

1 **Environmental health conditions in protracted displacement: a systematic scoping review**

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19
20 Adequate environmental health services are critical for human rights, health, and development,
21 especially in the context of forced displacement. There are more than 70 million forcibly
22 displaced persons worldwide, most in protracted situations, having been displaced for more than
23 two years. Some live in camps or informal settlements, but most live in urban areas.

24 Environmental health services are important in the transition from emergency response to
25 sustainable development in these settings, but evidence on environmental health in displaced
26 populations is disparate and of variable quality. We conducted a systematic scoping review of
27 environmental conditions, exposures, and outcomes in protracted displacement settings;
28 obstacles to improvement in environmental health services; and recommendations made for
29 improvement. We included 213 publications from peer-reviewed and grey literature databases.
30 Data were extracted on environmental health topics including water, sanitation, hygiene,
31 overcrowding, waste management, energy supply, vector control, menstrual hygiene, air quality,
32 and food safety. Most studies present data from low- and lower-middle income countries.

33 Northern Africa and Western Asia and Sub-Saharan Africa are the most-represented regions.

34 There is substantial evidence on water, sanitation, and crowding, but few studies report findings
35 on other environmental health topics. Water-related disease, parasites, and respiratory infections
36 are frequently cited and studies report that services often fail to meet international standards for
37 humanitarian response. The most frequent obstacles and recommendations are institutional,
38 political, or implementation-related, but few studies provide concrete recommendations for
39 improvement. Our review compiles and characterizes the research on environmental health in
40 protracted displacement. We recommend including displaced populations in international
41 environmental health policy and monitoring initiatives, and bridging from humanitarian response
42 to sustainable development by preparing for long-term displacement from the early stages of a
43 crisis.

44
45 **Keywords:** refugee; internally displaced person (IDP); humanitarian; post-emergency;
46 migration; WaSH

47

48 1. Introduction

49 There are more than 70 million forcibly displaced persons¹ worldwide, many of whom live in
50 low- and middle-income countries (UNHCR, 2019). Adequate environmental health services,
51 including water, sanitation, and hygiene (WaSH), are critical to health, development, and human
52 rights, and cannot be denied based on immigration or legal status (Heller, 2018). Environmental
53 health services are especially important for forcibly displaced populations; overcrowded camps
54 and poor environmental health conditions foster the spread of communicable diseases, and
55 inadequate environmental health services have detrimental impacts on the health and wellbeing
56 of displaced persons and host communities (UNHCR, 2011; Cronin et al., 2008). Environmental
57 health services in humanitarian crises, especially in non-household settings, are poorly
58 understood, and evidence is of variable quality (Blanchet et al., 2017; Cronk et al., 2015).

59 Although environmental health is often among the highest priorities in emergencies,
60 long-term, sustainable services and their monitoring are challenging in camp settings as well as
61 outside of camps, where 60% of displaced populations live (UNHCR, 2016a). Refugee and
62 internally displaced person (IDP) settings are typically designed as short-term solutions, but
63 forcible displacement usually outlasts the emergency stage; 80% of refugee crises last more than
64 10 years, and 40% persist past 20 years (Crawford et al., 2015). Protracted crises—defined by
65 the United Nations High Commissioner for Refugees (UNHCR) as situations where populations
66 are displaced for longer than two years—require different environmental health standards than
67 acute emergencies (UNHCR, 2017a). This is reflected in the distinct principles outlined in the
68 Sphere handbook—the international charter for humanitarian response—for protracted crises
69 (Sphere Association, 2018).

¹ We defined “forcibly displaced” as displacement that is a result of anthropogenic threats (e.g. war, political violence, persecution) or natural disaster.

70 In order to compile and characterize the existing evidence on environmental health in
71 protracted displacement, we conducted a systematic scoping review to answer the following
72 research questions:

- 73 1. *What environmental health conditions, exposures, and outcomes are reported in protracted*
74 *refugee or IDP settings?*
- 75 2. *What obstacles are reported to prevent improvements in environmental health in these*
76 *settings?*
- 77 3. *What recommendations do studies give to improve environmental health in these settings?*
78

79 Using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

80 guidelines, we analyzed data extracted from peer-reviewed publications and grey literature. Our
81 results describe environmental health conditions, exposures, and outcomes related to: water,
82 sanitation, and hygiene; overcrowding; waste management; energy supply; vector control;
83 menstrual hygiene; food safety; and air quality. We also extracted information on obstacles to
84 improvement that are reported in the studies included in our review, as well as their
85 recommendations. Based on our findings, we make recommendations for policymakers,
86 environmental health service providers, and researchers.

87 **2. Methods**

88 *2.1 - Research questions and search strategy*

89 This systematic review was designed according to the PRISMA methodology (Moher et al.,
90 2009). We selected a scoping review as our methodology in order to map the key concepts of this
91 emerging area of research, and structured the review to answer our research questions about
92 environmental health conditions, exposures, and outcomes, obstacles to improvement, and
93 recommendations. Scoping reviews determine what evidence is available on a given topic, and
94 take a broader approach than systematic literature reviews (Peters et al., 2015). We designed a
95 search strategy using terminology associated with environmental health and displaced

96 populations, based on other systematic reviews on related topics (Adair-Rohani et al., 2013; De
 97 Buck et al., 2015; Freeman et al., 2014; Moffa et al., 2019, 2018). Search terms included
 98 environmental health factors (water, sanitation, and hygiene; waste management; energy supply;
 99 vector control; air quality; food hygiene and safety; and cleanliness); and displaced populations
 100 terms (refugees; internally displaced persons (IDPs); and other displaced populations such as
 101 asylum seekers). Examples are included in **Table 1**, and the full search terms are available in *SI*.

102 **Table 1 – Themes and examples of search terms for a systematic scoping review on**
 103 **environmental health in protracted 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”

104
 105 For peer-reviewed literature, PubMed, Web of Science, Scopus, and EBSCOhost Global
 106 Health were searched between September 23rd 2017 and October 12th 2017. Using Cochrane’s
 107 online systematic review software, Covidence, two screeners reviewed titles and abstracts of
 108 each publication. If necessary, a third reviewer resolved conflicts. The same process was used for

109 full text review.

110 For grey literature, the databases: DisasterLit; International Rescue Committee; United
 111 Nations Children’s Fund (UNICEF) WaSH; UNHCR; RAND; Centers for Disease Control and
 112 Prevention (CDC) WaSH; Water, Engineering and Development Centre (WEDC); International
 113 Committee of the Red Cross; World Bank Water were searched between December 23rd 2017
 114 and January 6th 2018. One of four screeners adapted the search terms for environmental health,
 115 displaced populations, or both, according to the search systems for each database (e.g. character
 116 limits, sector of focus), and documented search methods and number of results (S2). The results
 117 of each search were scanned for relevant publications, and screeners selected documents for full
 118 text review. Two screeners reviewed each document and included or excluded them using the
 119 criteria outlined in section 2.2, with a third screener resolving conflicts if needed.

120 2.2 – Study eligibility criteria

121 For peer-reviewed literature, studies were excluded if they had any of the characteristics
 122 outlined in **Table 2**:

123 **Table 2 – Exclusion criteria for peer-reviewed literature for a systematic scoping review on**
 124 **environmental health in protracted displacement**

Exclusion criteria	Explanation
Not focused on population of interest	Populations that have not been displaced; officially resettled displaced populations; Single patient or household; animal or epidemiological migration
Not forcibly displaced	Economically-driven or voluntary migration
Not focused on setting of interest	Analysis does not concern the setting in which displaced populations reside; setting is intended for permanent resettlement
Not environmental health	Not connected to environmental health or human health
Wrong study type	Documents that do not provide new data or analysis; news articles, letters to the editors, opinion pieces, newsletters
Published before 1945	We excluded articles that preceded the current “refugee regime”—the policies, institutions, and convention that

	continue to shape the international community’s approach to mass displacement. ²
Not in English	N/A
Duplicate	Duplicate that was not removed by Covidence
Inaccessible	Research team and university library exhausted all reasonable resources, but could not locate a copy of the publication

125
 126 For grey literature, we used the same criteria, and reviewers also excluded publications if they
 127 did not meet criteria established by the Accuracy, Authority, Coverage, Objectivity, Date, and
 128 Significance (AACODS) checklist (Tyndall, 2010).

129 *2.3 – Data Extraction*

130 After full text review, each publication was sorted into one of three phases of displacement as
 131 defined by UNHCR: emergency (0–6 months), medium-term (6 months – 2 years), or protracted
 132 (more than two years) (UNHCR, 2017a). This review analyzes publications that fell into the
 133 “protracted” category.

