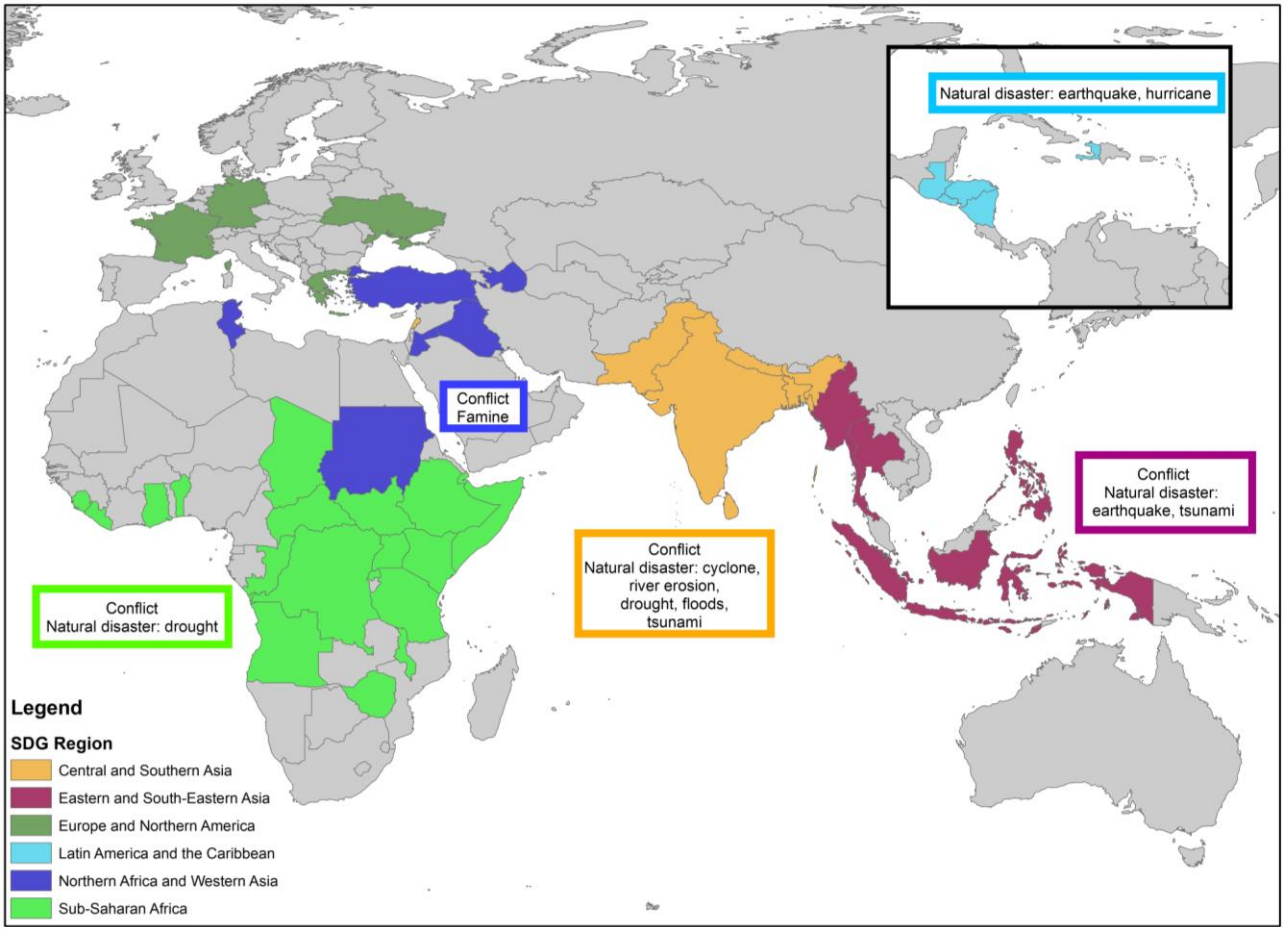

Figure 4 - Map of reported reasons for displacement of populations by Sustainable Development Goals region for a systematic scoping review of environmental health in transitional displacement

