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

3
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18
19
20 **Abstract**

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

40
41 Keywords: refugee; internally displaced; migration; humanitarian; development

43 1. Introduction

44 By the end of 2019, there were 79.5 million forcibly displaced people worldwide, and
45 30,000 people were forcibly displaced every day (UNHCR, 2019; USA for UNHCR, 2020a) (see
46 **Table 1** for definitions). Settlements for displaced populations are primarily designed to provide
47 rapid onset emergency support, such as basic shelter, medical care, nutrition, and water,
48 sanitation and hygiene (WaSH) facilities. However, they often fail to meet minimum
49 environmental health standards, and are ill-suited to longer-term displacement (Behnke et al.,
50 2020; Cronin et al., 2008; Sphere Association, 2018; van der Helm et al., 2017).

51 Ensuring adequate environmental health services for displaced persons is critical for
52 human health and development, and is fundamental to achieving Sustainable Development Goal
53 6, which calls for “availability and sustainable management of water and sanitation for all”
54 (Cronk et al., 2015; United Nations General Assembly, 2015). Most humanitarian crises persist
55 for several years; less than one in forty refugee crises is resolved within three years, and more
56 than 80% last more than a decade. Displaced populations’ needs for environmental health
57 services evolve even as international attention and initial spikes in funding subside (Crawford et
58 al., 2015; Mason and Mosello, 2016). This can result in inadequate and unsustainable
59 environmental health services, leading to a heightened risk of communicable diseases and
60 increased morbidity and mortality (Cronin et al., 2008; Schuller and Levey, 2014).

61 The United Nations High Commissioner for Refugees (UNHCR) WaSH manual
62 categorizes crises into phases based on the length of time that a population is displaced:
63 “emergency” (0-6 months), “transitional” (6 months – 2 years), or “protracted” (2+ years)
64 (UNHCR, 2017). While the priority in the emergency stage is to save lives through rapid
65 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).

87 **2. Methods**

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

- 92 1. What are the environmental health conditions, exposures, and outcomes in the
 93 transitional phase of forcible displacement?
- 94 2. What obstacles are reported to impede improvements in environmental health in these
 95 settings?
- 96 3. What recommendations do studies give to improve environmental health in these
 97 settings?
 98

99 *2.1 – Search strategy*

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

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

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

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

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

115
 116 Abstracts and titles of retrieved studies were screened by a team of five reviewers using
 117 Cochrane’s Covidence online software. Studies that were approved by two reviewers as meeting
 118 the inclusion criteria were included in full text review. When the same study was included by
 119 one reviewer and excluded by another, a third reviewer made the decision. The same screening
 120 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

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

135 **Table 4 - Data extracted from papers included in a systematic scoping review of**
 136 **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

137
 138 Environmental health condition categories that were documented during data extraction included
 139 water supply, water storage, sanitation, hand hygiene, menstrual hygiene, oral hygiene, other
 140 hygiene and cleaning, animal vector(s), waste management, surfaces/fomites, crowding, and
 141 energy. Studies that reported water quantity provided, available, or used in settings were
 142 contextualized with the water standards reported and the amount recommended. Study countries
 143 were classified according to the World Bank list of economies (World Bank, 2018). Obstacles to
 144 improving environmental health conditions, as well as related recommendations, were divided
 145 into the following categories: institutional, political, and implementation.