134 The following data were extracted from included publications: metadata (e.g. publication
 135 title, year of study, study type); contextual characteristics (e.g. study country/countries, stage of
 136 displacement at time of study); population characteristics (e.g. origin of refugee/IDP population,
 137 reason for displacement); setting characteristics (e.g. setting establishment date, total setting
 138 population, managing authority, funder(s)); environmental health conditions reported (e.g. water
 139 source(s); sanitation service(s); animal vector(s); crowding); environmental health exposures and
 140 hazards (e.g. toxins; pathogens; disease transmission route(s)); outcomes (e.g. health outcomes;
 141 livelihood outcomes); other relevant themes (e.g. climate/season/natural disaster; relevant
 142 country policies); and obstacles to improvement, knowledge gaps, and recommendations.

² Although the Convention of the Status on Refugees was not established until 1951, the negotiations that shaped this and other components of the current “refugee regime” began around 1945. The development of the “current expression” of this regime was prompted by the displacement of 30 million people during and after World War II (Barnett, 2002; Keely, 2001).

143 Simplified extraction tables are available in *S3*.

144 Each publication was assigned to a region (Sustainable Development Goals (SDG)

145 regional groupings (United Nations, 2017)) and income level (World Bank's list of economies

146 (World Bank, 2018)), according to the country or countries studied; if a publication reported on

147 more than one country or spanned more than one income level or region, it was counted in all

148 applicable categories.

149 3. Results

150 The search process for this study is outlined in **Figure 1**:

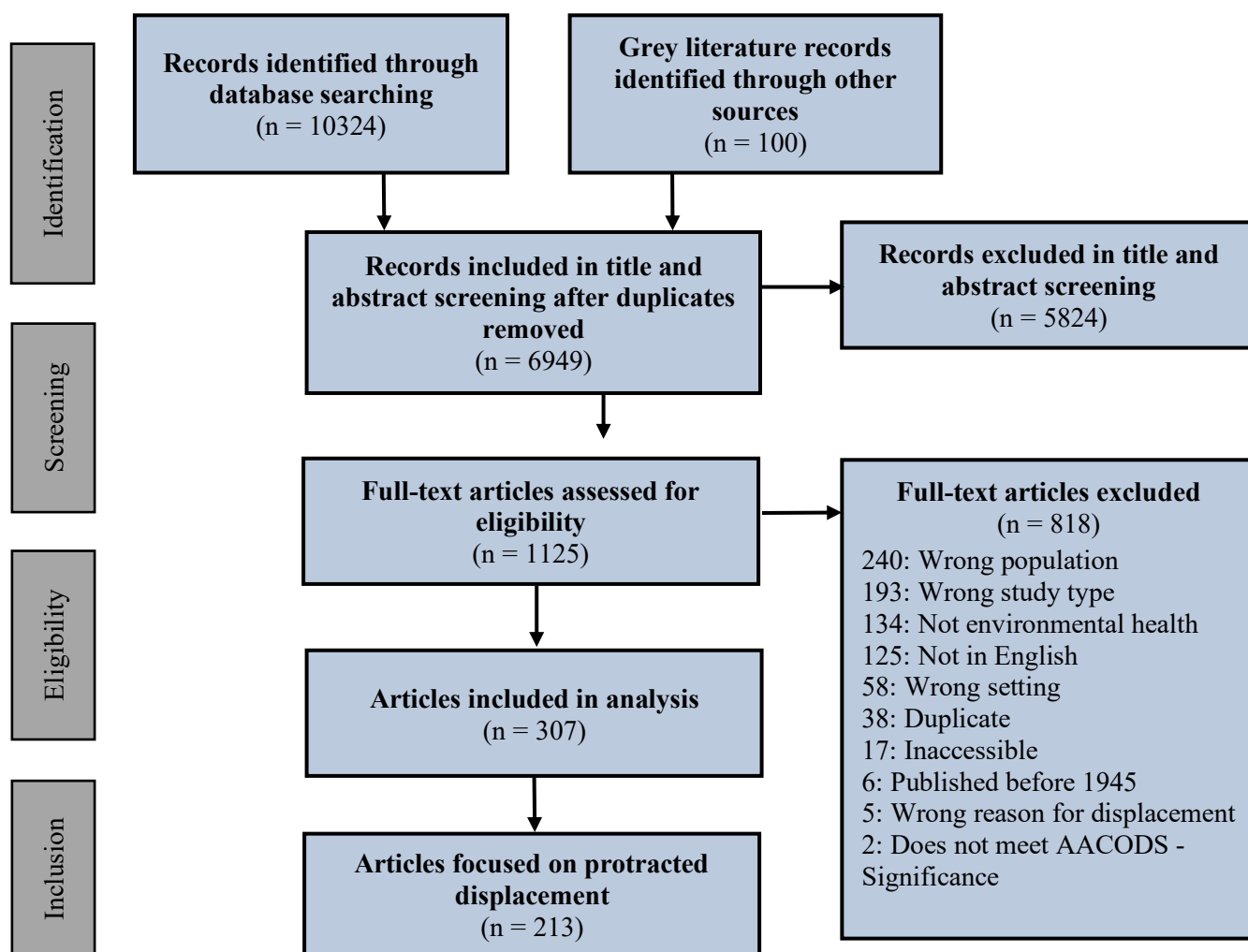


Figure 1 – Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flow Diagram for a systematic scoping review on environmental health in protracted displacement

151 3.1 – Metadata

152 3.1.1 Study characteristics

153 Based on our search criteria, 307 publications were eligible for data extraction. Of these,
 154 213 publications fell into the “protracted” stage of displacement and are thus included in this
 155 paper. Findings for the emergency stages are presented in a separate publication (Shackelford et
 156 al., 2020) and findings for the transitional phase will be presented in a forthcoming review.

Stage of displacement	Number of publications*
Emergency (0-6 months)	104
Mid-term/transitional (6 months – 2 years)	88
Protracted (more than 2 years)	213
*The total exceeds 307 because some publications fell into more than one category.	

157 shows the number of eligible publications that fell into each stage of displacement.

158 **Table 3 – Publications by stage of displacement for a systematic scoping review of**
 159 **environmental health in displaced populations**

Stage of displacement	Number of publications*
Emergency (0-6 months)	104
Mid-term/transitional (6 months – 2 years)	88
Protracted (more than 2 years)	213
*The total exceeds 307 because some publications fell into more than one category.	

160
 161 Of the eligible publications, 213 presented data on environmental health services in
 162 displaced population that qualified as protracted – 198 peer-reviewed publications and 15 from
 163 grey literature.

164 Study characteristics are described in **Table 4**. Over half of the studies (n=113, 53%)
 165 were quantitative. Twenty-eight studies (13%) used approaches categorized as “other”; these
 166 included project and situation reports, threat assessments, guidance documents, and project
 167 evaluations, or did not state the study type.

168 **Table 4 - Study characteristics for a systematic scoping review on environmental health in**
 169 **protracted displacement**
 170

Characteristic	Count	Percentage
Publication source		
Peer-reviewed database	198	93%
Grey literature	15	7%
Study type		
Quantitative	113*	53%
<i>Cross-sectional</i>	91	81%
<i>Case control</i>	11	10%
<i>Controlled trial</i>	5	4%
<i>Cohort</i>	4	4%
Literature review	37	17%
Mixed-methods	20	9%
Qualitative	10	5%
Case study	5	2%
Other	28	13%
*Some studies used more than one quantitative method, and others did not specify which quantitative methods were used, so the subgroups do not add up to 113. Percentages in italics are out of the 113 quantitative studies.		

171
 172 The oldest publication included was published in 1946, and the most recent in 2017 (**Figure 2**).
 173 With the exception of the oldest publication, there were no eligible publications from before
 174 1979. Over half (n=112, 53%) were published after 2008.

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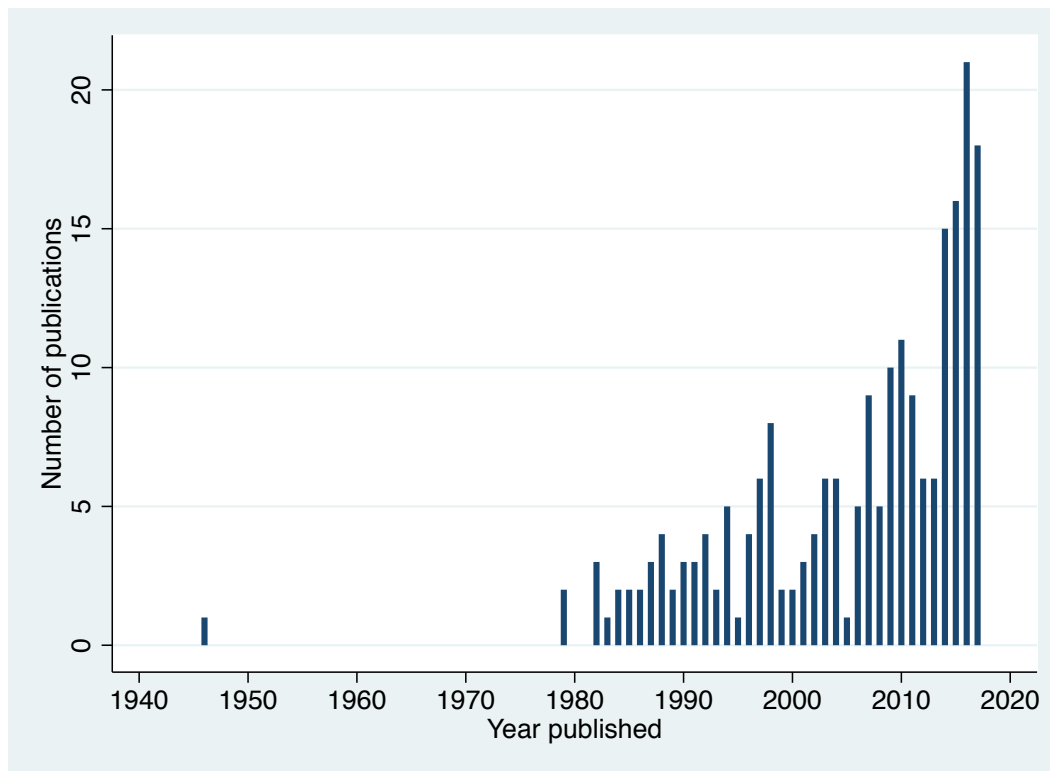
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186 **Figure 2 - Number of publications by year published included in a systematic scoping**
 187 **review on environmental health in protracted displacement**