3.4 Environmental health conditions

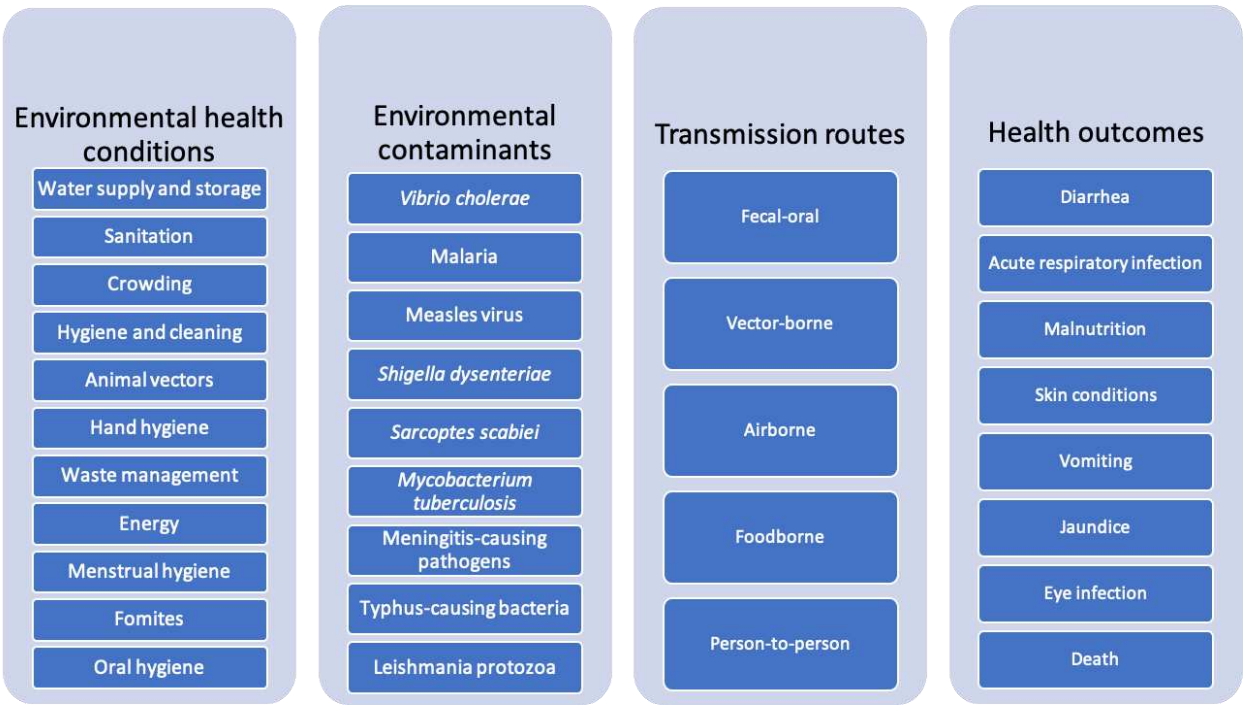

Figure 5 - Summary of environmental health conditions and contaminants, transmission routes, and health outcomes as reported by 88 studies included in a systematic scoping review of environmental health in transitional displacement

An overview of environmental health conditions, contaminants, transmission routes, and health outcomes is available in **Figure 5**, and the number of studies reporting on each environmental health condition is summarized in **Table 8**. *S3* shows which studies reported on each environmental condition. Water supply and sanitation were described most often (n=56, 64% and n=50, 57% respectively). Menstrual hygiene (n=3, 3%), surfaces/fomites (n=3, 3%) and oral hygiene (n=2, 2%) were described least often.

Table 8 - Environmental health conditions reported in a systematic scoping review of environmental health in transitional displacement

Topic	Count	Percentage
Water Supply	56	64%
Sanitation	50	57%
Crowding	25	28%
Other Hygiene and Cleaning	25	28%
Animal Vector(s)	23	26%

Water Storage	19	22%
Hand hygiene	17	19%
Waste Management	13	15%
Energy	10	11%
Menstrual Hygiene	3	3%
Surfaces/Fomites	3	3%
Oral Hygiene	2	2%
*** Water Supply includes water source, use, and amount available or provided. ** Other Hygiene and Cleaning includes food handling, cleaning clothes, personal hygiene other than hand and oral hygiene, and general hygiene training.**		

Table 9 compares the quantity of water provided, available, or used in settings to the water standards reported and the amount recommended. The amount of water provided, available or used in camps ranged from one to 40 liters/person/day (L/p/d). The recommended water amount was reported in various ways, with some studies reporting drinking and domestic needs separately and others reporting them together. The lowest recommended water amount was 1.8 liters/person/day (for drinking) and the greatest was 40-60 L/p/d for healthcare settings.