146 **3. Results**

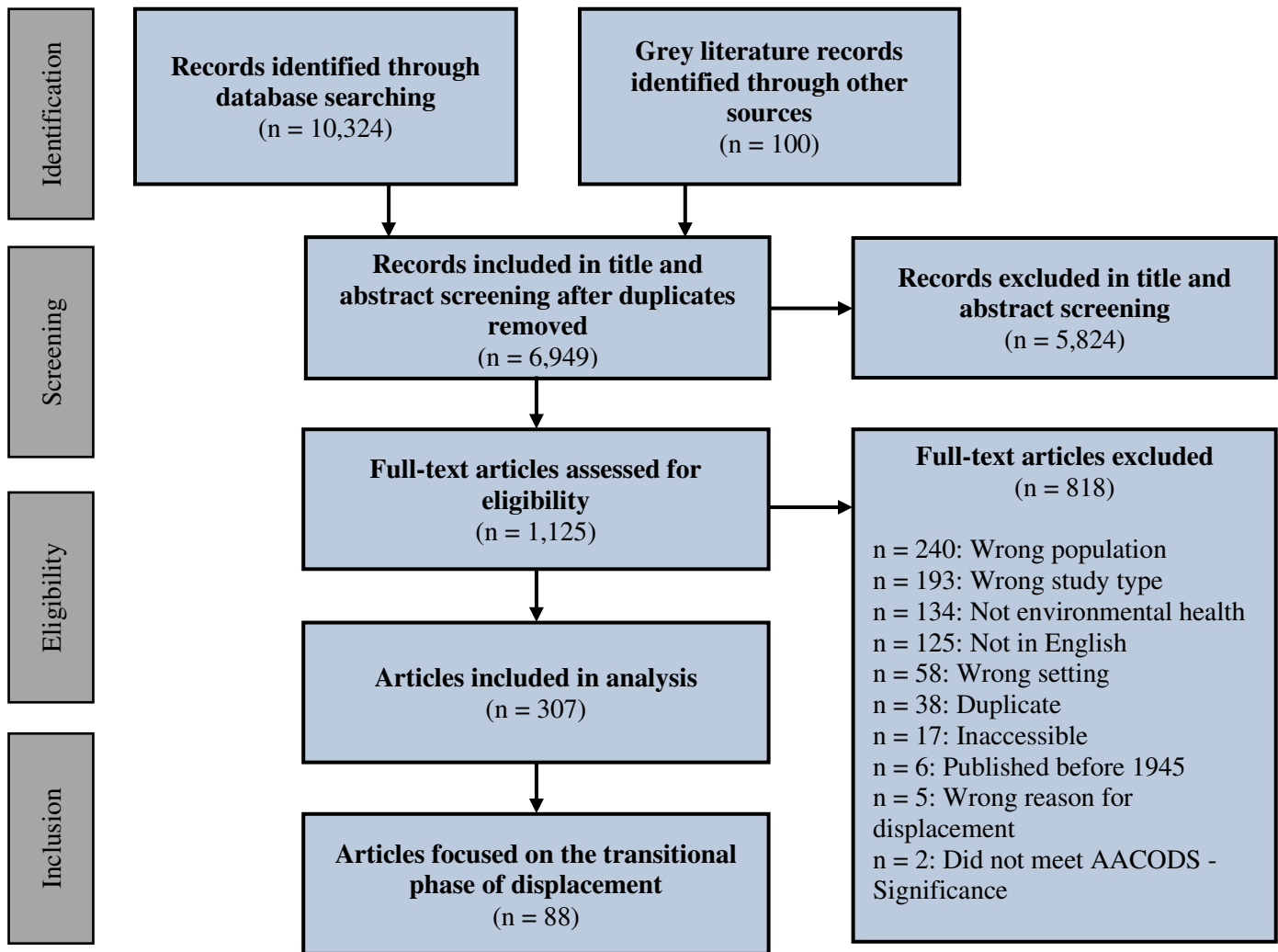


Figure 1 – Search strategy for peer-reviewed and grey literature of a systematic scoping review of environmental health in transitional displacement.