188 3.1.2 Setting characteristics

189 Publications present findings from 54 countries and from all SDG regions except Oceania

190 (Error! Reference source not found.). A breakdown by region and by country is available in *S4*.

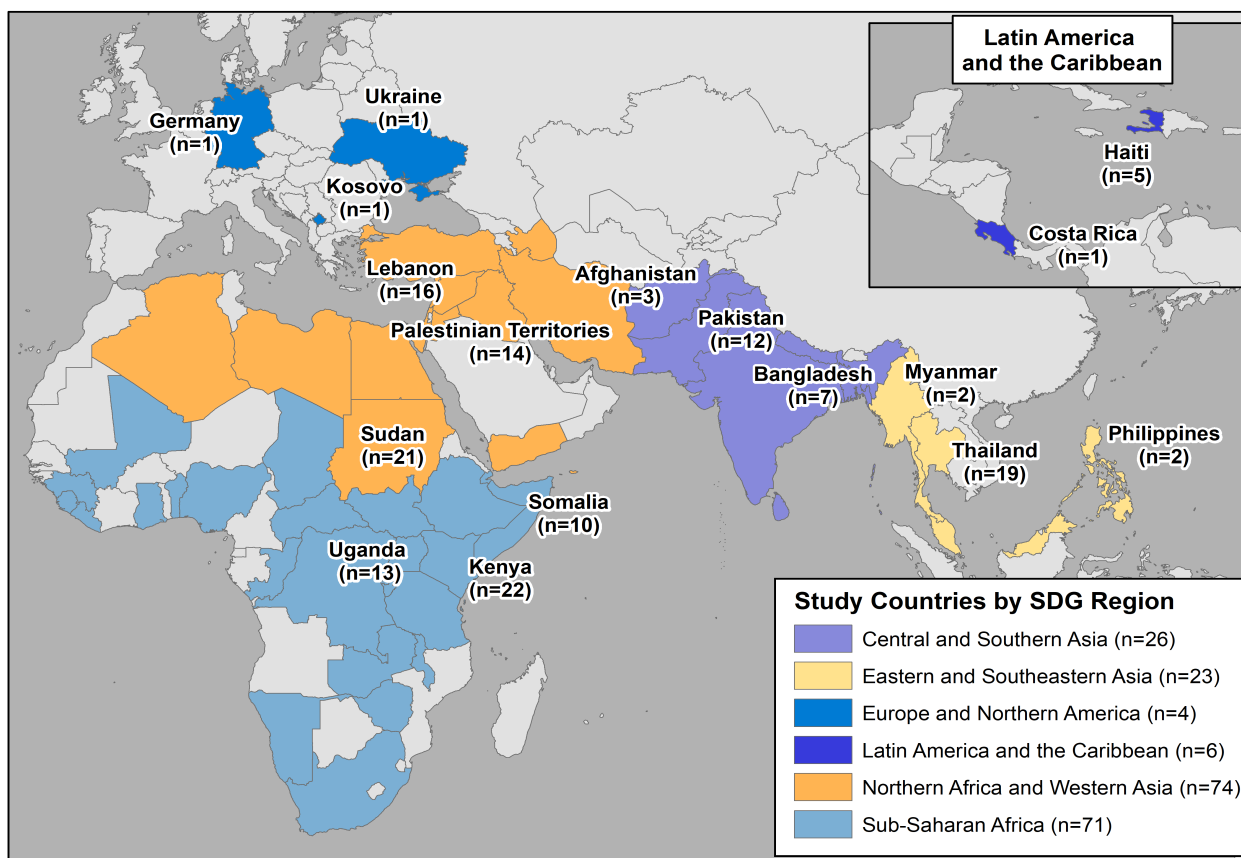


Figure 3 – Map of countries represented in a systematic scoping review on environmental health conditions in protracted displacement. Countries are color-coded by SDG region, with the three most represented countries in each region and their corresponding number of papers listed (except for Latin America and the Caribbean, where only two countries were represented).

191 One study (0.5%) presents findings on the European region in general, one presents findings on
 192 Africa in general, one presents findings on the Sahel region, and 18 publications (8%) do not
 193 specify the countries addressed.

194 Northern Africa and Western Asia is the most represented region (n=74, 35%), followed
 195 by Sub-Saharan Africa (n=71, 33%). This is nearly three times the number of publications as the
 196 next most represented regions: Central and Southern Asia (n=26, 12%) and Eastern and
 197 Southeastern Asia (n=23, 11%). The least represented regions are Latin America and the
 198 Caribbean (n=6, 3%) and Europe and Northern America (n=4, 2%). The most represented

199 country in the literature is Kenya with 22 publications (10%), followed by Sudan (n=21, 10%)
 200 and Thailand (n=19, 9%).

Income level	Count	Percentage*
Low-income	55	26%
Lower middle-income	87	41%
Upper middle-income	58	27%
High-income	1	0.5%
*The percentages do not add up to 100% because some publications reported data on more than one country or region.		

201 shows how many publications fall into each country income category. The majority of
 202 publications represent low-income countries (n=55, 26%) or lower middle-income countries
 203 (n=87, 41%).

204 **Table 5 – Publications by World Bank income level for a systematic scoping review on**
 205 **environmental health in protracted displacement**
 206

Income level	Count	Percentage*
Low-income	55	26%
Lower middle-income	87	41%
Upper middle-income	58	27%
High-income	1	0.5%
*The percentages do not add up to 100% because some publications reported data on more than one country or region.		

207 The terminology used to describe the settings in which displaced populations live is shown in
 208 **Table 6**; 203 publications (95%) report this information. Terminology was separated into three
 209 categories based on the vocabulary used in the publications: Camp (n=184, 86%), settlement
 210 (n=19, 9%), and other (n=38, 18%).

212 **Table 6 - Terminology used to describe settings in which displaced populations live, for a**
 213 **systematic scoping review on environmental health in protracted displacement**

Setting	Count	Percentage*
Camp	184	86%
Settlement	19	9%

Other	38	18%
Urban	20	9%
Village	12	6%
Gathering	3	1%
Slum	3	1%
Holding center	2	1%
Community	1	0.5%
“Out of camp”	1	0.5%
“Colonia”	1	0.5%

*The percentages do not add up to 100% because some publications reported data on more than one country or region.

214

215 3.1.3 – Population characteristics

216 Nearly three-quarters of the publications (n=155, 73%) report findings on refugees, and
 217 58 (27%) report on IDPs. Other terms used to describe the population of interest are: displaced
 218 person/individual/people/community/population (n=6, 3%), asylum seekers (n=3, 1%),
 219 climate/environmental refugee/migrant (n=3, 1%), and displaced migrant (n=1, 0.5%). Some
 220 studies use more than one of these terms to describe displaced populations.

221 Of the 132 publications (62%) that specified reasons for population displacement, nearly
 222 all (n=124, 94% of 132) mention conflict. Other reasons include natural disaster (n=19, 14%)
 223 and famine (n=6, 5%). Cited natural disasters include droughts (n=12, 9%), earthquakes (n=6,
 224 5%), floods (n=5, 4%), cyclones (n=3, 2%), river erosion (n=2, 2%), and tsunamis (n=1, 1%).
 225 Some publications (n=14, 11%) list more than one reason.

226 3.1.4 – Environmental health topics

227 The most frequently discussed environmental health topic is water, with findings reported
 228 in 149 studies (70%), followed by sanitation (n=107, 50%), and then crowding (n=79, 37%)
 229 (Table 7).

230 **Table 7 - Prevalence of environmental health topics considered in publications included in**
 231 **a systematic scoping review on environmental health in protracted displacement**

Topic	Count*	Percentage
Water	149	70%
Sanitation	107	50%
Crowding	79	37%
Vector control	60	28%
Energy	36	17%
Waste management	33	15%
Hand hygiene	31	15%
Food safety	24	11%
Menstrual hygiene	7	3%
*The percentages do not add up to 100% because some publications reported data on more than one topic.		