Table 9 - Water amounts provided, available or used versus recommended, according to studies included in a systematic scoping review of environmental health in transitional displacement

Author(s)	Water Amount Actually Provided, Available or Used (Liters/Person/Day)	Standard Reported/ Recommended Water Amount
Azman et al., 2017	15	N/A
Cronin et al., 2008	camp averages, 2003, 2004, 2005: 23.1, 35, 31.3	>20 L/p/d (UNHCR, 2006, 2000); >15 L/p/d (The Sphere Project, 2004)
Cronin et al., 2009	8 to 20	N/A
De Buck et al., 2015	N/A	1.8 to 7.0 (drinking); 10 to 20.8 (domestic) (EPA, 2011; FEMA and American Red Cross, 2004; OFDA, 2005; Reed and Shaw, 1999; The Sphere Project, 2011; UNHCR, 2007; USACE, 2012; White et al., 1972)
De Lange et al. 2014	7.5 to 15	(The Sphere Project, 2011)
Gambrill 1994	5	Minimum 20 L/p/d (no specific standard cited)

McKenzie and De la Haye, 1996	4 camps, water available and average consumed in each: 18.5 (available), 13 (consumed); 9.2 (available), 7.4 (consumed); 20.4 (available), 12.8 (consumed); 18.5 (available), 11.2 (consumed)	N/A
Milton et al., 2017	18 in one camp; 16 in another	N/A
Rebaudet et al., 2013	1	N/A
Toole and Waldman 1997	6	Minimum 15 L/p/d (UNHCR, 1992)
Walden et al. 2005	11 to 15 L/household/day*	N/A
Toole and Malkki, 1992	1 to 3	Minimum 15-20 L/p/d 40-60 L/patient/day in healthcare settings (UNHCR, 1982)
UNHCR, 2008	3 camp averages: 40; 20.5; 15.2	>20 L/p/d; >15 L/p/d (The Sphere Project, 2004; UNDP, 2006; UNHCR, 2006, 2000)
UNICEF and Hydroconseil, 2017	35	35 L/p/d UNICEF and national sector standards
***Did not provide L/person/day.**		

Drinking water treatment was reported in 16 (18%) studies, while five (6%) studies explicitly reported that water was not treated. Thirty-eight (43%) studies reported on water supply but did not report on water treatment (*S3*).

The number of people per toilet or latrine ranged from six to 1,013. The largest people/toilet or latrine standard reported was 20 (**Table 10**). Open defecation was reported in nine (10%) studies (*S3*).

Table 10 - Latrine or toilet ratio versus standard reported by studies included in a systematic scoping review of environmental health conditions in transitional displacement

Author(s)	Actual People/Latrine or Toilet Ratio	Standard Reported
Azman et al., 2017	>20	N/A
Cronin et al., 2008	Camp averages, 2003, 2004, 2005: 27.7, 36, 26.9	20 people/latrine

		(UNHCR, 2000, 2006 and The Sphere Project, 2004)
Cook 1946	"About 19"	N/A
Cronin et al., 2009	6-48	N/A
T De Veer, 1996	50	N/A
Dhesi et al. 2018	75	N/A
Khan and Munshi 1983	50	N/A
Milton et al., 2017	16 in one setting; 20 in another	N/A
Schuller and Levey, 2014	1,013 in one setting; 273 in another	20 people/latrine (The Sphere Project, 2004)
UNHCR, 2008	N/A	20 people/latrine (UNHCR, 2000, 2006 and The Sphere Project, 2004)
UNICEF and Hydroconseil, 2017	14	14 people/latrine UNICEF guideline and national sector standards

3.5 Exposures, outcomes and risk factors

The pathogenic exposures, transmission routes, outcomes and risk factors are summarized in *S4*.

Sixty (68%) studies reported at least one specific pathogen responsible for causing illness (*S4*).

Table 11 lists the top ten pathogens most frequently reported.