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

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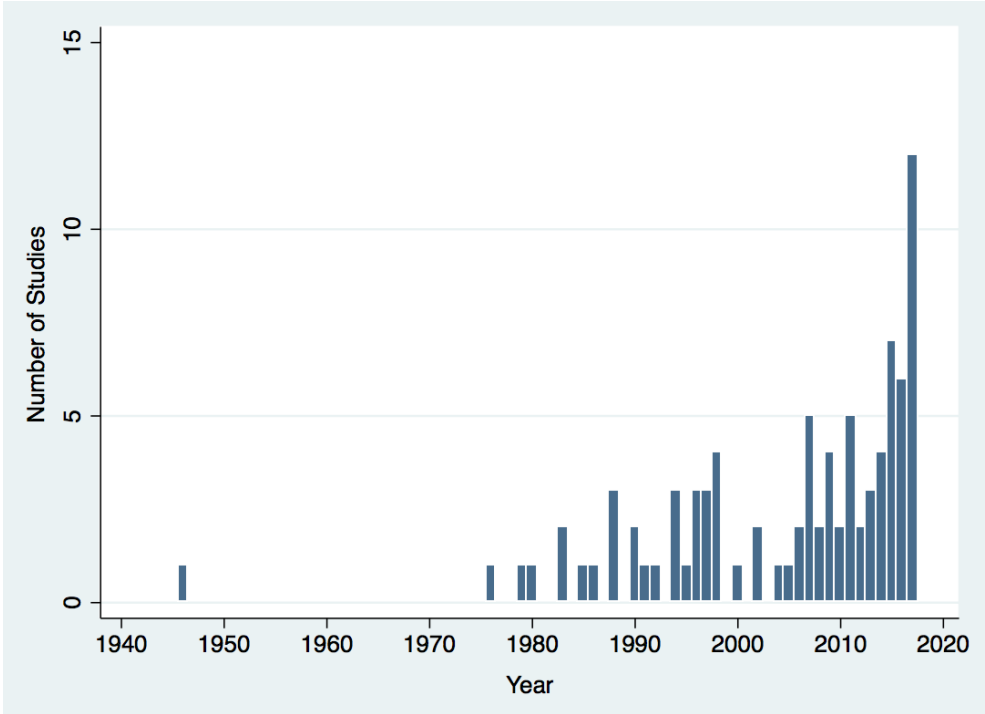


Figure 2 – Distribution of publication years for studies included in a systematic scoping review of environmental health in transitional displacement

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%
<i>Cross-sectional</i>	20	23%
<i>Cohort</i>	3	3%
<i>Case control</i>	3	3%
<i>Retrospective cross-sectional</i>	2	2%
<i>Controlled trial</i>	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.

173

174 *3.2 Setting characteristics*

175 Forty-four countries and the Occupied Palestinian Territories (OPT) were represented.

176 One paper focused on the Sahel region, which comprises several countries, rather than a specific

177 country. All Sustainable Development Goal (SDG) regions, with the exception of Oceania, were

178 represented (United Nations, 2017). The breakdown of study count by country and SDG region

179 is shown **Table 6**.

180 **Table 6 – Sustainable Development Goals region and country classification for studies**
181 **included in a systematic scoping review of environmental health in transitional**
182 **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%
<i>Sudan</i>	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.

183
 184 The most represented region was Sub-Saharan Africa (n=26, 30%), followed by Northern
 185 Africa and Western Asia (n=16, 18%) and Central and Southern Asia (n=14, 16%). The least
 186 represented regions were Latin America and the Caribbean (n=8, 9%), Eastern and South-Eastern
 187 Asia (n=6, 7%) and Europe and Northern America (n=5, 6%). Of the eight studies that were
 188 conducted in Latin America and the Caribbean, seven concerned Haiti (**Table 6**).

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

192 **Table 7 - Income level classifications for studies included in a systematic scoping review of**
 193 **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%

194
 195 Seventy-four (84%) studies described conditions in settings that the study authors
 196 referred to as camps. Twenty-one (24%) described conditions in settings named using other
 197 terms such as “hosting facilities” (Mellou et al., 2017), “informal tented settlements” (UNHCR,
 198 2016) and “evacuation sites” (Brown et al., 1988).

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

203 3.3 Population characteristics

204 The study populations were described as refugees in 57 (65%) studies and IDPs in 28
205 (32%) studies. Eleven (13%) studies used both terms. In five (6%) studies, an alternative term
206 was used, such as “climate migrant” (Ahsan et al., 2011), “asylum seeker” (Mellou et al., 2017)
207 or “climate refugee” (Ahsan et al., 2011). One study (not included in the tally above) classified
208 the population as refugees, even though they did not move across borders (Katraschuk et al.,
209 2016). **Figure 3** shows which terminology was most frequently used in each SDG region.