232

233 3.2 – Environmental health conditions, exposures, and outcomes

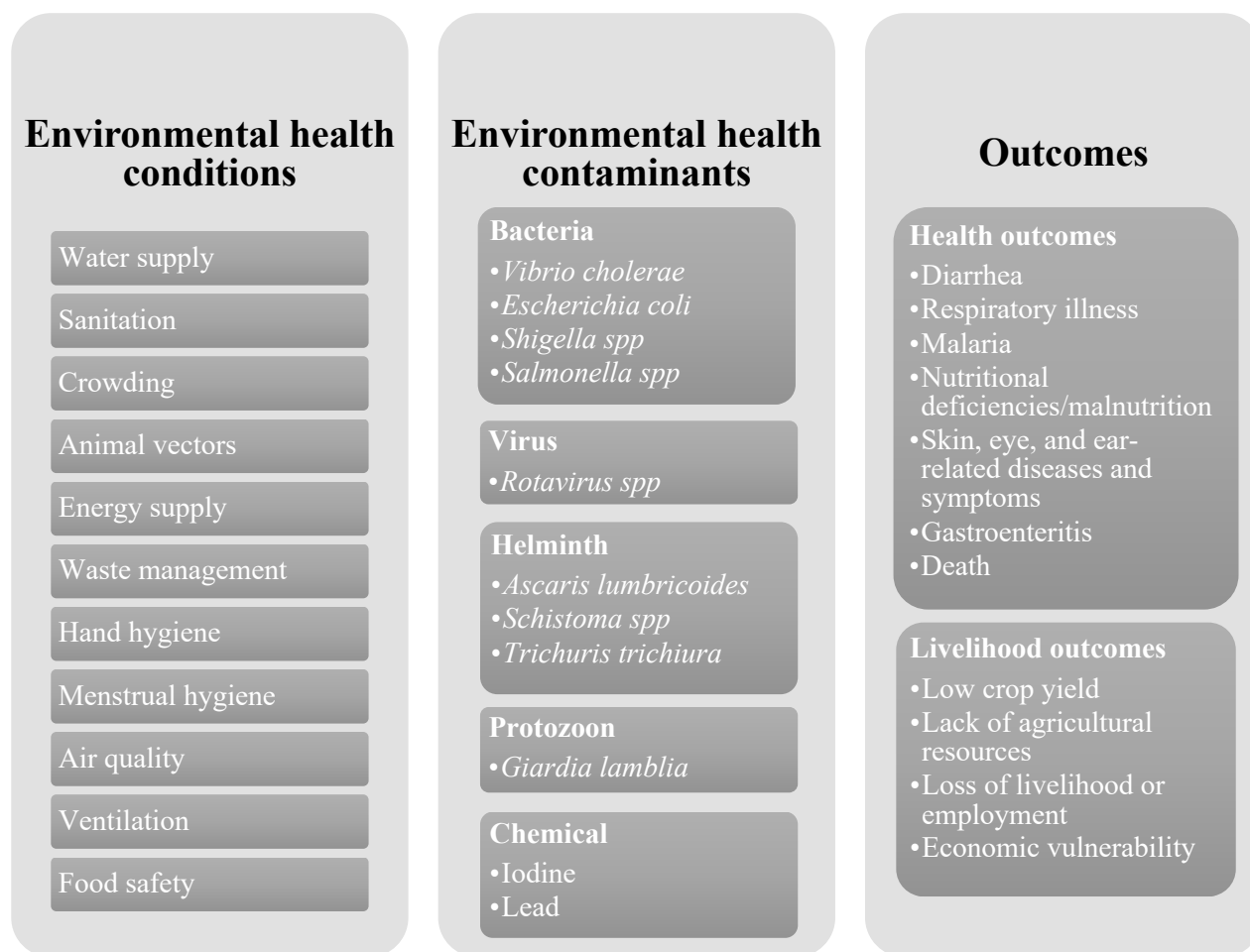


Figure 4 - Summary of environmental health conditions, contaminants, and outcomes reported in 213 publications included in a systematic scoping review on environmental health in protracted displacement

234 3.2.1 – Environmental health conditions

235 Themes for water supply conditions include water source(s); water collection; water
 236 distribution and access; water system reliability; water quantity; water quality; water treatment;
 237 water storage; water uses; cost of water; and water management. Reported water sources span
 238 unimproved source types (unprotected well; surface water; irrigation canal) and improved
 239 sources (borehole; protected spring; private well; protected well; piped water; rainwater
 240 collection; private vendor; bottled water) (WHO/UNICEF, 2018). Studies also present findings

241 on distance from water points, time spent collecting water, threats at the point of collection
 242 (drowning; snakes; crocodiles) (Apiyo, 2014), and arguments or fights over water collection
 243 (WFP et al., 2014). Distribution is reported to occur through trucking or pipelines (to communal
 244 taps or to individual households). Limited hours for water collection, water system breakdowns,
 245 and interruptions in water supply are reported.

246 Eighteen publications present findings on average water consumption per day, which
 247 ranged from one to 40 liters per capita per day (**Table 8**). One systematic review evaluates the
 248 minimum water allocation necessary in post-disaster situations, but did not present primary data
 249 (De Buck et al., 2015). Water quality is also addressed, with publications describing poor taste
 250 and chemical, bacterial, and helminth contamination as concerns. The use of both treated and
 251 untreated water is described, with treatment occurring from the municipal to the household level.
 252 Treatment methods include chlorine, filtration, boiling, and ultraviolet (UV) disinfection. Water
 253 tanks and buckets are reported for household level storage.

254 **Table 8 – Summary of average water quantity data from publications included in a**
 255 **systematic scoping review on environmental health in protracted displacement**

Publication	Country/countries	Population(s)	Setting(s)	Water quantity
CDC, 2003	Liberia	IDP	Settlement	1.8 liters/capita/day
Cronin, Shrestha, Spiegel, Gore, & Hering, 2009	Ethiopia; Kenya; Tanzania; Sierra Leone; Democratic Republic of the Congo (DRC); Republic of the Congo	Refugee	Camp	8-20 liters/capita/day
Crooks & Hailegiorgis, 2014	Kenya	Refugee	Camp	4-15 liters/capita/day
Davey & Maziliauskas, 2003	Lebanon	Refugee	Camp	Less than 50 liters/household/day
Fadul & Reed, 2010	Sudan	IDP; Refugee	Village	12 liters/capita/day

Herrera & Sataviriya, 1984	Thailand	Refugee	Camp; holding center	15-40 liters/capita/day
Milton et al., 2017	Bangladesh	Refugee; displaced individuals	Camp	16-18 liters/capita/day
Shultz et al., 2009	Kenya	Refugee	Camp	19 liters/capita/day
Singh et al., 2017	Kenya	IDP	Camp	20 liters/family/day
Toole & Waldman, 1990	Ethiopia ³	Refugee	Camp	6 liters/capita/day
van der Helm, Bhai, Coloni, Koning, & de Bakker, 2017	Jordan	Refugee	Camp	35 liters/capita/day
Vivar, Pichel, Fuentes, & Martínez, 2016	Algeria	Refugee	Camp	15-17 liters/capita/day
M. Toole & Malkki, 1992	Ethiopia; Kenya ⁴	Refugee	Camp	1-3 liters/capita/day
UNHCR, 2006	Sudan; Chad	IDP; Refugee	Camp; Village	19 liters/capita/day
UNHCR, 2008	Ghana; Kenya; Uganda	Refugee	Camp	40 (Ghana), 20.5 (Kenya), and 15.2 (Uganda) liters/capita/day
UNHCR, 2017b	DRC; Rwanda; Uganda; Tanzania	Refugee	Camp	17 liters/capita/day
UNHCR, 2016b	South Sudan	Refugee	Camp; settlement	9 liters/capita/day
Waters, 1984	Thailand	Refugee	Camp	12.5-40 liters/capita/day

256
257 Studies report water being used for drinking, bathing, washing, cooking, household
258 cleaning, laundry, irrigation, flushing toilets, making tea, and making formula milk for babies. In
259 some cases, water is reported to have been provided free of charge, but water tariffs and
260 connection fees are also reported. Affordability, especially of water purchased from private

³ This publication presented data on IDPs and refugees in both Ethiopia and Sudan, but this quantity was presented in the context of a Somali refugee camp in Ethiopia

⁴ This publication presented data on many countries and contexts, but this quantity was presented in the context of Somali refugee camps in Ethiopia and Kenya

261 vendors, is reported to be of particular concern. Management mechanisms include water
262 committees, with looting and lack of ownership mentioned as concerns. The use of UNHCR and
263 Sphere standards is reported.

