Throughout history, tuberculosis (TB) as well as humanitarian crises have occurred, mostly episodically and sometimes together (1). Higher TB incidence and adverse TB outcomes have often been associated with socioeconomic deprivation and other social risk factors, and during the 20th century, large TB incidence and mortality increases were observed during the two world wars in several European countries. This review aims to summarize the evidence of health effects in crises-affected populations, with a particular focus on TB epidemiology, care, and outcomes.

WHAT IS A CRISIS AND HOW DOES IT AFFECT POPULATIONS?

The term crisis in this context is “a time of intense difficulty and danger.” More specifically and in the humanitarian sense, it is defined as “an event or series of events representing a critical threat to the health, safety, security, or wellbeing of a community, usually over a wide area” (2). Humanitarian crises are often unforeseen and by definition have adverse impacts on the health and socioeconomic well-being of the affected population. The World Health Organization (WHO) categorizes crises into three levels according to the required emergency response (3); this review focuses on the severe end (levels 2 and 3), where moderate to severe effects on public health require a regional or global WHO response. Humanitarian crises can be economic, political, societal, or environmental, and they frequently span more than one aspect of society. Examples include sudden political change, civil unrest and other types of armed conflict, famine, infectious disease epidemics, natural and environmental disasters, and other harmful events (2).

Humanitarian crises have significant socioeconomic and health effects on the resident population which may lead to large population displacements, with people either migrating internally (becoming internally displaced persons [IDPs]) or becoming refugees and asylum seekers crossing international borders into third countries. Once such persons have arrived in the host country, additional issues may arise, such as uncertainty about their legal status or difficulty accessing the host country’s health care system. The journey of an affected person can be categorized in three parts: residency in the affected (sender) country, transit, and settlement in the host country. Many issues interact and overlap, and individual personal experiences may differ significantly. Nevertheless, this categorization provides a useful framework for examining the issues systematically.

1Centre for Infectious Disease Surveillance and Control, Public Health England, Colindale, London NW9 5EQ, United Kingdom; 2Institute for Global Health, University College London, London WC1N 1EH, United Kingdom.
DATA AND SOURCES OF INFORMATION

There is an obvious scarcity of epidemiological and health information in these humanitarian situations, although information from United Nations agencies, governmental and nongovernmental organizations, or academia, with often variable quality, may be available. On the whole, the information consists of survey data, often collected for operational reasons and frequently with limitations around definitions and methodology. The Centre for Research on the Epidemiology of Disasters, Brussels, Belgium, has captured and collated considerable amounts of data from these sources and created the Complex Emergency Database (CE-DAT) (4), a key knowledge resource for this topic area. Despite their limitations, these data provide useful snapshots and insight into these situations.

THE RESIDENT POPULATION

Resident (nondisplaced) populations in a humanitarian crisis situation include all those who are unable or unwilling to move. Health effects on this population vary significantly, depending on the type of crisis and environment, but there are a number of commonalities. There are direct and indirect health effects on both resident and transient populations. Direct health effects are typically caused by direct harm, for example, through violence, whereas indirect effects occur through destruction or breakdown of infrastructure, which, in turn, jeopardizes basic human needs, such as provision of clean water and food, safe shelter, and suitable clothing. Breakdown of infrastructure can increase the risk of infectious diseases in general (e.g., waterborne or foodborne gastrointestinal infections) but also airborne infections through increasing transmission risk in situations with overcrowding, temporary accommodations, and mass shelters. Malnutrition and other secondary effects may also lead to a higher susceptibility to infectious diseases in this population. Frequently, the health service infrastructure (buildings, facilities, and staff) is also affected, and this, in turn, increases barriers to access and ultimately adversely affects health outcomes (Fig. 1).

Notwithstanding the often catastrophic direct health effects of a crisis, it is important to note that indirectly caused morbidity and mortality in humanitarian situations are often significant and frequently exceed direct effects, even in violent situations, once the immediate aftermath has passed (5, 6). Infectious diseases of all types are a dominant cause of excess mortality in many humanitarian crises. CE-DAT-based analyses of recent complex humanitarian emergencies, including those in Sudan, Somalia, Democratic Republic of the Congo, and Ethiopia, estimated significant excess mortalities, particularly in the resident population (1.51; 95% confidence interval [CI], 1.47 to 1.58) and in IDPs (2.5; 95% CI, 2.2 to 2.93) (5).

Several factors common in humanitarian crises are acknowledged and independent risk factors for increased TB incidence and adverse outcomes, such as overcrowding, malnutrition, socioeconomic deprivation and poverty, comorbidities (particularly those related to immunosuppression, e.g., HIV infection), or barriers to health care access associated with diagnostic and treatment delays. However, TB is often not a primary concern in humanitarian situations, partly explained by its slower onset but also because the importance of TB will depend on the TB background epidemiology.

