Adequate environmental health services are critical for human rights, health, and development, especially in the context of forced displacement. There are more than 70 million forcibly displaced persons worldwide, most in protracted situations, having been displaced for more than two years. Some live in camps or informal settlements, but most live in urban areas. Environmental health services are important in the transition from emergency response to sustainable development in these settings, but evidence on environmental health in displaced populations is disparate and of variable quality. We conducted a systematic scoping review of environmental conditions, exposures, and outcomes in protracted displacement settings; obstacles to improvement in environmental health services; and recommendations made for improvement. We included 213 publications from peer-reviewed and grey literature databases. Data were extracted on environmental health topics including water, sanitation, hygiene, overcrowding, waste management, energy supply, vector control, menstrual hygiene, air quality, and food safety. Most studies present data from low- and lower-middle income countries. Northern Africa and Western Asia and Sub-Saharan Africa are the most-represented regions. There is substantial evidence on water, sanitation, and crowding, but few studies report findings on other environmental health topics. Water-related disease, parasites, and respiratory infections are frequently cited and studies report that services often fail to meet international standards for humanitarian response. The most frequent obstacles and recommendations are institutional, political, or implementation-related, but few studies provide concrete recommendations for improvement. Our review compiles and characterizes the research on environmental health in protracted displacement. We recommend including displaced populations in international environmental health policy and monitoring initiatives, and bridging from humanitarian response to sustainable development by preparing for long-term displacement from the early stages of a crisis.

Keywords: refugee; internally displaced person (IDP); humanitarian; post-emergency; migration; WaSH
1. **Introduction**

There are more than 70 million forcibly displaced persons\(^1\) worldwide, many of whom live in low- and middle-income countries (UNHCR, 2019). Adequate environmental health services, including water, sanitation, and hygiene (WaSH), are critical to health, development, and human rights, and cannot be denied based on immigration or legal status (Heller, 2018). Environmental health services are especially important for forcibly displaced populations; overcrowded camps and poor environmental health conditions foster the spread of communicable diseases, and inadequate environmental health services have detrimental impacts on the health and wellbeing of displaced persons and host communities (UNHCR, 2011; Cronin et al., 2008). Environmental health services in humanitarian crises, especially in non-household settings, are poorly understood, and evidence is of variable quality (Blanchet et al., 2017; Cronk et al., 2015).

Although environmental health is often among the highest priorities in emergencies, long-term, sustainable services and their monitoring are challenging in camp settings as well as outside of camps, where 60% of displaced populations live (UNHCR, 2016a). Refugee and internally displaced person (IDP) settings are typically designed as short-term solutions, but forcible displacement usually outlasts the emergency stage; 80% of refugee crises last more than 10 years, and 40% persist past 20 years (Crawford et al., 2015). Protracted crises—defined by the United Nations High Commissioner for Refugees (UNHCR) as situations where populations are displaced for longer than two years—require different environmental health standards than acute emergencies (UNHCR, 2017a). This is reflected in the distinct principles outlined in the Sphere handbook—the international charter for humanitarian response—for protracted crises (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.
In order to compile and characterize the existing evidence on environmental health in protracted displacement, we conducted a systematic scoping review to answer the following research questions:

1. What environmental health conditions, exposures, and outcomes are reported in protracted refugee or IDP settings?
2. What obstacles are reported to prevent improvements in environmental health in these settings?
3. What recommendations do studies give to improve environmental health in these settings?

Using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, we analyzed data extracted from peer-reviewed publications and grey literature. Our results describe environmental health conditions, exposures, and outcomes related to: water, sanitation, and hygiene; overcrowding; waste management; energy supply; vector control; menstrual hygiene; food safety; and air quality. We also extracted information on obstacles to improvement that are reported in the studies included in our review, as well as their recommendations. Based on our findings, we make recommendations for policymakers, environmental health service providers, and researchers.

2. Methods

2.1 - Research questions and search strategy

This systematic review was designed according to the PRISMA methodology (Moher et al., 2009). We selected a scoping review as our methodology in order to map the key concepts of this emerging area of research, and structured the review to answer our research questions about environmental health conditions, exposures, and outcomes, obstacles to improvement, and recommendations. Scoping reviews determine what evidence is available on a given topic, and take a broader approach than systematic literature reviews (Peters et al., 2015). We designed a search strategy using terminology associated with environmental health and displaced
populations, based on other systematic reviews on related topics (Adair-Rohani et al., 2013; De Buck et al., 2015; Freeman et al., 2014; Moffa et al., 2019, 2018). Search terms included environmental health factors (water, sanitation, and hygiene; waste management; energy supply; vector control; air quality; food hygiene and safety; and cleanliness); and displaced populations terms (refugees; internally displaced persons (IDPs); and other displaced populations such as asylum seekers). Examples are included in Table 1, and the full search terms are available in S1.

Table 1 – Themes and examples of search terms for a systematic scoping review on environmental health in protracted displacement

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

For peer-reviewed literature, PubMed, Web of Science, Scopus, and EBSCOhost Global Health were searched between September 23rd 2017 and October 12th 2017. Using Cochrane’s online systematic review software, Covidence, two screeners reviewed titles and abstracts of each publication. If necessary, a third reviewer resolved conflicts. The same process was used for
For grey literature, the databases: DisasterLit; International Rescue Committee; United Nations Children’s Fund (UNICEF) WaSH; UNHCR; RAND; Centers for Disease Control and Prevention (CDC) WaSH; Water, Engineering and Development Centre (WEDC); International Committee of the Red Cross; World Bank Water were searched between December 23rd 2017 and January 6th 2018. One of four screeners adapted the search terms for environmental health, displaced populations, or both, according to the search systems for each database (e.g. character limits, sector of focus), and documented search methods and number of results (S2). The results of each search were scanned for relevant publications, and screeners selected documents for full text review. Two screeners reviewed each document and included or excluded them using the criteria outlined in section 2.2, with a third screener resolving conflicts if needed.