264 Studies report on sanitation technology and construction (including pit latrines, ventilated
265 improved pit (VIP) latrines, communal latrines, household latrines, emergency latrines, and
266 hanging latrines; toilets, pour-flush toilets, toilets with U-bends, aqua privies, container-based
267 toilets, and public sewerage systems); and general considerations related to spacing, ventilation,
268 and drainage. Open defecation is commonly reported. Wastewater is also frequently addressed
269 (including references to cesspits, soak-aways, septic tanks, flood control, and desludging.
270 Moreover, studies reference wastewater treatment through waste stabilization and oxidation
271 ponds, and wastewater treatment plants).

272 Some of the poorest sanitation conditions reported are zero latrines for an IDP population
273 in Somalia (Grunewald, F., 2012) and for a refugee population in the Central African Republic
274 (UNHCR, 2016b), and defecation into plastic bags that were then thrown into a ravine in an IDP
275 camp in Haiti (Schuller and Levey, 2014). Conversely, studies report that 100 per cent of
276 households had their own latrines in a refugee camp in Jordan (van der Helm et al., 2017),
277 universal availability of sanitation infrastructure in a refugee camp on the Thailand-Myanmar
278 border (McCleery et al., 2015), and 97% of households being connected to a sewerage network
279 in a refugee camp in Jerusalem (Issa et al., 2015). Of the 107 publications (50%) that report on
280 sanitation conditions, 42 (20%) report coverage data, though measurement methods varied: 21
281 studies (10%) report household or population sanitation coverage, 15 (7%) measure average
282 number of persons per latrine or toilet per person, six (3%) measure coverage of a specific
283 sanitation technology (sewer connection, communal latrines, private latrines, etc.), five (2%)

284 report percentages of the population engaging in open defecation, five (2%) report the
285 breakdown of the use of different sanitation technologies, two (1%) report on the average
286 distance from shelters to latrines, two (1%) report on percentage of households engaging in
287 proper child excreta disposal, and one (0.5%) reports on the percentage of households meeting
288 UNHCR excreta disposal standards. Several studies use more than one indicator to assess
289 sanitation conditions.

290 A few studies address sanitation concerns other than household toilet coverage. One
291 mentions sanitary waste from health care facilities (UNHCR, 2008) and one reports on sanitation
292 coverage in restaurants (Al-Khatib & Al-Mitwalli, 2007). Two publications address disposal of
293 dead bodies in camps (Schuller and Levey, 2014; UNHCR, 2008). Publications reference the
294 World Health Organization (WHO), UNICEF, and UNHCR standards and guidelines for
295 sanitation; one study notes that refugees considered the UNICEF guideline of 14 persons per
296 toilet to be insufficient due to conflicts that arise over toilet upkeep (Hydroconseil, 2017).

297 Overcrowding is the third-most discussed topic. Many publications mention
298 “overcrowded conditions” without additional commentary. Studies use a variety of methods to
299 present data on crowding, including the crowding index (individuals per room), average family
300 size, acreage/average shelter size per family, population density, population growth, and persons
301 per tent or shelter. Eight studies (4%) present data on the “crowding index” (Afon et al., 2010;
302 Al-Khatib et al., 2003; Al-Khatib & Tabakhna, 2006; Dolan, CG., Tollman, SM., Nkuna, VG., &
303 Gear, JS., Habib et al., 2014, 1997; Molla, Mollah, Fungladda, et al., 2014; Mourada, 2004;
304 Rueff & Viaro, 2010). The highest crowding index reported was in a refugee camp in Nigeria,
305 where nearly 30% of the population lived in shelters with seven or more persons per room (Afon
306 et al., 2010). In addition to crowding within and between households, one study references

307 crowding in schools (Affolter and Allaf, 2014) and one references crowding in hospitals
308 (Ekmekci, PE., 2016)

309 Many animal vectors of disease are discussed, including insects (mosquitos, cockroaches,
310 flies, sandflies, lice, bed bugs, and fleas), mites, donkeys, dogs, coyotes, foxes, cats, rodents,
311 birds, cows, goats, pigs, and freshwater snails. Reported reservoirs of and causes for vector
312 breeding include: domestic water sources, surface water pools, standing water, inadequate or
313 polluted water supplies, animal water supplies; poor sanitary practices, full latrines, wastewater
314 ditches, poor drainage; dead animal carcasses, poor waste management practices (open dumping,
315 accumulation of waste, standing water around uncollected trash, uncovered waste); forests or
316 fields, food storage, food preparation, food sale, raw meat consumption; rotting roof mats;
317 animals around the household; shrubs, firewood, rubble, and rat burrows. Vector control
318 measures mentioned include bed nets, indoor and outdoor spraying, treated bed sheets,
319 fumigation, corral use for animals, screening on latrine vents, building latrines away from food,
320 effective drainage, covers on latrine holes, and sealing water containers. Other factors affecting
321 vector control and vector-related disease transmission include season, cost of control measures,
322 chloroquine resistance, and low immunity against vector-based diseases among displaced
323 populations.

324 Reported energy coverage varies from no household access (Mahmoud, Sheikh,
325 Domeika, & Mårdh, 1994; McCleery et al., 2015) to 95% or more of households having access
326 (Rodriguez, SV., Santos Ocampo, PD., Ka, E., & Tescon, V., 1982). One study notes that camps
327 near urban areas had better access to electricity (Boss, LP., Brink, EW., & Dondero, TJ., 1987).
328 Reported energy sources include solar, fossil fuel, wood or charcoal, gas, and reused waste. One
329 publication notes that energy was accessed informally through the grid (Yassin et al., 2016).

330 Publications report on the following energy uses: cooking or reheating food; pumping or
331 purifying water; pumping or treating wastewater; refrigeration (for food or vaccines); lighting
332 (for sanitation facilities and communal areas); heating; and non-governmental organization
333 (NGO) needs (administration and telecommunications). Cost of energy service is also addressed;
334 studies note that displaced persons sometimes did not receive energy services due to the cost
335 (Grunewald, F., 2012), that energy costs for pumping water were high (Waters, 1984), and that
336 only wealthier individuals had access to electricity (Krings, 1987).

337 Waste management involves household waste management, waste collection and
338 transport, and waste disposal. Publications addressing household waste mention refuse pits,
339 garbage around shelters, waste production per capita, and the use of garbage bins with lids.
340 Multiple studies reference drains, soak-aways, streams, and latrines being clogged with trash.
341 Two waste collection methods are reported: through trucking—managed by an NGO,
342 municipality, or private contractor—or through a community-organized process involving
343 residents serving as garbage collectors with wheelbarrows. Reported periodicity of waste
344 collection varies, with the most frequent collection reported to be six days per week (Yassin et
345 al., 2016). Waste disposal was reported to occur through dumping (open or semi-covered) or
346 incineration. Incineration was reported to occur at both the household level and at dumpsites for
347 the whole settlement, and one publication mentions incineration of solid waste at health care
348 facilities (UNHCR, 2008). One study describes the use of waste as manure (WFP et al., 2014)
349 and one mentions composting (Dolan, CG., Tollman, SM., Nkuna, VG., & Gear, JS., 1997).

350 Major themes for hand hygiene include the availability of water, the availability of soap
351 or ash, hand hygiene behavior, distance to handwashing facilities from latrines, and hygiene
352 education and promotion. Publications that address hand hygiene behavior mention handwashing

353 times (before eating, after eating, after using the latrine), adoption of handwashing, the use of
 354 drinking water cups for handwashing (WFP et al., 2014), and handwashing at schools and health
 355 posts (UNHCR, 2016b).

356 Publications that discuss menstrual hygiene addressed: access and distribution of
 357 menstrual hygiene materials (such as sanitary pads); disposal of menstrual hygiene materials;
 358 privacy for menstruating women; and facilities in schools. Sanitary pads are occasionally
 359 discussed in the context of distributing NFIs (non-food items). One publication discusses the cost
 360 and purchase of menstrual hygiene materials (UNHCR, 2016).

361 Environmental health topics discussed, others than those listed in **Table 7**, include: air
 362 quality and pollution; ventilation, mold, and dampness; and food safety and hygiene. Food safety
 363 and hygiene fell under the category of “other hygiene,” which we separated from “hand hygiene”
 364 and which also includes included laundry, bathing, washing, hygienic breastfeeding practices,
 365 washing dishes, hygiene kits, and other general hygiene-related conditions and factors.

366 3.2.2 Environmental hazards and exposures

367 Contaminants were categorized as “pathogens” or “chemicals”; 77 studies (36%) present
 368 findings on pathogens, and 23 studies (11%) present findings on chemicals. The most frequently
 369 discussed pathogen is *Vibrio cholerae* (n=26, 12%), followed by *E. coli* (n=13, 6%). The most
 370 commonly cited chemical is iodine (n=7, 3%), and all publications reporting this contaminant
 371 were conducted in the Tindouf province in Algeria. The ten most frequently addressed
 372 pathogens, and their environmental classifications based on their categorization in the Sphere
 373 handbook (Sphere Association, 2018), can be seen in **Table 9**.