Estimates of TB incidence in the resident population during a crisis vary significantly depending on the background incidence (7), the type of crisis, and the different types of resident populations (8, 9), but they can often dramatically exceed background incidence rates (10). For example, in Timor-Leste, following the declaration of independence and ensuing civil unrest, the incidence and number of new cases increased dramatically, including a high proportion of smear-positive pulmonary TB (11). Similarly, estimated incidence rates in Sub-Saharan conflict areas, such as the Democratic

---

Republic of the Congo, Somalia, or South Sudan, remain very high (12) and increase in association with times of conflict (13). However, the picture is more complex; estimates of incidence among Syrians, which was comparatively low (19 per 100,000) (14) before the war, have varied, but they frequently remain below those reported from many other conflict areas (15).

TB is a complex disease, and diagnostic and treatment delays are often significant, even in advanced economies with stable health care provision (16). Humanitarian emergencies can be associated with increasing barriers to access of health care, through destruction of infrastructure, lack of means to pay for it, or conflicting needs and concerns (e.g., security). In addition, the function of national treatment programs (NTPs) and associated infectious disease surveillance can be significantly impaired. Diagnostic and laboratory capacity may be severely affected and access to TB medications compromised.

Together, these circumstances will lead to increased diagnostic and treatment delays and significant case underreporting, at both patient and population levels. The lack of timely and continued access to effective treatment not only increases morbidity and mortality but also increases development of drug resistance, which aggravates the treatment situation, as supplies for specialized drugs may be scarce. This may be complicated additionally through regional movement of persons to neighboring countries, in turn posing challenges to their treatment programs (17).

Through international efforts, including multiagency responses to rebuild NTPs and implementation of ad hoc surveillance tools such as WHO prevalence surveys, these effects can be mitigated (13), but such responses may be partial, expensive, and difficult to organize and do not always compensate for the loss of infrastructure, particularly in prolonged periods of unrest. This leads to considerable suffering of the population but also significant uncertainties around incidence estimates.

Because of the complexities of diagnosing and treating TB, including its lengthy standard treatment course, there had been concerns around establishing TB treatment programs in the early stages of humanitarian emergencies to avoid competing with resources needed to mitigate more immediate threats to life and particularly to avoid low treatment completion rates associated with loss to follow-up or medication stockouts, which, in turn, may be associated with increasing rates of drug resistance (18). However, more recently, there have been good examples of success, particularly in multiagency efforts between the private and state sectors, as well as nongovernmental agencies (10), to achieve an early reestablishment of NTPs with high treatment completion rates (11). The WHO TB field manual (18) and, more recently, the WHO Eastern and Mediterranean Regional Office (EMRO) guide on TB in complex emergencies (19) recognize the success of multiagency efforts to establish effective treatment programs in humanitarian emergencies. Both documents recommend a number of considerations before establishing TB treatment programs. In order to address concerns described above, the recommended population setting would be semi-stable (for at least 18 months), where basic needs (such as food and clean water) are provided for, with a clinical service providing for essential needs and with a mortality rate of less than 1 per 10,000 persons per day (18, 19). In addition, there are a number of basic requirements to be met in establishing the TB program in these situations, including ensuring political commitment and stable financing, the establishment of quality-assured diagnostics and laboratory services, an effective drug supply management system, the use of standardized treatment regimens with effective patient support, and a robust monitoring and evaluation system (18). Because of the concern around the complexity and costs of treating multidrug-resistant TB, often associated with inappropriate treatment choices or inadequate treatment due to intermittently interrupted drug supplies, specific attention should be paid to ensuring robust supply routes and appropriate training so that first-line drugs are effectively used throughout the program.

The WHO field manual and EMRO guide are very helpful references for implementing such TB control programs among the resident or refugee population affected by humanitarian emergencies (Fig. 2). After establishing the need and political commitment for the program, a strong emphasis is laid upon establishing a good collaboration among different organizations of private, not-for profit, and international organizations and with the state sector (NTP). This includes agreeing upon the roles and responsibilities for each player, establishing the lead agency, and defining the links to the state health system—usually agreed to in a memorandum of understanding. There are good examples demonstrating that a well-functioning collaboration between different agencies is vital to the overall success and efficiency of the program (11, 13). All of this is the foundation upon which the program planning (outlined in detail in the manual) is based, which defines details around requirements for staff, accommodation, facilities, logistics, and monitoring. For the implementation phase, the manual gives particular emphasis to the role
of staff training according to the WHO International Standards for Tuberculosis Care (20) to ensure high standards of diagnostics, treatment, and care.