2.2 – Study eligibility criteria

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

<table>
<thead>
<tr>
<th>Exclusion criteria</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not focused on population of interest</td>
<td>Populations that have not been displaced; officially resettled displaced populations; Single patient or household; animal or epidemiological migration</td>
</tr>
<tr>
<td>Not forcibly displaced</td>
<td>Economically-driven or voluntary migration</td>
</tr>
<tr>
<td>Not focused on setting of interest</td>
<td>Analysis does not concern the setting in which displaced populations reside; setting is intended for permanent resettlement</td>
</tr>
<tr>
<td>Not environmental health</td>
<td>Not connected to environmental health or human health</td>
</tr>
<tr>
<td>Wrong study type</td>
<td>Documents that do not provide new data or analysis; news articles, letters to the editors, opinion pieces, newsletters</td>
</tr>
<tr>
<td>Published before 1945</td>
<td>We excluded articles that preceded the current “refugee regime”—the policies, institutions, and convention that</td>
</tr>
</tbody>
</table>
continue to shape the international community’s approach to mass displacement.²

<table>
<thead>
<tr>
<th>Not in English</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duplicate</td>
<td>Duplicate that was not removed by Covidence</td>
</tr>
<tr>
<td>Inaccessible</td>
<td>Research team and university library exhausted all reasonable resources, but could not locate a copy of the publication</td>
</tr>
</tbody>
</table>

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

2.3 – Data Extraction

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

The following data were extracted from included publications: metadata (e.g. publication title, year of study, study type); contextual characteristics (e.g. study country/countries, stage of displacement at time of study); population characteristics (e.g. origin of refugee/IDP population, reason for displacement); setting characteristics (e.g. setting establishment date, total setting population, managing authority, funder(s)); environmental health conditions reported (e.g. water source(s); sanitation service(s); animal vector(s); crowding); environmental health exposures and hazards (e.g. toxins; pathogens; disease transmission route(s)); outcomes (e.g. health outcomes; livelihood outcomes); other relevant themes (e.g. climate/season/natural disaster; relevant 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).
Simplified extraction tables are available in S3.

Each publication was assigned to a region (Sustainable Development Goals (SDG) regional groupings (United Nations, 2017)) and income level (World Bank’s list of economies (World Bank, 2018)), according to the country or countries studied; if a publication reported on more than one country or spanned more than one income level or region, it was counted in all applicable categories.

3. Results

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
3.1 – Metadata

3.1.1 Study characteristics

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

<table>
<thead>
<tr>
<th>Stage of displacement</th>
<th>Number of publications*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency (0-6 months)</td>
<td>104</td>
</tr>
<tr>
<td>Mid-term/transitional (6 months – 2 years)</td>
<td>88</td>
</tr>
<tr>
<td>Protracted (more than 2 years)</td>
<td>213</td>
</tr>
</tbody>
</table>

*The total exceeds 307 because some publications fell into more than one category.

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

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

Study characteristics are described in Table 4. Over half of the studies (n=113, 53%) were quantitative. Twenty-eight studies (13%) used approaches categorized as “other”; these included project and situation reports, threat assessments, guidance documents, and project evaluations, or did not state the study type.
### Table 4 - Study characteristics for a systematic scoping review on environmental health in protracted displacement

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publication source</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peer-reviewed database</td>
<td>198</td>
<td>93%</td>
</tr>
<tr>
<td>Grey literature</td>
<td>15</td>
<td>7%</td>
</tr>
<tr>
<td><strong>Study type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantitative</td>
<td>113*</td>
<td>53%</td>
</tr>
<tr>
<td>Cross-sectional</td>
<td>91</td>
<td>81%</td>
</tr>
<tr>
<td>Case control</td>
<td>11</td>
<td>10%</td>
</tr>
<tr>
<td>Controlled trial</td>
<td>5</td>
<td>4%</td>
</tr>
<tr>
<td>Cohort</td>
<td>4</td>
<td>4%</td>
</tr>
<tr>
<td>Literature review</td>
<td>37</td>
<td>17%</td>
</tr>
<tr>
<td>Mixed-methods</td>
<td>20</td>
<td>9%</td>
</tr>
<tr>
<td>Qualitative</td>
<td>10</td>
<td>5%</td>
</tr>
<tr>
<td>Case study</td>
<td>5</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>28</td>
<td>13%</td>
</tr>
</tbody>
</table>

*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.

The oldest publication included was published in 1946, and the most recent in 2017 (Figure 2).

With the exception of the oldest publication, there were no eligible publications from before 1979. Over half (n=112, 53%) were published after 2008.
3.1.2 Setting characteristics

Publications present findings from 54 countries and from all SDG regions except Oceania (Error! Reference source not found.). A breakdown by region and by country is available in S4.
One study (0.5%) presents findings on the European region in general, one presents findings on Africa in general, one presents findings on the Sahel region, and 18 publications (8%) do not specify the countries addressed.