374 **Table 9 – Ten most frequently addressed pathogens in publications included in a systematic**
 375 **scoping review on environmental health in protracted displacement**

Pathogen	Common name	Environmental classification	Count	Percentage
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<i>Vibrio cholerae</i>	Cholera	Fecal-oral (bacterial)	26	12%
<i>Escherichia coli</i>	<i>E. coli</i>	Fecal-oral (bacterial)	13	6%
<i>Shigella spp</i>	Dysentery	Fecal-oral (bacterial)	8	4%
<i>Ascaris lumbricoides</i>	Roundworm	Soil-transmitted helminth	7	3%
<i>Giardia lamblia</i>	Giardia	Fecal-oral (protozoon)	7	3%
<i>Schistoma spp</i>	Bilharzia	Water-based helminth	6	3%
<i>Trichuris trichiura</i>	Whipworm	Soil-transmitted helminth	6	3%
<i>Salmonella spp</i>	Salmonella	Fecal-oral (bacterial)	6	3%
<i>Rotavirus spp</i>	Rotavirus	Fecal-oral (virus)	6	3%
<i>Malaria spp</i>	Malaria	Vector-borne	6	3%

376
377 Some studies report a relationship between specific environmental health conditions and
378 the presence or prevalence of contaminants.

379
380
381 **Table 10** shows which environmental health conditions were linked to eight of the most
382 frequently reported contaminants in at least one of the publications included in this review.

383
384
385 **Table 10 – Reported associations between environmental health conditions and**
386 **contaminants as reported in studies for a systematic scoping review of environmental**
387 **health in protracted displacement**

388



Cholera	x	x	x	x	x	x	x
E. coli	x	x				x	
Shigella	x	x				x	x
Giardia	x	x				x	x
Rotavirus	x	x				x	x
Malaria	x	x		x	x		
Iodine	x						
Lead	x						

389

390 3.2.3 Outcomes

391 Outcomes of environmental health conditions are reported in 136 studies (64%) and were
 392 categorized as health (n=133, 62%) or livelihood (n=10, 5%). Percentages below are out of the
 393 total of 213 publications.

394 Diarrhea is the most frequently reported health outcome (n=53, 25%), followed by
 395 respiratory illness (n=35, 16%) and malaria (n=34, 16%). Reported respiratory illnesses include
 396 acute respiratory infection, upper respiratory infection, lower respiratory infection, tuberculosis,
 397 pneumonia, bronchitis, asthma, whooping cough, emphysema, and other respiratory infections.
 398 Reported nutritional deficiencies and malnutrition outcomes include protein, micronutrient, and
 399 niacin deficiencies, anemia, and scurvy. Skin-related diseases and symptoms, including rashes,
 400 scabies, lesions, eye-related afflictions such as conjunctivitis and blindness, and ear infections
 401 are noted as health outcomes. Other outcomes reported to be associated with environmental
 402 health conditions include vomiting, cold-like symptoms, influenza and influenza-like illnesses,
 403 thyroid dysfunction (due to excessive iodine exposure), gastroenteritis, fever, measles, urinary
 404 tract infections, tonsillitis, abdominal pain, dehydration, stunting, and mental illness. Death is
 405 frequently listed as an outcome, or implied through discussions of morbidity and mortality.

406 Few publications report on livelihood outcomes. Those that do mostly relate to
 407 agriculture, referencing low crop yield (Muhammad et al., 2012) and a lack of funds for crop
 408 diversification, greenhouses, and efficient use of limited land (Singh et al., 2017). In one study,
 409 insufficient vegetation for animals and animal diseases are cited as outcomes for those who rear
 410 animals as part of their livelihoods (Gila et al., 2011). Three studies mention loss of livelihood
 411 (Ahsan et al., 2011; Barbieri et al., 2017; Caniato et al., 2017). Other outcomes include
 412 unemployment (De Buck et al., 2015), economic vulnerability and a lack of opportunity (Dolan
 413 et al., 1997), low income (Apiyo, 2014; Molla et al., 2014a; Singh et al., 2017), low market
 414 access (Apiyo, 2014), and lack of access to loans (Singh et al., 2017).

415 3.3 – Obstacles to improvement

416 **Table 11 - Summary and examples of reported obstacles and recommendations in 213**
 417 **publications included in a systematic scoping review of environmental health in protracted**
 418 **displacement**

Category	Obstacle	Example	Recommendation	Example
Institutional	Legal/policy environment	<i>Laws limiting expansion or development of camp infrastructure (Rueff and Viaro, 2010)</i>	More effective legal/policy structures	<i>Regulations establishing periodic food safety inspection and training (Kalipeni and Oppong, 1998)</i>
	Management challenges	<i>Balancing needs for rapid deployment of infrastructure and interventions in crises with the potential for integrated development in the future (Tota-Maharaj, 2016)</i>	Management improvements	<i>Centralize information on WaSH programs through development of a database system (Parpaleix and Pajak, 2016)</i>
	Lack of coordination	<i>Lack of coordination between WaSH NGO partners and across sectors</i>	Better camp planning	<i>Settling displaced populations near existing communities (Afon et al., 2010)</i>

		<i>(Hydroconseil, 2017)</i>		
Political	Conflict and instability	<i>Rival military force denying IDPs access to food and healthcare (Toole and Waldman, 1990)</i>	Increase transparency	<i>Avoid mistrust through increased transparency about use of community resources (Bönda, 2007a)</i>
	Resource scarcity	<i>Insufficient water supply infrastructure; 400 families relying upon a single borehole (Singh et al., 2017)</i>	Improve political agency of displaced populations	<i>Ensure that displaced populations are able to participate and exert influence in relevant forums (Aagaard-Hansen and Chaignat, 2010)</i>
	Financial concerns	<i>Cost of sanitation infrastructure construction (Taylor, 1979)</i>	Bolster fundraising efforts	<i>Seek additional funding from private philanthropic organizations and international agencies (Milton et al., 2017b)</i>
Implementation	Infrastructure	<i>Poor road infrastructure preventing delivery of WaSH supplies (Apiyo, 2014)</i>	Increase education and awareness	<i>Training refugees to provide basic health diagnostic and curative services (Dick and Simmonds, 1983)</i>
	Behavioral	<i>Theft of crockery from drying racks (Waterkeyn et al., 2005)</i>	Implement targeted interventions	<i>Temporary closure of markets during cholera outbreaks (Moren et al., 1991)</i>
	Monitoring and research	<i>Difficulty of tracking multiple source water use (Abouteir et al., 2011)</i>	Targeted adoption of technology	<i>Pilot mass cholera vaccinations in high-risk populations (Dorlencourt et al., 1999)</i>
Fill research gaps			<i>Investigate timing of vaccination interventions at various stages of crises (Lam et al., 2015)</i>	

420 Forty-three studies (20%) mention specific obstacles to improving environmental health
421 conditions. Such obstacles are institutional, political, or implementation-related (**Table 11**).

422 Reported institutional obstacles concern legal and policy environments and management. The
423 lack of international humanitarian laws devoted to IDPs is cited as a concern (Aagaard-Hansen
424 and Chaignat, 2010). National laws and policies are frequently described as obstacles;
425 specifically, policies which require refugees to stay in camps prevent them from seeking
426 government health services (Mohamed et al., 2014), and laws that prevent the expansion or
427 development of permanent camp infrastructure limit potential improvements in environmental
428 health conditions (Hydroconseil, 2017; Rueff & Viaro, 2010). Inadequate coordination among
429 NGOs, governments, and the private sector, between sectors (for example, between water
430 providers and energy providers), and across levels of management is described as an obstacle
431 (Ahsan et al., 2011; Bönda, 2007b; Hydroconseil, 2017; Toole and Malkki, 1992; Waters, 1984).
432 Moreover, the short duration of most projects, the high turnover of NGOs and employees
433 providing services in camps, and frequent changes in camp location pose challenges to continuity
434 and quality of services (Hydroconseil, 2017; M. Toole & Malkki, 1992). One study mentions
435 balancing needs for rapid deployment of infrastructure and interventions in crises with the
436 potential for integrated development in the future as a challenge (Tota-Maharaj, 2016).

437 Political challenges at multiple levels are mentioned in the literature—publications report on
438 international, national, and community-level conflict; resource scarcity; and financial barriers.
439 International conflict, a lack of international cooperation, and insecurity or violence are
440 frequently-referenced obstacles. These are sometimes described as indirect obstacles, but in
441 some cases created direct disruptions; one study notes a case where IDPs were denied access to
442 food and healthcare by a rival military force (Toole and Waldman, 1990). At the national level, a

443 fear of government officials (Mohamed et al., 2014) and reluctance to participate in mass
444 vaccination due to rumors of biological warfare (Grunewald, 2012) are cited as challenges. At
445 the local level, publications note weak engagement of both displaced populations and host
446 communities as a challenge; both populations are reported to have been left out of planning,
447 decision-making, and management processes. Studies report resentment among host
448 communities (Hydroconseil, 2017) and tensions between displaced populations and host
449 communities (Bönda, 2007b) as consequences.

