August 2014

Technical Brief

Demographic profile

Using secondary data

Contents

Acknowledgements

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1. Introduction

Data on births, deaths, location, age and sex structure of the affected populations are essential resources and tools in emergencies, both natural disasters and complex emergencies. They guide operational and strategic response, and facilitate reporting to decision makers, political leaders and the general public[1].

Humanitarian operational standards and guidelines contain numerous references to such data as a basis for action (e.g. the guideline may be to vaccinate all children aged <5, and for that you need to know how many children are in that age group). They are also seen as important to establish what the pre-disaster baseline was, in order to estimate the severity of the change (e.g. the level of excess mortality, displacement, etc.).

However, in the initial days and weeks following a disaster, detailed primary data are difficult to assemble due to several constraints, including time pressure, security, access, and population displacement. To assist in that situation, there is widespread use of *'standard populations'* (e.g. UNHCR 2007, SPHERE 2011, JH and IFRC 2008). Such standards rely on averages (e.g. that children aged <5 constitute an average of 9.32% of the global total population).

However, *standard populations* vary among guidelines and sources. At times they are decades out of date, yet are presented with misleading precision. In reality, populations are demographically very diverse, and may differ markedly from *standard populations* For example, children aged <5 constitute 4%, 7.5% and 22% of the population in Japan, Brazil and Niger respectively. Also, terminologies are inconsistent (e.g. the term 'children' may not be well defined in terms of age, and the same applies to other age groups such as 'older people').

Yet, context specific and up-to-date secondary data, at least at the national level, are easy to estimate or access, giving a better baseline than *standard populations*. A basic interpretation of secondary data can provide a better understanding of trends, including the highly political estimates of mortality and displacement.

Therefore, the purpose of this technical brief is to assist humanitarian workers in using secondary demographic data in emergencies. It recommends building a *context specific* demographic profile based on available information. It proposes some rule-of-thumb standards, which can be adapted to the local context, tailoring to the purpose and the time available. The document provides:

- *Long term guidance sheets (if you have a few days):* identifying demographic 'mega trends', and possible interactions with disaster risk, impact and response. This broader perspective is essential for interpreting data in emergencies, and as input for longer term strategy (e.g. CAP or SRP)[2].
- *Short term quick start (if you have an hour):* accessing demographic data for immediate operational needs in a specific emergency, such as input in a flash appeal (e.g. within 24-48 hours).

Clearly, this supplements, rather than replaces, the need for primary data, but is intended to be helpful in preparing for large scale primary data collection, and in triangulating the results[3].

This brief attempts only to sketch the overall dimensions. There is a large body of evidence especially on mortality in disasters, but little on other aspects, e.g. fertility (UN 2011). This is despite the fact that demography is particularly interactive – change one dimension and all the other dimensions are also likely to change.

[1] For a basic introduction to demography, see the 2011 Population Reference Bureau Handbook and 2009 (Haub) for an analysis of demographic trends and their humanitarian impact.

[2] Consolidated Appeals Process or Strategic Response Plan

[3] For guidance on how to collect primary demographic data in emergencies, see the ACAPS 2012: *Estimation of affected population figures.* See also Reed, 2002 and UN 2011.

2. What are demographic data?

Demography is the quantitative study of populations. Demographic data, in their simplest form, refer to six interacting dimensions:

- Births, deaths, migration (and resulting population growth)
- Age, sex, spatial distribution (and resulting population structure).

The following chapters give guidance sheets on each of those dimensions. In addition, we have added details on a few issues of special concern to humanitarians: households and disability.

Even in non-emergency situations, accurate demographic data are often difficult to gather. For example, globally about one third of births and two thirds of deaths are not accurately recorded (Setel 2007). Apart from the problems this poses for protection of rights (e.g. if children have no birth certificate), this means that many people do not know their precise age or that death, or its cause, is not recorded. The existing secondary data are therefore the result of several decades of demographic analysis and consultations among a wide range of experts, using demographic modeling. 'Raw data' are often of questionable use: they need assessment and interpretation.

In emergencies, it is even more challenging to collect and analyze demographic data. Furthermore, some data may change radically in emergencies (e.g. mortality, displacement), while others remain relatively stable in the short term (e.g. age, fertility).