### POPULATIONS ON THE MOVE

In humanitarian crises, affected persons may either be forcefully displaced from their homes or decide to flee the emergency. Crises in recent years have generated significant and increasing numbers of such displaced persons. In 2015, the United Nations High Commissioner for Refugees (UNHCR) recorded 65.3 million forcibly displaced persons (about the size of the UK population); 21.5 million of these were refugees, and 3.2 million were asylum seekers. The number of IDPs was estimated at 40.8 million (21, 22). The transit time, migration route, and circumstances are highly variable, and so is the experience of these things.

Displaced populations can face very similar adverse conditions, through loss or interruption of their traditional infrastructure and social networks during their often-hazardous journey and difficulties faced when trying to settle in their new host country.

Some may find safety as IDPs or when migrating to neighboring countries, as seen during the current Syrian conflict or in Sub-Saharan Africa (e.g., Somalis in neighboring countries like Kenya or displaced South Sudanese). Others may find shelter in irregular make-shift camps or more organized, UNHCR-administered refugee camps. There are also significant numbers of IDPs, forcefully displaced migrants, and refugees living among local communities in neighboring countries, for example, Syrians who live in communities in Lebanon. It is worth noting that for a significant number of displaced persons, their “temporary” refuge in neighboring countries within the region will continue for years or sometimes decades. These populations are often at high risk of TB, and there is a need for strengthening TB diagnosis and care in these situations, as demonstrated in the example of IDPs within Afghanistan (23).

While there are commonalities, such as relative overcrowding or the limitations of infrastructure and facilities, health and safety conditions and access to care in these camps can also depend on whether camps are recognized by the host country (24, 25). It is possible that apart from the more complex security situation, the sometimes more informal arrangements within the country may in part explain the higher morbidity and mortality for IDPs than for regional refugees (5). Another important aspect is the travel itself, which may vary from the formal travel arrangements of official resettlement programs (often for “recognized” refugees (26)) to more informal, sometimes long and treacherous and not always legal routes (27, 28). These circumstances of accommodation and travel significantly influence health outcomes, and this may be one explanation for the variation of health outcomes, including TB rates, observed among migrants from the same country (8, 15). It follows that access to health care can be severely limited en route and varies significantly among settled refugees (29) and those in informal camps (24), in detention in transit countries, and in the process of travel (30).

Effective TB detection and care are unlikely except in the most stable of these situations, such as in established camp situations (11). This may explain the relatively high rates of active TB found on arrival in ports, where informal routes are more common, and the attractiveness of active case finding interventions for receiver countries (31). Screening for TB at ports is often limited to active case finding (32) and frequently faced with operational problems, including loss to follow-up for identified cases (31). A number of countries have therefore implemented pre-entry screening procedures for migrants and refugees (33), although these are limited to recognized refugees following formal travel arrangements. Although the need of medical and TB care en route may be significant, health care access is likely limited to stable camp situations or after

**Figure 2** Steps in establishing a TB control program among persons affected by humanitarian crises. Adapted from the WHO field manual (18) and the WHO EMRO guide for TB control in complex emergencies (19).
arrival in the receiving country. Ensuring early and robust access to TB diagnosis and treatment postarrival is therefore a key European and global priority (34).

INFECTION DISEASES AND TB POSTARRIVAL

Displaced individuals who seek refuge in receiving countries are often a mixed group of migrants with very different health profiles, legal statuses, and entitlements. Depending on their entry route and other circumstances, they may have recognition as refugees, arrive on other visa types (such as workers or students), or have no legal status (“undocumented migrants”). On or after arrival, many individuals without refugee status may claim asylum (“asylum seekers”), but whether and when asylum is claimed and granted can depend on operational considerations and applicable legislations (e.g., the Dublin regulations prescribing an asylum claim to be filed in the first European Union country transited). It is worth noting that there are also significant numbers of displaced persons who remain as IDPs within their own country or regional refugees in neighboring countries for long periods and never move to resettle or immigrate to high-income host countries (see above).

While TB risk across this heterogeneous group of migrants to high-income countries varies, refugees, asylum seekers, and other displaced individuals are often at higher risk of TB after arrival in the receiving countries. While in 2014, about 26.8% of the 58,008 TB cases notified in the European Union and Economic Area were in individuals born abroad, this proportion varies significantly (0.3% to 100%), and in many Western European countries, the majority of TB cases are notified among persons who arrived from higher-incidence countries (35). Often, TB disproportionately affects high-risk groups, including vulnerable migrants. Asylum seekers are often highly vulnerable, and there is evidence of increased TB incidence in this population (36). More recently, an increase of nonnative TB cases has also been reported in a number of Middle Eastern countries hosting Syrian refugees (8, 37).