Table 11 - Ten most frequently reported pathogens in a systematic scoping review of environmental health in transitional displacement

Pathogen	Disease name	Count	Percentage
Vibrio cholerae	Cholera	27	31%
Malaria	Malaria	18	20%
Plasmodium falciparum		8	9%
Plasmodium varix		4	5%
Measles virus	Measles	11	13%
Hepatitis E virus	Hepatitis E	10	11%
Shigella/ *shigella dysenteriae*	Shigellosis	9	10%
Sarcoptes scabiei var hominis	Scabies	7	8%
Mycobacterium tuberculosis	Tuberculosis	7	8%

Meningitis-causing pathogens	Meningitis	6	7%
Typhus-causing bacteria	Typhus	5	6%
Rickettsia typhi	Murine Typhus	1	1%
Leishmania protozoa	Leishmaniasis	4	5%
	Visceral (Kala-azar)	1	1%
	Cutaneous	1	1%

254
255 The most commonly-reported health outcome was diarrhea (n=35, 40%) (*S4*). In addition
256 to health outcomes resulting from the pathogens outlined in **Table 11** and *S4*, health outcomes
257 included the following: acute respiratory infections and other general respiratory infections
258 (n=16, 18%); malnutrition (n=9, 10%); death (n=7, 8%); general skin conditions (n=6, 7%);
259 vomiting (n=4, 5%); jaundice (n=3, 3%); and eye infection (n=2, 2%) (*S4*).
260 The following transmission routes for pathogens were reported: fecal-oral; vector-borne;
261 airborne; foodborne; and person-to-person transmission. In several studies, the transmission
262 route was not explicitly stated but was implied based on the associated disease. Risk factors[2]
263 implicated in adverse health outcomes were identified in 34 (39%) studies (*S4*). The most
264 reported risk factor was overcrowding, reported in 13 (15%) studies. Ten (11%) studies reported
265 malnutrition as a risk factor and five (6%) of them attributed the malnutrition to poor food
266 quality (Barbieri et al., 2017; Cronin et al., 2008; Mohamed et al., 2015; Prothero, 1994; Shears,
267 1991) or inadequate food quantity (Connolly et al., 2004; Cronin et al., 2008; Mohamed et al.,
268 2015; Prothero, 1994; Shears, 1991). Poor water quality or inadequate water supply were
269 reported in eleven studies (13%). Other implicated risk factors were poor sanitation (n=9, 10%)
270 and poor hygiene (n=7, 8%). One study reported a lack of hand washing prior to eating and a

[2] Studies were still included in a risk factor count if a particular risk factor was implied without being stated verbatim (for example, high population density for "overcrowding").

lack of soap in households as risk factors for cholera (Hatch et al., 1994). Less frequently reported risk factors were waste management (n=2, 2%) (Connolly et al., 2004; Prothero, 1994), limited access to health care (n=2, 2%) (Connolly et al., 2004; Kimbrough et al., 2012) and young age (n=2, 2%) (Desenclos et al., 1988; Mellou et al., 2017). Pregnancy (n=3, 3%) (Cronin et al., 2008; Guerrero-Latorre et al., 2016; Mcgready et al., 2010) and HIV-positive status (n=2, 2%) (Cronin et al., 2008; Kimbrough et al., 2012) were reported as morbidity and mortality risk factors.

3.6 Obstacles to improvement of environmental health services

Obstacles to improvement in environmental health services were reported in n=22 (25%) studies (**Table 12 and S3)**. Obstacles were divided into three categories: institutional obstacles; political obstacles; implementation obstacles **(Table 12)**.

Table 12 - Summary of obstacles and recommendations from studies included in a systematic scoping review on environmental health in transitional displacement

	Obstacles	Recommendations
Institutional	• Legal/policy environments • Management issues	• More effective legal/policy structures • Management improvements • Standards and indicators
Political	• Conflict and instability • Resource scarcity • Financial concerns	• Improve coordination across governments and other institutional bodies • Curb violence • Increase funding from private organizations
Implementation	• Infrastructure • Behavioral • Monitoring and research	• Increase education and awareness • Targeted interventions • Infrastructural improvement and targeted adoption of technology

		• Fill research gaps

Institutional obstacles included refugee-related policies and issues with setting management (Behnke et al., 2020). National policies requiring refugees to remain in camps were reported to have resulted in refugees not seeking government services (Mohamed et al., 2014). Lack of coordination among NGOs in the WaSH sector and other sectors, such as shelter and health, were reported to have made the provision of sanitary facilities difficult (UNICEF and Hydroconseil, 2017). Humanitarian agencies that build or provide facilities often do not have decision making power in settlements (Tota-Maharaj, 2016). Other management issues included lack of coordination among planning and development authorities (Ahsan et al., 2011) and short duration of projects (UNICEF and Hydroconseil, 2017). Defining needs and designing immediate and long-term plans over the course of a few months was reported to result in decreased quality of facilities (UNICEF and Hydroconseil, 2017).