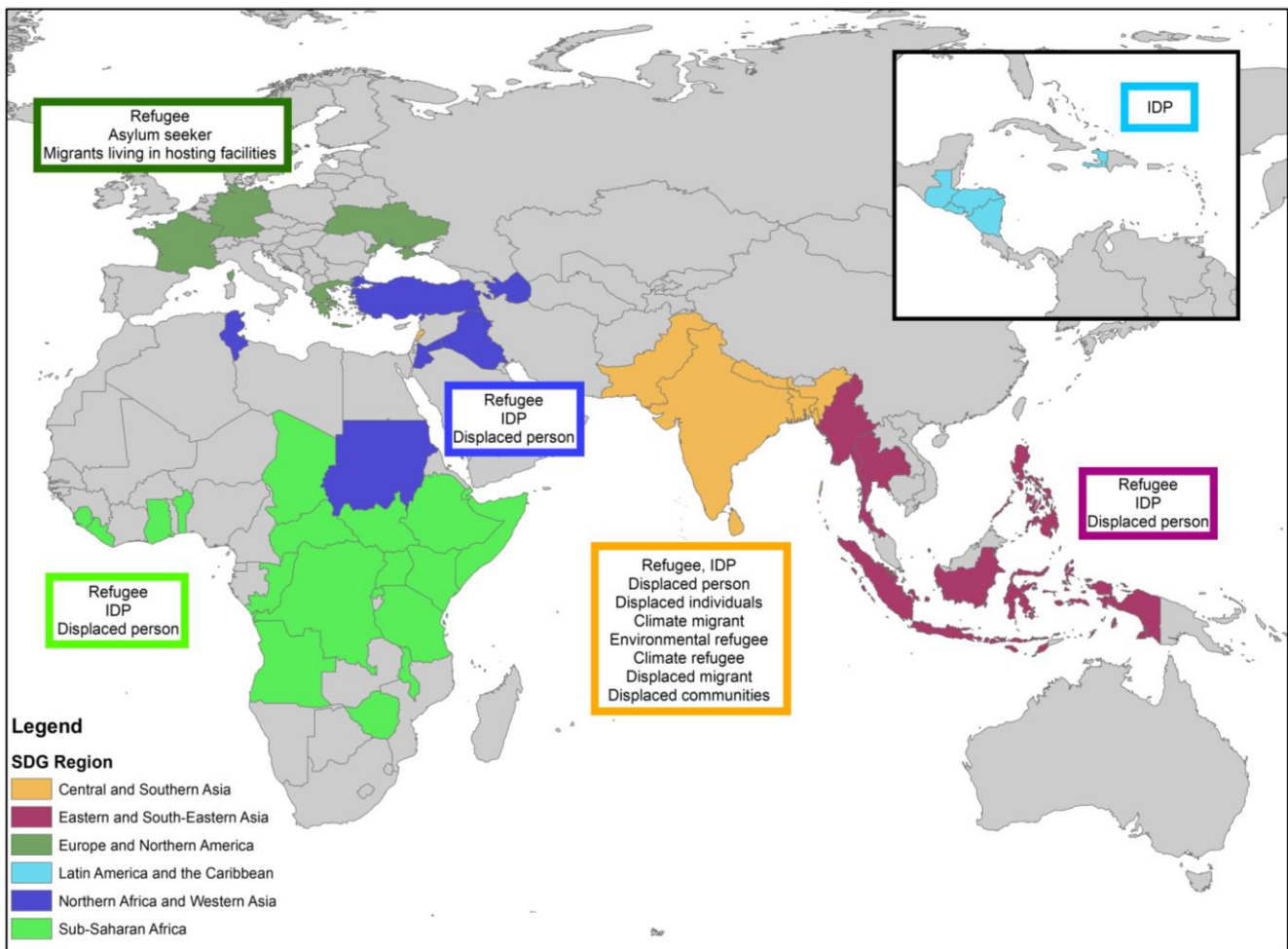


Figure 3 – Map of population terminology used to describe forcibly displaced populations by Sustainable Development Goals region for a systematic scoping review on environmental health in transitional displacement