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

---

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

<table>
<thead>
<tr>
<th>Income level</th>
<th>Count</th>
<th>Percentage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-income</td>
<td>55</td>
<td>26%</td>
</tr>
<tr>
<td>Lower middle-income</td>
<td>87</td>
<td>41%</td>
</tr>
<tr>
<td>Upper middle-income</td>
<td>58</td>
<td>27%</td>
</tr>
<tr>
<td>High-income</td>
<td>1</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

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

The majority of publications represent low-income countries (n=55, 26%) or lower middle-income countries (n=87, 41%).

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

<table>
<thead>
<tr>
<th>Income level</th>
<th>Count</th>
<th>Percentage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-income</td>
<td>55</td>
<td>26%</td>
</tr>
<tr>
<td>Lower middle-income</td>
<td>87</td>
<td>41%</td>
</tr>
<tr>
<td>Upper middle-income</td>
<td>58</td>
<td>27%</td>
</tr>
<tr>
<td>High-income</td>
<td>1</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

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

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

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

<table>
<thead>
<tr>
<th>Setting</th>
<th>Count</th>
<th>Percentage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp</td>
<td>184</td>
<td>86%</td>
</tr>
<tr>
<td>Settlement</td>
<td>19</td>
<td>9%</td>
</tr>
</tbody>
</table>
### Other

<table>
<thead>
<tr>
<th>Term</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>20</td>
<td>9%</td>
</tr>
<tr>
<td>Village</td>
<td>12</td>
<td>6%</td>
</tr>
<tr>
<td>Gathering</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Slum</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Holding center</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Community</td>
<td>1</td>
<td>0.5%</td>
</tr>
<tr>
<td>“Out of camp”</td>
<td>1</td>
<td>0.5%</td>
</tr>
<tr>
<td>“Colonia”</td>
<td>1</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

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

#### 3.1.3 – Population characteristics

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

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

#### 3.1.4 – Environmental health topics

The most frequently discussed environmental health topic is water, with findings reported in 149 studies (70%), followed by sanitation (n=107, 50%), and then crowding (n=79, 37%) (Table 7).
Table 7 - Prevalence of environmental health topics considered in publications included in a systematic scoping review on environmental health in protracted displacement

<table>
<thead>
<tr>
<th>Topic</th>
<th>Count*</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>149</td>
<td>70%</td>
</tr>
<tr>
<td>Sanitation</td>
<td>107</td>
<td>50%</td>
</tr>
<tr>
<td>Crowding</td>
<td>79</td>
<td>37%</td>
</tr>
<tr>
<td>Vector control</td>
<td>60</td>
<td>28%</td>
</tr>
<tr>
<td>Energy</td>
<td>36</td>
<td>17%</td>
</tr>
<tr>
<td>Waste management</td>
<td>33</td>
<td>15%</td>
</tr>
<tr>
<td>Hand hygiene</td>
<td>31</td>
<td>15%</td>
</tr>
<tr>
<td>Food safety</td>
<td>24</td>
<td>11%</td>
</tr>
<tr>
<td>Menstrual hygiene</td>
<td>7</td>
<td>3%</td>
</tr>
</tbody>
</table>

*The percentages do not add up to 100% because some publications reported data on more than one topic.*
3.2 – Environmental health conditions, exposures, and outcomes

<table>
<thead>
<tr>
<th>Environmental health conditions</th>
<th>Environmental health contaminants</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water supply</td>
<td>Bacteria</td>
<td>Health outcomes</td>
</tr>
<tr>
<td>Sanitation</td>
<td>• Vibrio cholerae</td>
<td>• Diarrhea</td>
</tr>
<tr>
<td>Crowding</td>
<td>• Escherichia coli</td>
<td>• Respiratory illness</td>
</tr>
<tr>
<td>Animal vectors</td>
<td>• Shigella spp</td>
<td>• Malaria</td>
</tr>
<tr>
<td>Energy supply</td>
<td>• Salmonella spp</td>
<td>• Nutritional deficiencies/malnutrition</td>
</tr>
<tr>
<td>Waste management</td>
<td>Virus</td>
<td>• Skin, eye, and ear-related diseases and symptoms</td>
</tr>
<tr>
<td>Hand hygiene</td>
<td>• Rotavirus spp</td>
<td>• Gastroenteritis</td>
</tr>
<tr>
<td>Menstrual hygiene</td>
<td>Helminth</td>
<td>• Death</td>
</tr>
<tr>
<td>Air quality</td>
<td>• Ascaris lumbricoides</td>
<td>Livelihood outcomes</td>
</tr>
<tr>
<td>Ventilation</td>
<td>• Schistoma spp</td>
<td>• Low crop yield</td>
</tr>
<tr>
<td>Food safety</td>
<td>• Trichuris trichiura</td>
<td>• Lack of agricultural resources</td>
</tr>
<tr>
<td></td>
<td>Protozoon</td>
<td>• Loss of livelihood or employment</td>
</tr>
<tr>
<td></td>
<td>• Giardia lamblia</td>
<td>• Economic vulnerability</td>
</tr>
<tr>
<td></td>
<td>Chemical</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Iodine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Lead</td>
<td></td>
</tr>
</tbody>
</table>

**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

3.2.1 – Environmental health conditions

Themes for water supply conditions include water source(s); water collection; water
distribution and access; water system reliability; water quantity; water quality; water treatment;
water storage; water uses; cost of water; and water management. Reported water sources span
unimproved source types (unprotected well; surface water; irrigation canal) and improved
sources (borehole; protected spring; private well; protected well; piped water; rainwater
collection; private vendor; bottled water) (WHO/UNICEF, 2018). Studies also present findings
on distance from water points, time spent collecting water, threats at the point of collection (drowning; snakes; crocodiles) (Apiyo, 2014), and arguments or fights over water collection (WFP et al., 2014). Distribution is reported to occur through trucking or pipelines (to communal taps or to individual households). Limited hours for water collection, water system breakdowns, and interruptions in water supply are reported.