Political obstacles included conflict and instability, resource scarcity, and financial concerns. One study reported riots after national elections, which prevented displaced people in Haiti from reaching health centers (Farmer et al., 2011). Urban refugees who feared government authorities

avoided facilities provided by the government in Kenya (Mohamed et al., 2014). Rival military forces reportedly denied food and health care access to IDPs in Sudan (Toole and Waldman, 1990). Conflict at the community level was reported as an obstacle to improvement in Lebanon, and resentment was reported among the municipalities, since they were not involved in NGO activities nor execution of plans (UNICEF and Hydroconseil, 2017). Because of the assistance that refugees received, the municipality viewed host populations in Lebanon, who did not receive any assistance, as more vulnerable (UNICEF and Hydroconseil, 2017).

Scarcity of the following resources was reported: soap (Farmer et al., 2011), water (Farmer et al., 2011; Rebaudet et al., 2013; UNICEF and Hydroconseil, 2017), purification tablets (Farmer et al., 2011) and toothpaste (Qayum et al., 2011). Financial concerns were reported for both governments and displaced people. One study reported that after an earthquake in Haiti, the Haitian government received 1% of emergency aid, leaving the government underfunded (Schuller and Levey, 2014). Another study reported that displaced people could not purchase mosquito repellant because of insufficient income (Mcgready et al., 2010).

Implementation obstacles included infrastructural and behavioral obstacles. Infrastructural obstacles included muddy water that required heavy chlorination (Malholland, 1985) and sewage/drainage problems (Tota-Maharaj, 2016). In Chad, there was little knowledge about the water table and sediment depth; as a result, developers could not be certain that the tubewells they constructed would be sustainable (Lytton et al., 2007). Short project duration was also reported as an obstacle to effective infrastructure interventions; in Lebanon, a sustainable waste collection system could not be developed because of the short timeframe of the project (UNICEF and Hydroconseil, 2017).

The level of community engagement was reported to be related to both infrastructural and behavioral obstacles. In Lebanon, developing sustainable WaSH programs was challenging because neither the host community nor the refugees were involved in the design, planning and execution of projects. As a result, they could not maintain the WaSH services or the infrastructure without external support (UNICEF and Hydroconseil, 2017). In Chad, people were concerned about the construction of tubewells, since they worried that the water table would decrease and destroy their trees (Lytton et al., 2007).

3.7 Recommendations for improvement of environmental health conditions

About half (n=45, 51%) of the included studies provided recommendations to improve environmental health conditions in the transitional phase of forcible displacement (*S3*). Recommendations were divided into the same three categories as obstacles: institutional, political and implementation (**Table 12**).

Institutional recommendations included changing policies and setting management as well as using and adhering to environmental indicators and standards. Policy recommendations were general; one study recommended that policies for disease prevention, such as vaccinations, be agreed upon (Toole and Malkki, 1992); another suggested that NGOs should assume management responsibility in all camps (Schuller and Levey, 2014). On setting management related to WaSH, it was recommended that service providers and setting residents assist camp management agencies in maintenance activities. Camp management agencies and WaSH service providers were named as the responsible parties for ensuring that tools and materials needed for water supply, such as taps and pipes, are available and functional (Tota-Maharaj, 2016).

With respect to standards, one study recommended that hygiene standards be developed to prevent Hepatitis A virus (Mellou et al., 2017). Additionally, indicators were recommended for programs that help displaced people (Spiegel et al., 2002). A more specific indicator recommendation was that zone specialists in WaSH offices in Lebanon collect data and send them to the UNICEF office in the capital city, Beirut; these data would presumably then be an indicator of the conditions across Lebanon (UNICEF and Hydroconseil, 2017).