450 Studies frequently report scarcity of resources such as water, agricultural resources, and
451 energy. In one case, a lack of agricultural resources is reported to have led to harvest failure
452 (Juel-Jensen, 1985). Insufficient equipment, including tools, spare parts, containers for food
453 storage (Bonner et al., 2007), and cement (Waterkeyn et al., 2005) are also listed as obstacles,
454 and insufficient human resources and lack of funds are frequently cited. Financial obstacles at
455 the local level include: high prices for soap and other essential commodities, price uncertainty,
456 and low incomes.

457 Reported challenges in the implementation of interventions concern: infrastructure,
458 behavioral, and monitoring and research. Infrastructure challenges include the breakdown of
459 health services during conflict and disasters, poor road infrastructure, sewage system leaks, and
460 unsuitable soil for latrines. More specific infrastructure challenges include: circular pits for
461 latrines being difficult to dig (Bönda, 2007b); a lack of roofs on latrines leading to sun hitting
462 and overheating the seats, dissuading refugees from using latrines (Nyoka et al., 2017); and the
463 closure of a municipal waste dump that had been used by refugees, leading to a waste
464 management crisis (Stel and van der Molen, 2015). Publications present a wide range of
465 implementation challenges related to behavioral interventions. Some are broad and apply to

466 groups of displaced populations, such as negligence and a lack of awareness (Afon et al., 2010),
467 a lack of community acceptance of latrines (Bönda, 2007b), and a lack of ownership among
468 displaced populations (Hydroconseil, 2017). Individual behaviors that create obstacles for
469 improvement include sabotage of water pumps by private vendors (Bönda, 2007a), theft of
470 drying racks (Waterkeyn et al., 2005), vandalism (WFP et al., 2014), and embezzlement of water
471 committee funds (Bönda, 2007a). Some publications mention monitoring and research
472 challenges, including field staff safety, the difficulty of tracking water use when respondents use
473 multiple sources (Abouteir et al., 2011), and a lack of researcher understanding of transmission
474 dynamics of lymphatic filariasis (de Souza et al., 2014).

475 *3.4 – Recommendations reported in included studies*

476 Ninety-nine studies (46%) provide recommendations. Many of these recommendations are
477 general; few studies provide tailored recommendations or insight about how to achieve them.
478 Like obstacles (section 3.3), recommendations were categorized as institutional, political, and
479 implementation-related (**Table 11**).

480 Like the institutional obstacles, institutional recommendations involve legal structures and
481 management, but also include suggestions about camp planning and international, national, and
482 camp level laws and regulations. Management recommendations generally involve the
483 development of action plans, frameworks, or strategies for topics such as solid waste
484 management (Al-Khatib et al., 2007) or housing (Al-Khatib et al., 2006) or through an integrated
485 approach (Cronin et al., 2008a). Some studies recommend using existing guidelines and
486 protocols, including one study (Abouteir et al., 2011) that advocates for the use of the WHO
487 guidelines on management of infectious diarrhea (World Health Organization, 2005) and another
488 (Cronin et al., 2008b) recommending the use of minimum standards for environmental health

489 services. Studies also discuss the importance of standardization and harmonization of indicators
490 (Cronk et al., 2015), as well as the need to address displacement concurrently with other
491 determinants of health (Aagaard-Hansen and Chaignat, 2010). One study recommends
492 programmed inspections and maintenance as well as involving community leaders and displaced
493 populations in decision-making (Bönda, 2007a). In terms of camp planning, studies recommend
494 deliberate placement of camps. Studies suggest settling displaced populations near existing
495 communities (Afon et al., 2010), near clean water sources (Toole and Waldman, 1997), and in
496 community settings rather than in camps (Araya et al., 2011).

497 Political recommendations include curbing violence and conflict to remove barriers to
498 improvement of environmental health conditions for displaced populations. More practically,
499 studies recommend being transparent in the implementation of environmental health programs
500 and improving the political agency of displaced populations. Studies also recommend bolstering
501 fundraising efforts, improving coordination among stakeholders, and working with international
502 contractors more frequently.

503 Most recommendations are implementation-related, and concerned: education and
504 awareness; interventions; technology; infrastructure; and research. Many studies cite a need for
505 improved awareness of environmental health among displaced populations, recommending
506 health education programs, awareness sessions, posters and leaflets, and promotional events. A
507 few studies provide more specific recommendations, such as targeting environmental health
508 messaging during peak communicable disease transmission times (Ahmed et al., 2012) or
509 training refugees to provide basic diagnostic and health services (Dick and Simmonds, 1983).
510 Recommendations related to interventions vary widely. The most frequently discussed include
511 vaccination, improving disease surveillance and health information systems, treating drinking

512 water, preventing environmental health-related disease, reducing crowding, supporting host
513 communities in addition to displaced populations, and striving for early detection of
514 communicable diseases. A few studies provide specific recommendations for interventions, such
515 as prioritizing the treatment of acute respiratory infections (Ahmed et al., 2012), fortifying food
516 with micronutrients (Jemal et al., 2017), temporarily closing markets during cholera outbreaks
517 (Moren et al., 1991), and improving tuberculosis screening in HIV-positive populations
518 (Kimbrough et al., 2012).

519 A few studies reference technology in their recommendations—including installation of
520 microgrids to expand electricity access (Aste et al., 2017) and upgrading cooking technology in
521 displaced persons' households (Barbieri et al., 2017).

522 Infrastructure recommendations include adequate well protection, improving cleanliness
523 around shelters, and establishing guidelines for latrine construction. More specific
524 recommendations include constructing demonstration latrines to show displaced populations how
525 to construct their own (Paquet and Hanquet, 1998), modeling water systems after already
526 functioning ones in the surrounding community (Waters, 1984), and phasing out water trucking
527 (Waters, 1984).

528 In terms of research, studies recommend more field research, seeking user feedback on
529 interventions, and more qualitative research (Rueff and Viaro, 2010). More specific
530 recommendations include sharing research findings with donors and resource managers as well
531 as other stakeholders (A. A. Cronin et al., 2008; UNHCR, 2016), conducting more research on
532 the timing of interventions in crises (Lam et al., 2015), and investigation of the unintentional
533 behavioral effects that research might have on displaced populations (Inci et al., 2015).

534 **4. Discussion**

535 *4.1 – Overview*

536 This systematic scoping review is the first to comprehensively document evidence about
537 environmental health conditions in protracted displacement. Other reviews, such as De Buck et.
538 al. (2015) distinguish between “disaster” and “post-disaster” phases of their review of the
539 amount of water needed per day in emergencies, but did not focus on the protracted phase. Yates
540 et. al. (2017) conducted a systematic review of WaSH interventions in emergency settings
541 explicitly excluding protracted crises. Some other studies consider specific environmental health
542 conditions, exposures, or outcomes in the context of forced displacement, such as cooking
543 technologies (Barbieri et al., 2017), vaccine-preventable disease (Lam et al., 2015), tuberculosis
544 (Kimbrough et al., 2012); however in this study we more comprehensively explore
545 environmental health conditions, exposures, and outcomes in protracted displacement. We find
546 that many aspects of environmental health in displaced populations are infrequently reported—
547 energy, waste management, hand hygiene, menstrual hygiene, food safety, mold and ventilation,
548 and air quality.

549 We identify three frequent themes that are particularly relevant to protracted crises:
550 integration or separation of displaced populations and host communities; evolving funding for
551 and management of environmental health services; and institutional and political challenges.

552 The issue of integration or separation of displaced populations and host communities—
553 both socially and geographically—becomes more pertinent as crises extend into the protracted
554 stage. Studies report resentment among host populations and conflict between displaced
555 populations and host populations (Bönda, 2007b; Hydroconseil, 2017), suggesting that the
556 relationship between these communities is a concern in long-term planning, including for
557 environmental health service provision. Involving host communities and local leaders in

558 planning and decision-making may help to mitigate this kind of conflict (Bönda, 2007a).
559 Moreover, **Table 6** shows that most of the included literature focused on camps (n=184, 86%) or
560 settlements (n=19, 9%), which are often physically separated from host populations. However,
561 approximately 60% of displaced persons live in urban areas (UNHCR, 2016a), whereas only 38
562 studies (18%) reported data from urban areas, slums, or similar, more integrated settings. This
563 suggests a substantive overrepresentation of camp settings in the literature, which may lead to an
564 inadequate understanding of environmental health conditions for the majority of displaced
565 populations who live outside of camps.

566 Another common theme was long-term funding and management. Over time,
567 responsibility for environmental health services in displaced populations becomes less clearly
568 defined as funding dwindles and external actors withdraw their programming (Heller, 2018).
569 Some decisions that could be taken in the early planning stage of a crisis may alleviate this;
570 establishing camps near existing communities, for example, may facilitate the extension of
571 municipal services later on (Afon et al., 2010).

572 Protracted crises also give rise to institutional and political challenges; governments, host
573 communities, and displaced populations often struggle to accept the permanence of
574 displacement. Some national policies, such as a law in Lebanon that forbids the construction of
575 permanent infrastructure in refugee settlements (Hydroconseil, 2017), reflect this mindset. Such
576 legal and political constraints limit the potential for development and expansion of sustainable
577 environmental health services despite the need for long-term provision of these services.