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

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

<table>
<thead>
<tr>
<th>Publication</th>
<th>Country/countries</th>
<th>Population(s)</th>
<th>Setting(s)</th>
<th>Water quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC, 2003</td>
<td>Liberia</td>
<td>IDP</td>
<td>Settlement</td>
<td>1.8 liters/capita/day</td>
</tr>
<tr>
<td>Cronin, Shrestha, Spiegel, Gore, &amp; Hering, 2009</td>
<td>Ethiopia; Kenya; Tanzania; Sierra Leone; Democratic Republic of the Congo (DRC); Republic of the Congo</td>
<td>Refugee</td>
<td>Camp</td>
<td>8-20 liters/capita/day</td>
</tr>
<tr>
<td>Crooks &amp; Hailegiorgis, 2014</td>
<td>Kenya</td>
<td>Refugee</td>
<td>Camp</td>
<td>4-15 liters/capita/day</td>
</tr>
<tr>
<td>Davey &amp; Maziliauskas, 2003</td>
<td>Lebanon</td>
<td>Refugee</td>
<td>Camp</td>
<td>Less than 50 liters/household/day</td>
</tr>
<tr>
<td>Fadul &amp; Reed, 2010</td>
<td>Sudan</td>
<td>IDP; Refugee</td>
<td>Village</td>
<td>12 liters/capita/day</td>
</tr>
<tr>
<td>Study</td>
<td>Country/Region</td>
<td>Type</td>
<td>Setting</td>
<td>Water Consumption</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------</td>
<td>-------------</td>
<td>------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Herrera &amp; Sataviriya, 1984</td>
<td>Thailand</td>
<td>Refugee</td>
<td>Camp, holding center</td>
<td>15-40 liters/capita/day</td>
</tr>
<tr>
<td>Milton et al., 2017</td>
<td>Bangladesh</td>
<td>Refugee; displaced individuals</td>
<td>Camp</td>
<td>16-18 liters/capita/day</td>
</tr>
<tr>
<td>Shultz et al., 2009</td>
<td>Kenya</td>
<td>Refugee</td>
<td>Camp</td>
<td>19 liters/capita/day</td>
</tr>
<tr>
<td>Singh et al., 2017</td>
<td>Kenya</td>
<td>IDP</td>
<td>Camp</td>
<td>20 liters/family/day</td>
</tr>
<tr>
<td>Toole &amp; Waldman, 1990</td>
<td>Ethiopia (^3)</td>
<td>Refugee</td>
<td>Camp</td>
<td>6 liters/capita/day</td>
</tr>
<tr>
<td>van der Helm et al., 2017</td>
<td>Jordan</td>
<td>Refugee</td>
<td>Camp</td>
<td>35 liters/capita/day</td>
</tr>
<tr>
<td>Vivar et al., 2016</td>
<td>Algeria</td>
<td>Refugee</td>
<td>Camp</td>
<td>15-17 liters/capita/day</td>
</tr>
<tr>
<td>M. Toole &amp; Malkki, 1992</td>
<td>Ethiopia; Kenya (^4)</td>
<td>Refugee</td>
<td>Camp</td>
<td>1-3 liters/capita/day</td>
</tr>
<tr>
<td>UNHCR, 2006</td>
<td>Sudan; Chad</td>
<td>IDP; Refugee</td>
<td>Camp; Village</td>
<td>19 liters/capita/day</td>
</tr>
<tr>
<td>UNHCR, 2008</td>
<td>Ghana; Kenya; Uganda</td>
<td>Refugee</td>
<td>Camp</td>
<td>40 (Ghana), 20.5 (Kenya), and 15.2 (Uganda) liters/capita/day</td>
</tr>
<tr>
<td>UNHCR, 2017b</td>
<td>DRC; Rwanda; Uganda; Tanzania</td>
<td>Refugee</td>
<td>Camp</td>
<td>17 liters/capita/day</td>
</tr>
<tr>
<td>UNHCR, 2016b</td>
<td>South Sudan</td>
<td>Refugee</td>
<td>Camp; settlement</td>
<td>9 liters/capita/day</td>
</tr>
<tr>
<td>Waters, 1984</td>
<td>Thailand</td>
<td>Refugee</td>
<td>Camp</td>
<td>12.5-40 liters/capita/day</td>
</tr>
</tbody>
</table>

Studies report water being used for drinking, bathing, washing, cooking, household cleaning, laundry, irrigation, flushing toilets, making tea, and making formula milk for babies. In some cases, water is reported to have been provided free of charge, but water tariffs and connection fees are also reported. Affordability, especially of water purchased from private providers, can be a challenge. The quantities presented in this table are based on various studies and contexts, and may vary depending on local conditions and policies. Additional insights into water use in refugee camps and settlements can be found in the cited studies and resources.

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\(^3\) 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.
vendors, is reported to be of particular concern. Management mechanisms include water committees, with looting and lack of ownership mentioned as concerns. The use of UNHCR and Sphere standards is reported.

Studies report on sanitation technology and construction (including pit latrines, ventilated improved pit (VIP) latrines, communal latrines, household latrines, emergency latrines, and hanging latrines; toilets, pour-flush toilets, toilets with U-bends, aqua privies, container-based toilets, and public sewerage systems); and general considerations related to spacing, ventilation, and drainage. Open defecation is commonly reported. Wastewater is also frequently addressed (including references to cesspits, soak-aways, septic tanks, flood control, and desludging.