Health needs and access in the host country can be highly variable, but they depend on somewhat different factors than those described previously. In addition to previously described outcome determinants, such as health care availability and socioeconomic circumstances (including conflicting needs), the legal status and entitlements to basic provisions and health care play a major role within many receiver countries. Countries’ legislations are currently highly variable regarding this, and eligibility for health and social care can be dependent on the migrant’s legal status. In some countries, access to health care has even been actively restricted for specified migrant groups (38). Uncertainty about entitlements and poor ability to navigate the health system can introduce additional barriers (39), and potential consequences may include treatment delays leading to avoidable morbidity and mortality (16) and—in the case of TB—potentially avoidable transmissions. Considering the public health implications, some countries, such as the UK, have exempted TB care from health care access restrictions (so that it remains free), but there can be considerable uncertainty during the diagnostic phase, introducing significant access barriers for affected individuals (40).

It is important to mention that a number of international conventions and treaties define and protect the rights, responsibilities, and status of refugees. Article 14 of the Universal Declaration of Human Rights (1948) first recognized the right of a person to seek protection from persecution in third countries. The Convention relating to the Status of Refugees (1951), often regarded as the founding charter for the UNHCR, expands on article 14 and defines the term refugee as well as the rights and responsibilities of refugees. The Protocol Relating to the Status of Refugees (New York Protocol, 1967) removed the temporal and spatial restriction of the term “refugee.” Many Organisation for Economic Co-operation and Development states, including the United States and the UK, were among the 26 signatories of the protocol, and as of 2016, the convention had been ratified by 145 states and the protocol by 146 states (26). According to the convention and protocol (26), a refugee is defined as

A person who owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to such fear, is unwilling to return to it.

Article 23 of the convention outlines refugees’ rights with respect to “public relief” and states that access the host country’s health service should be “equivalent to that of the host population” (26). There are a number of related conventions and international legal texts related to this, including the International Covenant on Economic, Social and Cultural Rights (1966); UN general comment 14 (2000), outlining the responsibility
of member states to “ensure the right of access to health facilities ... on a non-discriminatory basis... including migrant populations” (41); and the International Convention of the Rights of all Migrants and Members of their Families (1990). In most signatory states (26), the implementation of these conventions is not usually in question for recognized refugees but is often felt not applicable to other types of migrants, such as asylum seekers, who may then be faced with legal or organizational barriers to health care access. This means that migrants without status are often among the most vulnerable population groups in the host country, leading to a higher risk of TB and other diseases and to worse health outcomes.

A different, but related, issue which may delay diagnoses is knowledge and awareness among health care workers. Since migrants can be affected by illnesses uncommon in many receiver countries and since disease presentations may also differ in this population group, early diagnosis and effective treatment depend significantly on health care worker knowledge and awareness. This is particularly relevant for TB, which has become relatively rare in a number of receiver countries in Europe and North America and is often limited to particular risk groups. Primary care practitioners in rural areas of the United States or the UK may see, on average, less than one TB case throughout their entire professional life. Current long treatment delays in many low-incidence countries can be explained by a mixture of patient-associated and provider-associated delays (16), often equally distributed. Vulnerable migrants can be disproportionately affected by these delays.

Tailored education, sign posting, and clear information are needed both for the affected individuals and for health care workers. In many countries, some effort is put into developing and distributing such materials, but target groups are sometimes limited to recognized refugees and the information is not always provided for or applicable to asylum seekers and other types of migrants seeking refuge from crisis situations. A mixture of different approaches can be effective. A number of countries provide more specific guidance on refugee health and TB (42). The migrant health guide from Public Health England is aimed at primary care and provides guidance on a number of diseases, including TB (43). Appropriately targeted information materials (44) and training opportunities (45) for professionals in low-incidence receiver countries are probably as important as work in awareness raising and destigmatization within affected communities (46).

Ensuring that TB can be rapidly diagnosed and appropriately treated with good outcomes among all migrants, particularly the most vulnerable, is in the public health interest of host countries. Member states of the WHO European Region approved a European “strategy and action plan for refugee and migrant health” in September 2016. The plan aims to “protect and improve the health of refugee and migrant populations, within a framework of humanity and solidarity and without prejudice to the effectiveness of health care provided to the host population,” outlining nine strategic areas to improve the health system response along with information and surveillance for refugees and migrants in Europe (47). It is hoped that this plan will provide further impetus for better TB detection, control, and outcomes among all migrants in host countries in order to improve outcomes for the individual and society.

Acknowledgments. I am very grateful for the constructive review and input of Poonam Dhavan, International Organization for Migration, Migration Health Division.


References