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

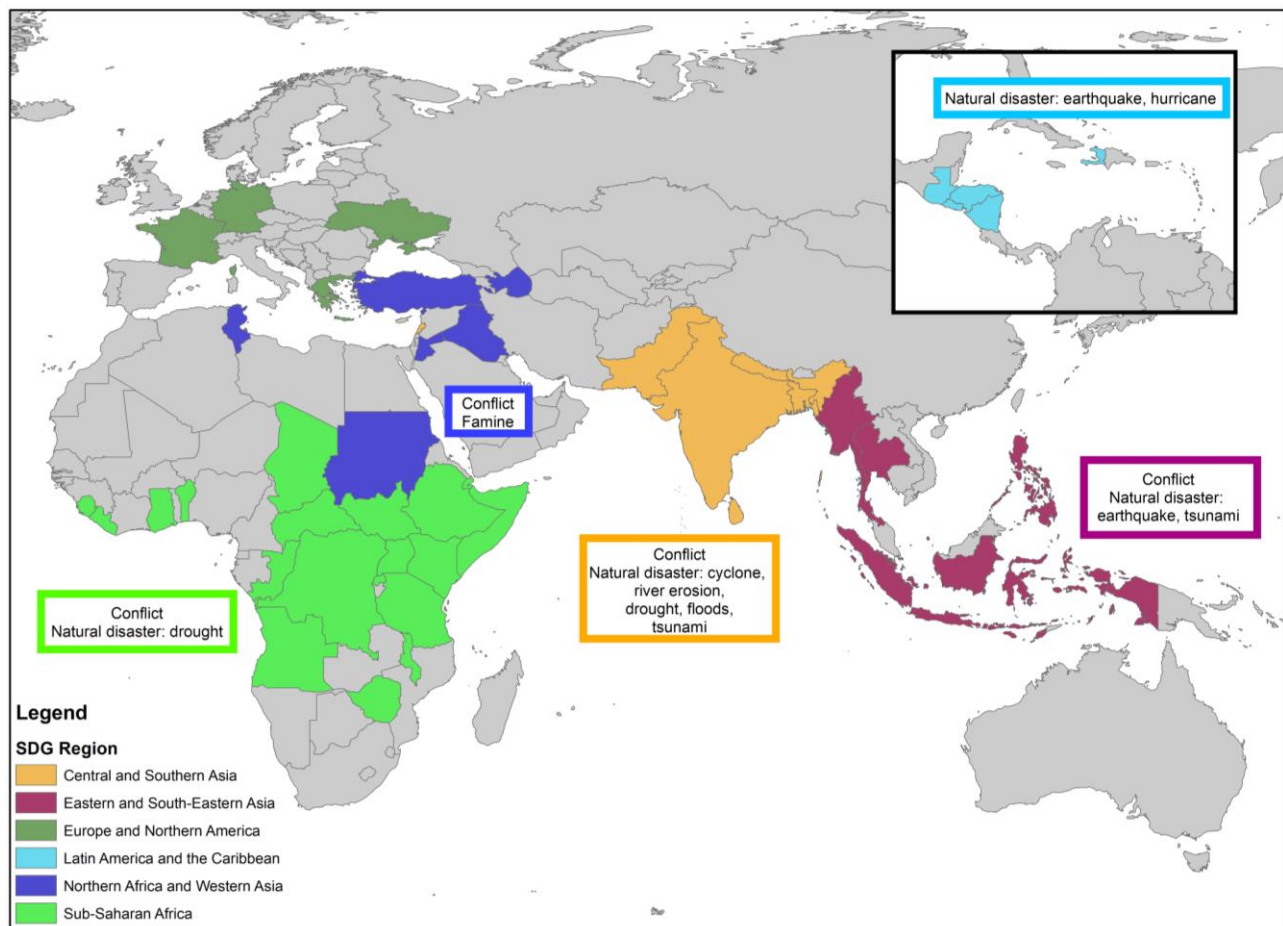
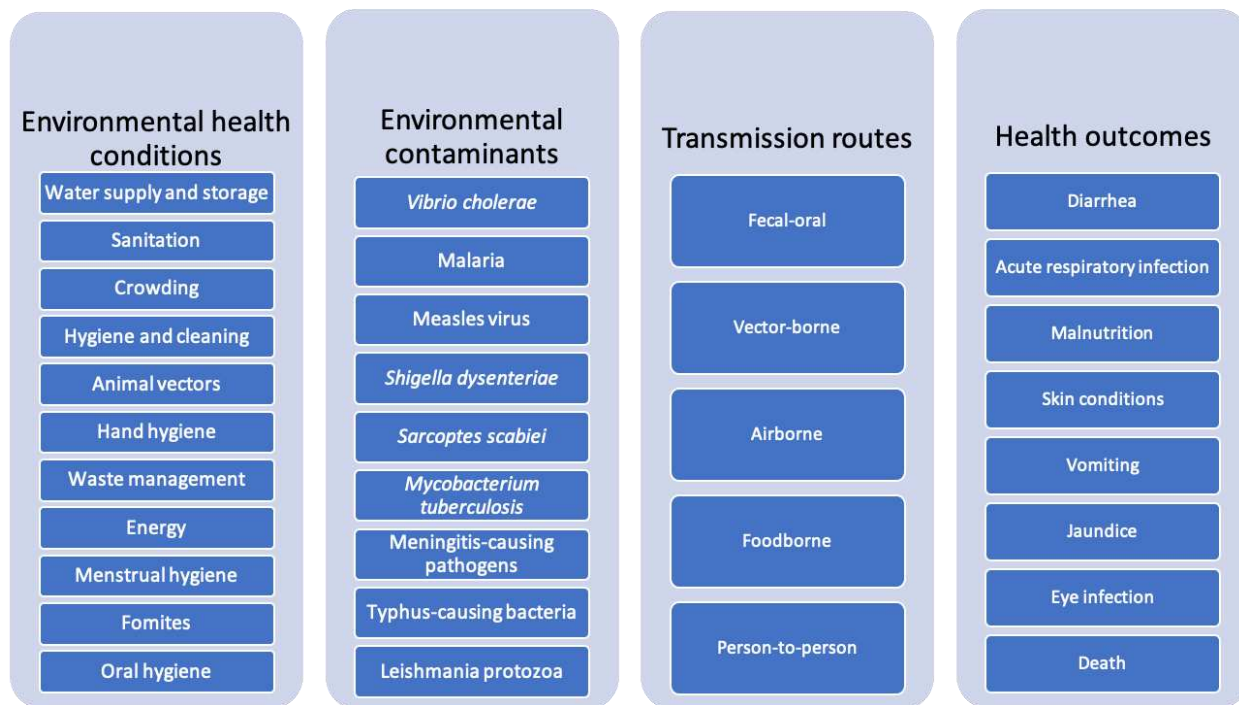