Moreover, studies reference wastewater treatment through waste stabilization and oxidation ponds, and wastewater treatment plants).

Some of the poorest sanitation conditions reported are zero latrines for an IDP population in Somalia (Grunewald, F., 2012) and for a refugee population in the Central African Republic (UNHCR, 2016b), and defecation into plastic bags that were then thrown into a ravine in an IDP camp in Haiti (Schuller and Levey, 2014). Conversely, studies report that 100 per cent of households had their own latrines in a refugee camp in Jordan (van der Helm et al., 2017), universal availability of sanitation infrastructure in a refugee camp on the Thailand-Myanmar border (McCleery et al., 2015), and 97% of households being connected to a sewerage network in a refugee camp in Jerusalem (Issa et al., 2015). Of the 107 publications (50%) that report on sanitation conditions, 42 (20%) report coverage data, though measurement methods varied: 21 studies (10%) report household or population sanitation coverage, 15 (7%) measure average number of persons per latrine or toilet per person, six (3%) measure coverage of a specific sanitation technology (sewer connection, communal latrines, private latrines, etc.), five (2%)
report percentages of the population engaging in open defecation, five (2%) report the breakdown of the use of different sanitation technologies, two (1%) report on the average distance from shelters to latrines, two (1%) report on percentage of households engaging in proper child excreta disposal, and one (0.5%) reports on the percentage of households meeting UNHCR excreta disposal standards. Several studies use more than one indicator to assess sanitation conditions.

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

Overcrowding is the third-most discussed topic. Many publications mention “overcrowded conditions” without additional commentary. Studies use a variety of methods to present data on crowding, including the crowding index (individuals per room), average family size, acreage/average shelter size per family, population density, population growth, and persons per tent or shelter. Eight studies (4%) present data on the “crowding index” (Afon et al., 2010; Al-Khatib et al., 2003; Al-Khatib & Tabakhna, 2006; Dolan, CG., Tollman, SM., Nkuna, VG., & Gear, JS., Habib et al., 2014, 1997; Molla, Mollah, Fungladda, et al., 2014; Mourada, 2004; Rueff & Viaro, 2010). The highest crowding index reported was in a refugee camp in Nigeria, where nearly 30% of the population lived in shelters with seven or more persons per room (Afon et al., 2010). In addition to crowding within and between households, one study references
crowding in schools (Affolter and Allaf, 2014) and one references crowding in hospitals (Ekmekci, PE., 2016)

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

Reported energy coverage varies from no household access (Mahmoud, Sheikh, Domeika, & Mårdh, 1994; McCleery et al., 2015) to 95% or more of households having access (Rodrigez, SV., Santos Ocampo, PD., Ka, E., & Tescon, V., 1982). One study notes that camps near urban areas had better access to electricity (Boss, LP., Brink, EW., & Dondero, TJ., 1987). Reported energy sources include solar, fossil fuel, wood or charcoal, gas, and reused waste. One publication notes that energy was accessed informally through the grid (Yassin et al., 2016).
Publications report on the following energy uses: cooking or reheating food; pumping or purifying water; pumping or treating wastewater; refrigeration (for food or vaccines); lighting (for sanitation facilities and communal areas); heating; and non-governmental organization (NGO) needs (administration and telecommunications). Cost of energy service is also addressed; studies note that displaced persons sometimes did not receive energy services due to the cost (Grunewald, F., 2012), that energy costs for pumping water were high (Waters, 1984), and that only wealthier individuals had access to electricity (Krings, 1987).

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

Major themes for hand hygiene include the availability of water, the availability of soap or ash, hand hygiene behavior, distance to handwashing facilities from latrines, and hygiene education and promotion. Publications that address hand hygiene behavior mention handwashing
times (before eating, after eating, after using the latrine), adoption of handwashing, the use of
drinking water cups for handwashing (WFP et al., 2014), and handwashing at schools and health
posts (UNHCR, 2016b).

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

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

3.2.2 Environmental hazards and exposures

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

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

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Common name</th>
<th>Environmental classification</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>[]</td>
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</tr>
</tbody>
</table>
Vibrio cholerae  Cholera  Fecal-oral (bacterial)  26  12%

Escherichia coli  E. coli  Fecal-oral (bacterial)  13  6%

Shigella spp  Dysentery  Fecal-oral (bacterial)  8  4%

Ascaris lumbricoides  Roundworm  Soil-transmitted helminth  7  3%

Giardia lamblia  Giardia  Fecal-oral (protozoon)  7  3%

Schistoma spp  Bilharzia  Water-based helminth  6  3%

Trichuris trichiura  Whipworm  Soil-transmitted helminth  6  3%

Salmonella spp  Salmonella  Fecal-oral (bacterial)  6  3%

Rotavirus spp  Rotavirus  Fecal-oral (virus)  6  3%

Malaria spp  Malaria  Vector-borne  6  3%

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

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

Table 10 – Reported associations between environmental health conditions and contaminants as reported in studies for a systematic scoping review of environmental health in protracted displacement
<table>
<thead>
<tr>
<th></th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholera</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. coli</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shigella</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Giardia</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Rotavirus</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Malaria</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Iodine</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>x</td>
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<td></td>
</tr>
</tbody>
</table>