Political recommendations focused on improving coordination across governments and other institutional bodies, curbing violence (Toole and Waldman, 1997) and increasing funding from private philanthropic organizations (Milton et al., 2017) (**Table 12**). Recommendations included a suggestion that local, national, and regional governments develop a better

353 coordination strategy (Ahsan et al., 2011) and local governments, national governments and
354 NGOs collaborate (Schuller and Levey, 2014). Dialogue between the national governments of
355 Myanmar and Bangladesh was recommended (Milton et al., 2017). Another study recommended
356 that different sectors of local government, such as the health authorities, municipal council, and
357 water board, collaborate (Wickramasinghe et al., 2007). UNICEF and Hydroconseil (2017) made
358 recommendations for how the UNICEF WaSH program in Beirut could improve coordination;
359 they suggested that UNICEF should coordinate with municipalities when designing and
360 implementing projects, and work with local NGOs to implement WaSH programs, as long as
361 local NGOs had the capacity (UNICEF and Hydroconseil, 2017).
362 The recommendations made most frequently concerned implementation. They included:
363 increasing education and awareness, developing targeted interventions, improving infrastructure,
364 data collection and monitoring, and filling knowledge gaps (**Table 12**). Recommendations
365 concerning education and awareness included: health education sessions to increase awareness of
366 the dangerous health effects of smoking (Jarrah et al., 2006); hygiene awareness and education
367 programs (Qayum et al., 2011; Toole and Malkki, 1992; Toole and Waldman, 1997); training
368 refugees to provide their own primary health care (Dick and Simmonds, 1983); and culturally
369 and socially relevant hygiene promotion sessions (UNICEF and Hydroconseil, 2017).
370 A frequently-recommended intervention was targeted vaccine campaigns. Lam et al.
371 (2015) recommended the provision of a measles vaccine for both displaced and host populations.
372 The same study emphasized the need to make vaccines, specifically against cholera, available to
373 displaced and host populations and to investigate the use of newer vaccines (Lam et al., 2015).
374 Mellou et al (2017) discussed a vaccination program in the context of the host country Greece;
375 and recommend that all refugee children be vaccinated in accordance with the national childhood

immunization program (Mellou et al., 2017). It was recommended that neighborhoods surrounding the camps in Haiti also receive water and sanitation services (Schuller and Levey, 2014), and that host communities in Lebanon—in addition to refugees—be supported by capacity-building activities and stabilization projects (UNICEF and Hydroconseil, 2017).

To improve infrastructure, one study recommended constructing demonstration latrine areas that would exemplify good pit construction; and that posters, technical leaflets, and promotional weeks be used to share information about latrine construction (McKenzie and De la Haye, 1996). Recommended technologies included centralized and upgraded cooking technologies in refugee camps and informal settlements (Barbieri et al., 2017) and percolating filters to improve wastewater treatment (Daniel and Lloyd, 1980).

Several studies recommended that data collection and monitoring be improved. Suggestions included enhanced surveillance of Hepatitis E virus (Azman et al., 2017); expansion of Health Information Systems to standardize and strengthen data collection and analysis (Cronin et al., 2008); monitoring water quality (De Veer, 1996); monitoring trends in the health problems of those crossing borders and living in border regions (Kamel, 1997); and more surveillance of TB among IDPs and in urban settings (Kimbrough et al., 2012).

Lastly, further research was recommended in several studies. Research recommendations included: performing research at the field level in order to understand how insufficient WaSH services affect refugees (Cronin et al., 2008); studying the effects of WaSH interventions on diseases beyond diarrheal diseases (Ramesh et al., 2015); and studying the role of local governments in WaSH and displacement response to clarify their role (UNICEF and Hydroconseil, 2017).

4. Discussion

4.1 Exposures, risk factors, and outcomes

Vibrio cholerae was the most commonly reported pathogen in displacement settings. The most commonly reported adverse health outcomes were diarrheal diseases, including dysentery. These diseases were most often associated with inadequate water, inadequate sanitation, and overcrowding. Most of the studies reporting diarrheal disease as an adverse health outcome did not identify the transmission route. However, studies reporting fecal-oral transmission for diarrheal disease-causing pathogens identified a need for detailed investigations of disease outbreaks, further assessments of water quality, and greater health data collection and analysis (Cronin et al., 2008; Ramesh et al., 2015; Rebaudet et al., 2013)

The most common risk factor for infectious diseases was overcrowding. Few data on setting capacity versus setting population size were available to analyze how many of the reported settings were operating above capacity. Overcrowding is associated with transmission of communicable disease (Connolly et al., 2004) as well as mental health challenges (Ziersch et al., 2017). No study identified open defecation as a risk factor for infectious diseases, which is surprising, and suggests an underreporting of open defecation in the transitional phase of displacement (Mara, 1996; Okullo et al., 2017).