Figure 4 - Map of reported reasons for displacement of populations by Sustainable Development Goals region for a systematic scoping review of environmental health in transitional displacement

216 3.4 Environmental health conditions



217

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

221 An overview of environmental health conditions, contaminants, transmission routes, and
 222 health outcomes is available in **Figure 5**, and the number of studies reporting on each
 223 environmental health condition is summarized in **Table 8**. S3 shows which studies reported on
 224 each environmental condition. Water supply and sanitation were described most often (n=56,
 225 64% and n=50, 57% respectively). Menstrual hygiene (n=3, 3%), surfaces/fomites (n=3, 3%) and
 226 oral hygiene (n=2, 2%) were described least often.

227 **Table 8 - Environmental health conditions reported in a systematic scoping review of**
 228 **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.		

229
230 **Table 9** compares the quantity of water provided, available, or used in settings to the
231 water standards reported and the amount recommended. The amount of water provided, available
232 or used in camps ranged from one to 40 liters/person/day (L/p/d). The recommended water
233 amount was reported in various ways, with some studies reporting drinking and domestic needs
234 separately and others reporting them together. The lowest recommended water amount was 1.8
235 liters/person/day (for drinking) and the greatest was 40-60 L/p/d for healthcare settings.

236 **Table 9 - Water amounts provided, available or used versus recommended, according to**
237 **studies included in a systematic scoping review of environmental health in transitional**
238 **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.		

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

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

245 **Table 10 - Latrine or toilet ratio versus standard reported by studies included in a**
246 **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

247

248 *3.5 Exposures, outcomes and risk factors*

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

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

251 **Table 11** lists the top ten pathogens most frequently reported.

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

Pathogen	Disease name	Count	Percentage
<i>Vibrio cholerae</i>	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%
<i>Rickettsia typhi</i>	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 factors²
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”).

271 lack of soap in households as risk factors for cholera (Hatch et al., 1994). Less frequently
 272 reported risk factors were waste management (n=2, 2%) (Connolly et al., 2004; Prothero, 1994),
 273 limited access to health care (n=2, 2%) (Connolly et al., 2004; Kimbrough et al., 2012) and
 274 young age (n=2, 2%) (Desenclos et al., 1988; Mellou et al., 2017). Pregnancy (n=3, 3%) (Cronin
 275 et al., 2008; Guerrero-Latorre et al., 2016; Mcgready et al., 2010) and HIV-positive status (n=2,
 276 2%) (Cronin et al., 2008; Kimbrough et al., 2012) were reported as morbidity and mortality risk
 277 factors.

278 *3.6 Obstacles to improvement of environmental health services*

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

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

	Obstacles	Recommendations
Institutional	<ul style="list-style-type: none"> • Legal/policy environments • Management issues 	<ul style="list-style-type: none"> • More effective legal/policy structures • Management improvements • Standards and indicators
Political	<ul style="list-style-type: none"> • Conflict and instability • Resource scarcity • Financial concerns 	<ul style="list-style-type: none"> • Improve coordination across governments and other institutional bodies • Curb violence • Increase funding from private organizations
Implementation	<ul style="list-style-type: none"> • Infrastructure • Behavioral • Monitoring and research 	<ul style="list-style-type: none"> • Increase education and awareness • Targeted interventions • Infrastructural improvement and targeted adoption of technology

284
285 Institutional obstacles included refugee-related policies and issues with setting
286 management (Behnke et al., 2020). National policies requiring refugees to remain in camps were
287 reported to have resulted in refugees not seeking government services (Mohamed et al., 2014).
288 Lack of coordination among NGOs in the WaSH sector and other sectors, such as shelter and
289 health, were reported to have made the provision of sanitary facilities difficult (UNICEF and
290 Hydroconseil, 2017). Humanitarian agencies that build or provide facilities often do not have
291 decision making power in settlements (Tota-Maharaj, 2016). Other management issues included
292 lack of coordination among planning and development authorities (Ahsan et al., 2011) and short
293 duration of projects (UNICEF and Hydroconseil, 2017). Defining needs and designing
294 immediate and long-term plans over the course of a few months was reported to result in
295 decreased quality of facilities (UNICEF and Hydroconseil, 2017).

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

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

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

314 Implementation obstacles included infrastructural and behavioral obstacles.
315 Infrastructural obstacles included muddy water that required heavy chlorination (Malholland,
316 1985) and sewage/drainage problems (Tota-Maharaj, 2016). In Chad, there was little knowledge
317 about the water table and sediment depth; as a result, developers could not be certain that the
318 tubewells they constructed would be sustainable (Lytton et al., 2007). Short project duration was
319 also reported as an obstacle to effective infrastructure interventions; in Lebanon, a sustainable
320 waste collection system could not be developed because of the short timeframe of the project
321 (UNICEF and Hydroconseil, 2017).

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

329 *3.7 Recommendations for improvement of environmental health conditions*

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

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

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

349 Political recommendations focused on improving coordination across governments and
350 other institutional bodies, curbing violence (Toole and Waldman, 1997) and increasing funding
351 from private philanthropic organizations (Milton et al., 2017) (**Table 12**). Recommendations
352 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

376 immunization program (Mellou et al., 2017). It was recommended that neighborhoods
377 surrounding the camps in Haiti also receive water and sanitation services (Schuller and Levey,
378 2014), and that host communities in Lebanon—in addition to refugees—be supported by
379 capacity-building activities and stabilization projects (UNICEF and Hydroconseil, 2017).