3.2.3 Outcomes

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

Diarrhea is the most frequently reported health outcome (n=53, 25%), followed by respiratory illness (n=35, 16%) and malaria (n=34, 16%). Reported respiratory illnesses include acute respiratory infection, upper respiratory infection, lower respiratory infection, tuberculosis, pneumonia, bronchitis, asthma, whooping cough, emphysema, and other respiratory infections. Reported nutritional deficiencies and malnutrition outcomes include protein, micronutrient, and niacin deficiencies, anemia, and scurvy. Skin-related diseases and symptoms, including rashes, scabies, lesions, eye-related afflictions such as conjunctivitis and blindness, and ear infections are noted as health outcomes. Other outcomes reported to be associated with environmental health conditions include vomiting, cold-like symptoms, influenza and influenza-like illnesses, thyroid dysfunction (due to excessive iodine exposure), gastroenteritis, fever, measles, urinary tract infections, tonsillitis, abdominal pain, dehydration, stunting, and mental illness. Death is frequently listed as an outcome, or implied through discussions of morbidity and mortality.
Few publications report on livelihood outcomes. Those that do mostly relate to agriculture, referencing low crop yield (Muhammad et al., 2012) and a lack of funds for crop diversification, greenhouses, and efficient use of limited land (Singh et al., 2017). In one study, insufficient vegetation for animals and animal diseases are cited as outcomes for those who rear animals as part of their livelihoods (Gila et al., 2011). Three studies mention loss of livelihood (Ahsan et al., 2011; Barbieri et al., 2017; Caniato et al., 2017). Other outcomes include unemployment (De Buck et al., 2015), economic vulnerability and a lack of opportunity (Dolan et al., 1997), low income (Apiyo, 2014; Molla et al., 2014a; Singh et al., 2017), low market access (Apiyo, 2014), and lack of access to loans (Singh et al., 2017).

### 3.3 – Obstacles to improvement

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

<table>
<thead>
<tr>
<th>Category</th>
<th>Obstacle</th>
<th>Example</th>
<th>Recommendation</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Institutional</strong></td>
<td>Legal/policy environment</td>
<td>Laws limiting expansion or development of camp infrastructure (Rueff and Viaro, 2010)</td>
<td>More effective legal/policy structures</td>
<td>Regulations establishing periodic food safety inspection and training (Kalipeni and Oppong, 1998)</td>
</tr>
<tr>
<td><strong>Management challenges</strong></td>
<td>Balancing needs for rapid deployment of infrastructure and interventions in crises with the potential for integrated development in the future (Tota-Maharaj, 2016)</td>
<td>Management improvements</td>
<td>Centralize information on WaSH programs through development of a database system (Parpaleix and Pająk, 2016)</td>
<td></td>
</tr>
<tr>
<td><strong>Lack of coordination</strong></td>
<td>Lack of coordination between WaSH NGO partners and across sectors</td>
<td>Better camp planning</td>
<td>Settling displaced populations near existing communities (Afon et al., 2010)</td>
<td></td>
</tr>
<tr>
<td>Political</td>
<td>Conflict and instability</td>
<td>Rival military force denying IDPs access to food and healthcare (Toole and Waldman, 1990)</td>
<td>Increase transparency</td>
<td>Avoid mistrust through increased transparency about use of community resources (Bönda, 2007a)</td>
</tr>
<tr>
<td>Resource scarcity</td>
<td>Insufficient water supply infrastructure; 400 families relying upon a single borehole (Singh et al., 2017)</td>
<td>Improve political agency of displaced populations</td>
<td>Ensure that displaced populations are able to participate and exert influence in relevant forums (Aagaard-Hansen and Chaignat, 2010)</td>
<td></td>
</tr>
<tr>
<td>Financial concerns</td>
<td>Cost of sanitation infrastructure construction (Taylor, 1979)</td>
<td>Bolster fundraising efforts</td>
<td>Seek additional funding from private philanthropic organizations and international agencies (Milton et al., 2017b)</td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td>Infrastructure</td>
<td>Poor road infrastructure preventing delivery of WaSH supplies (Apiyo, 2014)</td>
<td>Increase education and awareness</td>
<td>Training refugees to provide basic health diagnostic and curative services (Dick and Simmonds, 1983)</td>
</tr>
<tr>
<td>Behavioral</td>
<td>Theft of crockery from drying racks (Waterkeyn et al., 2005)</td>
<td>Implement targeted interventions</td>
<td>Temporary closure of markets during cholera outbreaks (Moren et al., 1991)</td>
<td></td>
</tr>
<tr>
<td>Monitoring and research</td>
<td>Difficulty of tracking multiple source water use (Abouteir et al., 2011)</td>
<td>Targeted adoption of technology</td>
<td>Pilot mass cholera vaccinations in high-risk populations (Dorlencourt et al., 1999)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fill research gaps</td>
<td>Investigate timing of vaccination interventions at various stages of crises (Lam et al., 2015)</td>
</tr>
</tbody>
</table>
Forty-three studies (20%) mention specific obstacles to improving environmental health conditions. Such obstacles are institutional, political, or implementation-related (Table II).

Reported institutional obstacles concern legal and policy environments and management. The lack of international humanitarian laws devoted to IDPs is cited as a concern (Aagaard-Hansen and Chaignat, 2010). National laws and policies are frequently described as obstacles; specifically, policies which require refugees to stay in camps prevent them from seeking government health services (Mohamed et al., 2014), and laws that prevent the expansion or development of permanent camp infrastructure limit potential improvements in environmental health conditions (Hydroconseil, 2017; Rueff & Viaro, 2010). Inadequate coordination among NGOs, governments, and the private sector, between sectors (for example, between water providers and energy providers), and across levels of management is described as an obstacle (Ahsan et al., 2011; Bonda, 2007b; Hydroconseil, 2017; Toole and Malkki, 1992; Waters, 1984).