It is important to note that several of the identified adverse health effects that are caused or reinforced by poor environmental health conditions are interrelated. Individuals already suffering from communicable or non-communicable diseases need consistent access to a nutritious diet and have higher energy requirements to strengthen their health and prevent opportunistic infections. Food insecurity over time may lead to poor nutritional status and has subsequent negative health implications at various levels: malnourished individuals with weaker immune systems are more vulnerable and susceptible to vector-related diseases such as malaria and to

422 waterborne diseases such as cholera. In addition, infections become more virulent in these cases:
423 the progression of cholera or malaria, for example, is worse in individuals with a poor health
424 status, while exacerbating the nutritional status further. Generally, a weakened immune system
425 aggravates infections, while at the same time decreasing the effectiveness of medication
426 (Anthonj et al., 2015; Paquet and Hanquet, 1998).

427 *4.2 Defining and contextualizing the "transitional phase" of displacement*

428 This is the first systematic scoping review reporting on environmental health conditions in
429 the transitional phase of forcible displacement. The transitional phase is dynamic and context-
430 specific, which makes a clear definition challenging. The timeline used in this review was based
431 on the 2017 UNHCR WaSH Manual, defining the transitional phase as the period between 6
432 months and two years after displacement (UNHCR, 2017). However, this is not a universal
433 method of classification. For example, Wickramasinge, et al. (2007) use alternative definitions of
434 the emergency and transitional phases, where emergency (immediate) is within the first month of
435 the disaster and transition (intermediate) is two to seven months after the disaster. However, the
436 wide variation in circumstances described in the studies included in this review suggest that
437 phases of displacement should not be defined by an arbitrary timeline, but rather by an analysis
438 of the conditions in which a displaced population is living. Our recommendation is to develop a
439 scale to classify displacement events into the emergency, transitional, and protracted phases on a
440 case-by-case basis, based on an analysis of their specific contexts and circumstances. Such a
441 scale would allow for more accurate classification of crisis phases and clearer definitions, which
442 could in turn trigger more tailored interventions and expedite the management and funding
443 changes that are needed to develop longer-term solutions.

Developing such a scale would require a better understanding of the transition from short-term to long-term displacement. Kett (2005) argues that, in order to classify a setting as transitional, three characteristics can be analyzed: the population itself; the settlement's internal institutions; and external management. During the process of transition, we would expect the population of displaced people to shift from a period of influx to relative stability. Within the settlement, rules and processes are expected to stabilize and become more formalized. External management would shift from aid agencies, such as NGOs, to the host government (Kett, 2005).

Of the 88 transitional phase papers included in this study, only 28 (32%) focused on the transitional phase exclusively. This suggests a research gap on environmental health conditions specific to the transitional phase. Studies focusing on the transitional phase generally described what was happening in a specific setting at a specific time, rather than contextualizing environmental health conditions, exposures, and outcomes within the transition process from an emergency to a protracted crisis. Exploring environmental health conditions during the transitional phase of displacement is more practical if researchers approach this phase with the understanding that the context is fundamentally different from emergency and protracted situations. For example, one study of tsunami survivors in Sri Lanka contrasted the health services provided during the transitional (intermediate) phase with those provided during the emergency (immediate) phase and addressed questions about the shift away from emergency response (Wickramasinghe et al., 2007). Additionally, a study of bathing and cleaning practices in a camp in Pakistan considered the shift in hygiene needs between the initial and long-term displacement periods and thus presented hygiene as a fluid need that changes over time (Qayum et al., 2011).

Beyond further research specific to the transitional phase, studies should consider how the process of transition affects environmental health conditions and differs from the other phases. In this paper, we analyze the studies classified as transitional phase and describe trends in the environmental health conditions. However, another suggestion for future research is to flip this approach: to first analyze the environmental health conditions of a setting, and then determine whether that setting is in transition. Through a flipped approach, we can ensure that the resources provided to a setting are appropriate given the conditions, rather than distributed based on a predetermined timeline.

4.3 Vulnerable populations

Adverse health effects in the context of forcible displacement have disproportionate effects on the most vulnerable populations, including children, orphans, pregnant women, nursing mothers, and people with chronic diseases and disabilities. Moreover, these populations are dependent upon social care and support networks that may not be available during displacement (Anthonj et al., 2015).