578 *4.2 – Recommendations for policy, monitoring, and practice*

579 Two of the primary obstacles described in included publications are institutional: the
580 exclusion of forcibly displaced populations in legal and policy environments, and a lack of

581 coordination between actors. The absence of forcibly displaced populations in international
582 development policies and environmental health frameworks is partially due to the taboos
583 attached to the social and political status of, and the lack of defined stakeholders and
584 responsibility for, involuntarily displaced populations (Behnke et al., 2018). The inclusion of
585 forcibly displaced populations in international policies is critical given that provision of
586 environmental health services in long-term displacement also requires a difficult transition from
587 emergency response to sustainable development. Such a transition requires coordination between
588 humanitarian and development actors as well as governments, displaced communities, and host
589 communities, which is not possible without appropriately framed policies to establish roles and
590 responsibilities throughout the process (Heller, 2018).

591 Forcibly displaced populations are also often left out of research that measures progress on
592 international policies and agreements related to environmental health. Specifically, insufficient
593 information on the enjoyment of human rights by refugees, asylum seekers, undocumented
594 migrants and internally displaced persons is collected in relation to the Sustainable Development
595 Goals (SDGs). Global monitoring for Goal 6, which sets a target of “availability and sustainable
596 management of water and sanitation for all” by 2030, does not include disaggregated data on
597 access to those services by forcibly displaced persons (United Nations General Assembly, 2015).
598 Without information on the extent to which forcibly displaced persons enjoy human rights, it is
599 impossible to plan and strategize effective ways to realize these rights. Monitoring initiatives
600 such as the WHO/UNICEF Joint Monitoring Programme (JMP) should disaggregate data and
601 conduct targeted analysis to evaluate WaSH services in displaced populations, much like its
602 recent additions of targeted analysis on WaSH in schools and health care facilities (UNICEF et
603 al., 2019).

604 Environmental health of forcibly displaced populations is directly linked to the human right
605 to water and sanitation, which was recognized by the UN General Assembly in 2010 (United
606 Nations General Assembly, 2010). According to the human rights framework, the migratory
607 status of a given population should not be grounds for discrimination; forcibly displaced persons
608 have equal human rights to non-displaced populations (United Nations Secretary-General, 2016).
609 Often, when relying on humanitarian assistance, people tend to be seen as “victims”,
610 “beneficiaries” or “recipients” and not as rights holders, and this perception hinders the transition
611 to long-term development (Heller, 2018). The human rights framework would require an
612 “inclusive approach”; that is, involving forcibly displaced persons in national and local
613 development planning and the improvement and expansion of local services. This approach
614 promotes sustainability and resilience and ensures access to those services for forcibly displaced
615 persons over time (Heller, 2018).

616 In addition to adopting a human rights approach to environmental health service provision in
617 protracted forcible displacement, the international community must also shift its approach to the
618 transition from emergency response to long-term sustainable development. Some have
619 suggested that, in some contexts, incorporating development activities in the early stages of a
620 crisis could be more effective; Mosel and Levine (2014), for example, suggest that there is a
621 need for a new model that “would essentially not be about linking different kinds of aid, but
622 about finding a different model of long-term engagement that can deal with protracted and
623 recurrent crises as part of normality”. Some ways in which this could take place include early
624 and frequent cooperation between humanitarian and international development actors, earlier
625 engagement with governments, and the implementation of more flexible funding mechanisms

626 (Mason, N., Mosello, B., Shah, J. & Grieve, 2017). This would address some of the institutional
627 and political obstacles described in section 3.3.

628 *4.3 – Evidence gaps and future research needs*

629 Due to the broad range of displaced populations and settings, there is a need for better
630 documentation of vocabulary related to forcible displacement. Understanding what forcible
631 displacement looks like in its many different contexts—from established refugee camps to
632 unofficial slums in urban centers—is critical for the development of more targeted programming
633 and policies. This review takes a first step towards documenting this vocabulary for displaced
634 populations and the settings where they settle (see **Table 6**), but is limited to the literature
635 included in this review, and a more comprehensive typology is needed.

636 There are some substantial gaps in evidence on environmental health in protracted
637 displacement. One is geographical; there were only six studies that reported findings on Latin
638 America and the Caribbean, and no studies on Oceania. Moreover, there were no studies on
639 Small Island Developing States (SIDS), which are likely to face challenges related to
640 displacement due to their vulnerability to the impacts of climate change (United Nations General
641 Assembly, 2015). Although the included studies may partially reflect the reality of the
642 geographic distribution of displaced populations, some countries and regions are
643 underrepresented. For example, in 2018, there were eight million forcibly displaced Colombians,
644 98% of whom have been displaced within Colombia’s borders for several years, making them
645 the second-largest group of internally displaced persons after Syrians (UNHCR, 2019), yet our
646 review retrieved no studies that reported data on Colombia.

647 There are also topical gaps, suggesting a need for broader coverage of environmental
648 health by researchers working in these contexts. Specifically, menstrual hygiene, air quality, food

649 safety, and ventilation, and mold are relatively under-researched in the context of protracted
650 displacement.

651 Although they were not the subject of this review, our findings are relevant to those who
652 face protracted displacement for reasons other than conflict or natural disaster. Those who are
653 displaced due to extreme poverty, for example, may face some of the same environmental health
654 conditions, exposures, and outcomes as forcibly displaced populations. Further research is
655 necessary on the conditions in which these populations live.

656 4.4 – *Limitations, Data quality and generalizability*

657 Given the breadth of this scoping review, some relevant terms or databases may have been
658 omitted. Several researchers contributed to this review, and inter-researcher inconsistencies may
659 have occurred in screening and data extraction. This review only included publications available
660 in English, which may affect the geographic representation of the studies included. In some
661 cases, it was not possible to determine when the displacement occurred; in these cases, we
662 included the publications to avoid data loss, but some mis-categorization may have occurred.

663 The quality of evidence varied substantially. We did not evaluate the quality of studies
664 included in the review, and instead compiled and reported aggregate results. Studies often failed
665 to report study type or other metadata, and recommendations in particular were lacking in
666 specificity.

667 Due to the scoping nature of this review, the results were heterogeneous. There is great
668 diversity across contexts, settings, populations, managing authorities, and conditions faced by
669 populations living in protracted displacement, and it is inappropriate to generalize findings
670 across displaced populations. However, this review is the first step in documenting evidence

671 related to environmental health conditions in protracted displacement, and some of the common
672 themes and lessons learned may be useful in responding to other crises.

673 **5. Conclusion**

674 This review is the first to analyze environmental health conditions in protracted
675 displacement. The global population of forcibly displaced persons is growing rapidly, at a rate
676 equivalent to 37,000 newly displaced persons per day (UNHCR, 2019). With global population
677 growth and the impacts of climate change, forcible displacement is likely to become more
678 frequent, and the likelihood of crises becoming protracted will remain high. Adequate
679 environmental health services are critical for human health, dignity, and human rights, but we
680 find that environmental health conditions in protracted displacement are often poor. Our results
681 suggest that these conditions facilitate the spread of communicable disease, foster preventable
682 environmental hazards, and lead to detrimental health and livelihood outcomes. Moreover,
683 institutional, political, and implementation-related obstacles impede improvement of
684 environmental health services in these contexts.

685 Research is rarely perceived as a priority in these settings, and the processes and institutions
686 that could facilitate the sharing of findings, lessons learned, and steps forwards are
687 underdeveloped. There is insufficient understanding of how NGOs, UN entities, donors,
688 governments, displaced populations, host communities, and other stakeholders can best approach
689 the complex challenge of long-term, sustainable environmental health service provision in
690 relation to protracted forcible displacement. However, the number of publications that were
691 identified in this review suggests that there is an opportunity to learn from existing evidence to
692 minimize adverse impacts of poor environmental conditions and sustain the health and wellbeing
693 of forcibly displaced populations.

694 Based on our findings, we make recommendations for policy, monitoring, and practice. First,
695 displaced populations must be addressed in international environmental health policy so that
696 stakeholders have a more nuanced understanding of the roles and responsibilities involved in
697 providing adequate services to these populations. This also extends to monitoring for global
698 development initiatives; research initiatives such as the UNICEF/WHO Joint Monitoring
699 Programme must collect and analyze data on the state of environmental health services for
700 forcibly displaced populations. The international community should also adopt a human rights
701 approach to forcible displacement, and include displaced populations and host communities in
702 planning for environmental health services in order to promote more inclusive development in
703 protracted crises. Finally, since most displacement lasts beyond the emergency stage, all relevant
704 stakeholders should work to shift their mindsets to longer-term planning and sustainable
705 development rather than emergency response alone. If decision-making in the early stages of
706 forcible displacement is carried out with the intention to prepare for potentially providing for
707 displaced populations for several years, many of the obstacles reported in these studies could be
708 precluded in future crises.

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