Moreover, the short duration of most projects, the high turnover of NGOs and employees providing services in camps, and frequent changes in camp location pose challenges to continuity and quality of services (Hydroconseil, 2017; M. Toole & Malkki, 1992). One study mentions balancing needs for rapid deployment of infrastructure and interventions in crises with the potential for integrated development in the future as a challenge (Tota-Maharaj, 2016).

Political challenges at multiple levels are mentioned in the literature—publications report on international, national, and community-level conflict; resource scarcity; and financial barriers. International conflict, a lack of international cooperation, and insecurity or violence are frequently-referenced obstacles. These are sometimes described as indirect obstacles, but in some cases created direct disruptions; one study notes a case where IDPs were denied access to food and healthcare by a rival military force (Toole and Waldman, 1990). At the national level, a
fear of government officials (Mohamed et al., 2014) and reluctance to participate in mass vaccination due to rumors of biological warfare (Grunewald, 2012) are cited as challenges. At the local level, publications note weak engagement of both displaced populations and host communities as a challenge; both populations are reported to have been left out of planning, decision-making, and management processes. Studies report resentment among host communities (Hydroconseil, 2017) and tensions between displaced populations and host communities (Bönda, 2007b) as consequences.

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

Reported challenges in the implementation of interventions concern: infrastructure, behavioral, and monitoring and research. Infrastructure challenges include the breakdown of health services during conflict and disasters, poor road infrastructure, sewage system leaks, and unsuitable soil for latrines. More specific infrastructure challenges include: circular pits for latrines being difficult to dig (Bönda, 2007b); a lack of roofs on latrines leading to sun hitting and overheating the seats, dissuading refugees from using latrines (Nyoka et al., 2017); and the closure of a municipal waste dump that had been used by refugees, leading to a waste management crisis (Stel and van der Molen, 2015). Publications present a wide range of implementation challenges related to behavioral interventions. Some are broad and apply to
groups of displaced populations, such as negligence and a lack of awareness (Afon et al., 2010),
a lack of community acceptance of latrines (Bönda, 2007b), and a lack of ownership among
displaced populations (Hydroconseil, 2017). Individual behaviors that create obstacles for
improvement include sabotage of water pumps by private vendors (Bönda, 2007a), theft of
drying racks (Waterkeyn et al., 2005), vandalism (WFP et al., 2014), and embezzlement of water
committee funds (Bönda, 2007a). Some publications mention monitoring and research
challenges, including field staff safety, the difficulty of tracking water use when respondents use
multiple sources (Abouteir et al., 2011), and a lack of researcher understanding of transmission
dynamics of lymphatic filariasis (de Souza et al., 2014).

3.4 – Recommendations reported in included studies

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

Like the institutional obstacles, institutional recommendations involve legal structures and
management, but also include suggestions about camp planning and international, national, and
camp level laws and regulations. Management recommendations generally involve the
development of action plans, frameworks, or strategies for topics such as solid waste
management (Al-Khatib et al., 2007) or housing (Al-Khatib et al., 2006) or through an integrated
approach (Cronin et al., 2008a). Some studies recommend using existing guidelines and
protocols, including one study (Abouteir et al., 2011) that advocates for the use of the WHO
guidelines on management of infectious diarrhea (World Health Organization, 2005) and another
(Cronin et al., 2008b) recommending the use of minimum standards for environmental health
services. Studies also discuss the importance of standardization and harmonization of indicators (Cronk et al., 2015), as well as the need to address displacement concurrently with other determinants of health (Aagaard-Hansen and Chaignat, 2010). One study recommends programmed inspections and maintenance as well as involving community leaders and displaced populations in decision-making (Bönda, 2007a). In terms of camp planning, studies recommend deliberate placement of camps. Studies suggest settling displaced populations near existing communities (Afon et al., 2010), near clean water sources (Toole and Waldman, 1997), and in community settings rather than in camps (Araya et al., 2011).

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

Most recommendations are implementation-related, and concerned: education and awareness; interventions; technology; infrastructure; and research. Many studies cite a need for improved awareness of environmental health among displaced populations, recommending health education programs, awareness sessions, posters and leaflets, and promotional events. A few studies provide more specific recommendations, such as targeting environmental health messaging during peak communicable disease transmission times (Ahmed et al., 2012) or training refugees to provide basic diagnostic and health services (Dick and Simmonds, 1983). Recommendations related to interventions vary widely. The most frequently discussed include vaccination, improving disease surveillance and health information systems, treating drinking
water, preventing environmental health-related disease, reducing crowding, supporting host communities in addition to displaced populations, and striving for early detection of communicable diseases. A few studies provide specific recommendations for interventions, such as prioritizing the treatment of acute respiratory infections (Ahmed et al., 2012), fortifying food with micronutrients (Jemal et al., 2017), temporarily closing markets during cholera outbreaks (Moren et al., 1991), and improving tuberculosis screening in HIV-positive populations (Kimbrough et al., 2012).

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

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

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

4. Discussion
4.1 – Overview

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

We identify three frequent themes that are particularly relevant to protracted crises:

1. integration or separation of displaced populations and host communities;
2. evolving funding for and management of environmental health services;
3. institutional and political challenges.

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

Moreover, Table 6 shows that most of the included literature focused on camps (n=184, 86%) or settlements (n=19, 9%), which are often physically separated from host populations. However, approximately 60% of displaced persons live in urban areas (UNHCR, 2016a), whereas only 38 studies (18%) reported data from urban areas, slums, or similar, more integrated settings. This suggests a substantive overrepresentation of camp settings in the literature, which may lead to an inadequate understanding of environmental health conditions for the majority of displaced populations who live outside of camps.