Among IDPs in Africa, women and children, who constitute over 70% of IDPs, are high-risk groups for a wide range of health conditions. Women are exposed to physical and sexual violence, resulting in injuries, sexually transmitted infections including HIV, unwanted pregnancies, and mental health effects (Owoaje et al., 2016). Children, particularly those under the age of five, are more prone to communicable diseases, including infectious diseases and acute respiratory infections, and to acute and chronic malnutrition in IDP camps (Guerrier et al., 2009; Hashmi et al., 2019; Owoaje et al., 2016). People living with disabilities are highly vulnerable as well, and are among the most hidden, excluded and neglected of all displaced and conflict-affected populations (Reilly, 2010). According to Nishikori et al. (2006), analyzing data

from evacuation camps for IDPs in the course of tsunami in Sri Lanka, women, children below the age of five, and the elderly have a higher mortality rate than other groups. Due to their heightened vulnerabilities and decreased visibility, any monitoring, research, and implementation efforts to address the needs of displaced populations should emphasize these groups.

4.4 Evidence gaps and future research needs

The studies included in this review had vital information gaps. The majority of studies (66%) did not report risk factors for disease, and 39% of studies reporting on a pathogen did not report the transmission route. Specific populations affected by disease, the number of people affected and the age of the people affected were not always reported. The majority of studies (80%) did not include the setting managing authority, and data on age and funding of infrastructure and setting capacity as compared to population were not provided. These gaps were noteworthy because managing authorities and funding sources can change during the transition from emergency to protracted displacement. A more complete understanding of the managing authority and funding sources during each phase would help policymakers to set clearer management and funding expectations.

Menstrual hygiene, oral hygiene and evidence related to fomite contamination was seldom discussed among studies included in this review. No study reported associations between open defecation or livestock and disease transmission. We suggest that future research is necessary to fill these evidence gaps. Additionally, 76% of the studies did not report obstacles to improvement, and studies' recommendations were lacking in specificity. Several studies made vague recommendations without identifying responsibility, and others did not provide recommended methods for improving and monitoring environmental health services, such as specific standards or guidelines.

512 *5.5 Limitations*

513 Given the breadth of this scoping review, some relevant terms or databases may have
514 been omitted. Additionally, although we worked to minimize bias and human error in the
515 screening, data extraction, and analysis phases of the study, some errors or oversights may have
516 occurred. Humanitarian emergencies and forcible displacement are dynamic situations, and
517 numbers change frequently due to the sudden nature of emergencies. Humanitarians working
518 with displaced populations often write short reports, overviews, situation analyses that are
519 typically updated daily, but such information is generally not published nor otherwise made
520 publicly available.

521 This review was restricted to publications that were available in English, which may have
522 affected the geographic representation of the studies included. For example, despite having large
523 displaced populations, few studies discussed Latin America and the Caribbean (n=8; 9%) or
524 Eastern and Southeastern Asia (n=6; 7%). In some cases, it was not possible to determine when
525 the displacement occurred; in these cases, we included the publications in our analysis to avoid
526 data loss. As a result, some incorrect categorization may have occurred during data extraction.
527 Due to the scoping nature of this review, the results were heterogeneous and we were not able to
528 account for the quality of the data presented.

529 **5. Conclusion**

530 Forced displacement is a growing challenge that often persists past the emergency phase.
531 This is the first systematic review to address environmental health conditions, exposures, and
532 outcomes in the transitional phase of displacement. This time between the emergency phase and
533 more stable protracted situations is critical for the transition from humanitarian response to a
534 more sustainable, development-oriented approach. This review analyzes available evidence to

build a better understanding of the environmental conditions, exposures, and outcomes that are prevalent in this phase. The goal of this study is to help avoid coordination failures among stakeholders due to mismatched objectives, funding, and implementation, and the misallocation of resources, which may lead to adverse health and development outcomes. Our results suggest that the environmental health conditions in the transitional phase of displacement are often poor, and that institutional, political, and implementation-related obstacles prevent improvement.

Our findings are in line with Abbas et al. (2018), noting that evaluation of current policy shows that the basic needs to migrant populations are not met, even in the countries that put most efforts in addressing their needs. In order to improve environmental health service provision in these settings, better coordination and accountability across all levels of government and NGOs around the world, and the adoption of respective policies, should be prioritized, and emergency preparedness and response activities should particularly target vulnerable groups (Owoaje et al., 2016). Moreover, each crisis should be assessed individually to determine resource allocation based on the conditions and needs in of each specific displaced population, rather than categorized as “emergency,” “transitional,” or “protracted” based on an arbitrary timeline. Providing sustainable environmental health services to displaced populations will require more tailored funding and interventions, as well as more intentional planning for the transition from emergency response to sustainable development.

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