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

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

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

398 **4. Discussion**

399 4.1 Exposures, risk factors, and outcomes

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

408 The most common risk factor for infectious diseases was overcrowding. Few data on setting
409 capacity versus setting population size were available to analyze how many of the reported
410 settings were operating above capacity. Overcrowding is associated with transmission of
411 communicable disease (Connolly et al., 2004) as well as mental health challenges (Ziersch et al.,
412 2017). No study identified open defecation as a risk factor for infectious diseases, which is
413 surprising, and suggests an underreporting of open defecation in the transitional phase of
414 displacement (Mara, 1996; Okullo et al., 2017).

415 It is important to note that several of the identified adverse health effects that are caused or
416 reinforced by poor environmental health conditions are interrelated. Individuals already suffering
417 from communicable or non-communicable diseases need consistent access to a nutritious diet
418 and have higher energy requirements to strengthen their health and prevent opportunistic
419 infections. Food insecurity over time may lead to poor nutritional status and has subsequent
420 negative health implications at various levels: malnourished individuals with weaker immune
421 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.

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

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

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

474 *4.3 Vulnerable populations*

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

480 Among IDPs in Africa, women and children, who constitute over 70% of IDPs, are high-risk
481 groups for a wide range of health conditions. Women are exposed to physical and sexual
482 violence, resulting in injuries, sexually transmitted infections including HIV, unwanted
483 pregnancies, and mental health effects (Owoaje et al., 2016). Children, particularly those under
484 the age of five, are more prone to communicable diseases, including infectious diseases and
485 acute respiratory infections, and to acute and chronic malnutrition in IDP camps (Guerrier et al.,
486 2009; Hashmi et al., 2019; Owoaje et al., 2016). People living with disabilities are highly
487 vulnerable as well, and are among the most hidden, excluded and neglected of all displaced and
488 conflict-affected populations (Reilly, 2010). According to Nishikori et al. (2006), analyzing data

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

493 *4.4 Evidence gaps and future research needs*

494 The studies included in this review had vital information gaps. The majority of studies
495 (66%) did not report risk factors for disease, and 39% of studies reporting on a pathogen did not
496 report the transmission route. Specific populations affected by disease, the number of people
497 affected and the age of the people affected were not always reported. The majority of studies
498 (80%) did not include the setting managing authority, and data on age and funding of
499 infrastructure and setting capacity as compared to population were not provided. These gaps
500 were noteworthy because managing authorities and funding sources can change during the
501 transition from emergency to protracted displacement. A more complete understanding of the
502 managing authority and funding sources during each phase would help policymakers to set
503 clearer management and funding expectations.

504 Menstrual hygiene, oral hygiene and evidence related to fomite contamination was seldom
505 discussed among studies included in this review. No study reported associations between open
506 defecation or livestock and disease transmission. We suggest that future research is necessary to
507 fill these evidence gaps. Additionally, 76% of the studies did not report obstacles to
508 improvement, and studies' recommendations were lacking in specificity. Several studies made
509 vague recommendations without identifying responsibility, and others did not provide
510 recommended methods for improving and monitoring environmental health services, such as
511 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

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

541 Our findings are in line with Abbas et al. (2018), noting that evaluation of current policy
542 shows that the basic needs to migrant populations are not met, even in the countries that put most
543 efforts in addressing their needs. In order to improve environmental health service provision in
544 these settings, better coordination and accountability across all levels of government and NGOs
545 around the world, and the adoption of respective policies, should be prioritized, and emergency
546 preparedness and response activities should particularly target vulnerable groups (Owoaje et al.,
547 2016). Moreover, each crisis should be assessed individually to determine resource allocation
548 based on the conditions and needs in of each specific displaced population, rather than
549 categorized as “emergency,” “transitional,” or “protracted” based on an arbitrary timeline.
550 Providing sustainable environmental health services to displaced populations will require more
551 tailored funding and interventions, as well as more intentional planning for the transition from
552 emergency response to sustainable development.

553

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