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

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

4.2 – Recommendations for policy, monitoring, and practice

Two of the primary obstacles described in included publications are institutional: the exclusion of forcibly displaced populations in legal and policy environments, and a lack of
coordination between actors. The absence of forcibly displaced populations in international
development policies and environmental health frameworks is partially due to the taboos
attached to the social and political status of, and the lack of defined stakeholders and
responsibility for, involuntarily displaced populations (Behnke et al., 2018). The inclusion of
forcibly displaced populations in international policies is critical given that provision of
environmental health services in long-term displacement also requires a difficult transition from
emergency response to sustainable development. Such a transition requires coordination between
humanitarian and development actors as well as governments, displaced communities, and host
communities, which is not possible without appropriately framed policies to establish roles and
responsibilities throughout the process (Heller, 2018).

Forcibly displaced populations are also often left out of research that measures progress on
international policies and agreements related to environmental health. Specifically, insufficient
information on the enjoyment of human rights by refugees, asylum seekers, undocumented
migrants and internally displaced persons is collected in relation to the Sustainable Development
Goals (SDGs). Global monitoring for Goal 6, which sets a target of “availability and sustainable
management of water and sanitation for all” by 2030, does not include disaggregated data on
access to those services by forcibly displaced persons (United Nations General Assembly, 2015).
Without information on the extent to which forcibly displaced persons enjoy human rights, it is
impossible to plan and strategize effective ways to realize these rights. Monitoring initiatives
such as the WHO/UNICEF Joint Monitoring Programme (JMP) should disaggregate data and
conduct targeted analysis to evaluate WaSH services in displaced populations, much like its
recent additions of targeted analysis on WaSH in schools and health care facilities (UNICEF et
al., 2019).
Environmental health of forcibly displaced populations is directly linked to the human right to water and sanitation, which was recognized by the UN General Assembly in 2010 (United Nations General Assembly, 2010). According to the human rights framework, the migratory status of a given population should not be grounds for discrimination; forcibly displaced persons have equal human rights to non-displaced populations (United Nations Secretary-General, 2016).

Often, when relying on humanitarian assistance, people tend to be seen as “victims”, “beneficiaries” or “recipients” and not as rights holders, and this perception hinders the transition to long-term development (Heller, 2018). The human rights framework would require an “inclusive approach”; that is, involving forcibly displaced persons in national and local development planning and the improvement and expansion of local services. This approach promotes sustainability and resilience and ensures access to those services for forcibly displaced persons over time (Heller, 2018).

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

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

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

There are also topical gaps, suggesting a need for broader coverage of environmental health by researchers working in these contexts. Specifically, menstrual hygiene, air quality, food
safety, and ventilation, and mold are relatively under-researched in the context of protracted displacement.

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

4.4 – Limitations, Data quality and generalizability

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

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

Due to the scoping nature of this review, the results were heterogeneous. There is great diversity across contexts, settings, populations, managing authorities, and conditions faced by populations living in protracted displacement, and it is inappropriate to generalize findings across displaced populations. However, this review is the first step in documenting evidence
related to environmental health conditions in protracted displacement, and some of the common
themes and lessons learned may be useful in responding to other crises.

5. Conclusion

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

Research is rarely perceived as a priority in these settings, and the processes and institutions
that could facilitate the sharing of findings, lessons learned, and steps forwards are
underdeveloped. There is insufficient understanding of how NGOs, UN entities, donors,
governments, displaced populations, host communities, and other stakeholders can best approach
the complex challenge of long-term, sustainable environmental health service provision in
relation to protracted forcible displacement. However, the number of publications that were
identified in this review suggests that there is an opportunity to learn from existing evidence to
minimize adverse impacts of poor environmental conditions and sustain the health and wellbeing
of forcibly displaced populations.
Based on our findings, we make recommendations for policy, monitoring, and practice. First, displaced populations must be addressed in international environmental health policy so that stakeholders have a more nuanced understanding of the roles and responsibilities involved in providing adequate services to these populations. This also extends to monitoring for global development initiatives; research initiatives such as the UNICEF/WHO Joint Monitoring Programme must collect and analyze data on the state of environmental health services for forcibly displaced populations. The international community should also adopt a human rights approach to forcible displacement, and include displaced populations and host communities in planning for environmental health services in order to promote more inclusive development in protracted crises. Finally, since most displacement lasts beyond the emergency stage, all relevant stakeholders should work to shift their mindsets to longer-term planning and sustainable development rather than emergency response alone. If decision-making in the early stages of forcible displacement is carried out with the intention to prepare for potentially providing for displaced populations for several years, many of the obstacles reported in these studies could be precluded in future crises.
Acknowledgements

The authors would like to thank Mary White (UNC Health Sciences librarian), Michelle Moffa, and Wilson Guo for their assistance in developing a search strategy, as well as Mabel D’Souza for screening and extracting data from articles. Thank you to Emma Kelly for her assistance with mapping and editing.

This project was made possible by funding from the Foreign Language and Area Studies fellowship through the Carolina Center for the Study of the Middle East and Islamic Civilizations, World Vision International, the Sut and Fay Ahuja Fellowship, the UNC Department of Public Policy, the UNC Department of Environmental Sciences and Engineering, the UNC Environment, Ecology, and Energy Program, the Morehead-Cain scholarship, CVM LLC, Carolina Performing Arts, and the Jon Curtis Student Enrichment Fund.
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