Demography is quantitative, and precise use of metrics is important. Imprecise definitions are major causes of confusion and disagreement in the utilization of demographic data. Therefore, definitions and formulas are provided throughout this technical brief. We have taken the liberty of sometimes expressing e.g. birth rates in % rather than per 1,000, because it is our experience that they are easier to remember that way.

The main source used throughout this document is UN Population Prospects, produced by the UN Department of Economic and Social Affairs. It is not the only good source, but it is helpful to use sources consistently to facilitate comparisons, and to provide a simple procedure, with easily accessible, high quality and widely accepted data. Other sources are also listed, many of them building on the same (imperfect) data sources, e.g.:

- UNData (http://data.un.org),
- Gapminder (http://www.gapminder.org)
- DHS/measure (http://www.dhsprogram.com)
- In-depth (http://www.indepth-network.org/)

3. Guidance Sheets – *if you have a few days*

a. Fertility (Births)

Metrics and terminology

Fertility denotes the number of births, whereas fecundity refers to the ability to become pregnant (or to impregnate); terminology differs across languages and cultures. The most commonly used metrics for fertility are:

- **Number of births,** e.g. per year
- **Crude Birth Rate (CBR):** the number of live births per 1,000 mid-year population per year. It can also be expressed as percent
- **Age-specific fertility:** the annual number of births to women of a certain age group, per 1,000 women of that age group.
- **Total Fertility Rate (TFR):** the average number of children a woman would be expected to have during her lifetime

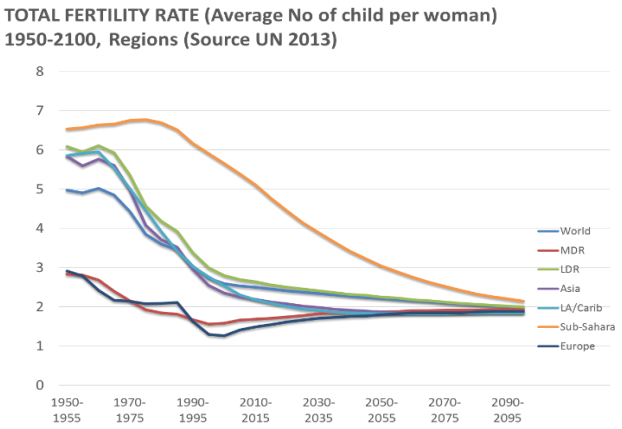
In emergencies, the first two metrics are useful for operational planning, for example, to project how many birthing kits will be needed. The TFR is a synthetic metric, based on age specific rates. Age specific rates are essential in order to understand demographic trends, but they are rarely possible or useful to calculate in emergencies. However, it is helpful in establishing the baseline demographic profile, since fertility is the single most important driver of other demographic metrics. Once you know the TFR, you can make a rough estimate of the rest.

Global mega-trends – the baseline

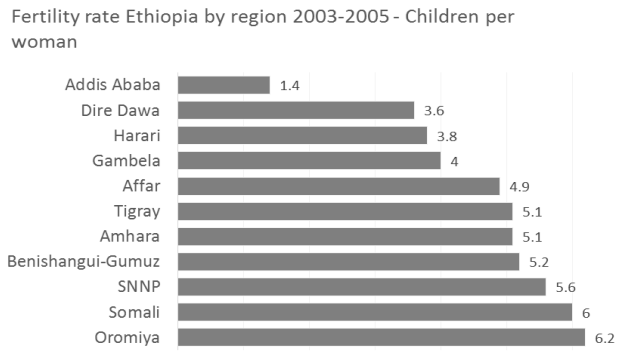
Globally, total fertility rates have halved since 1950, from an average of five children per woman to 2.5. This decline is almost universal.

200 years ago, TFR levels were similar around the world (5-7). They began declining in High Income Countries (HIC) 150-200 years ago, in Middle Income Countries (MIC) 40-50 years ago. In Low Income Countries (LIC), TFR decline is more recent, and remains high. Only a few countries have seen no decline (e.g. in Niger it is at 7.5). In other countries, TFR has declined to below replacement levels, e.g. in Thailand (1.4), and Brazil (1.8).

Radical differences exist in TFRs between countries, even neighbouring ones such as Iran (1.9) and Afghanistan (5.0).



Within countries, there is often geographic disparity. For example, in 2005 in Ethiopia, TFR was 1.4 in Addis, but above six in some rural areas.



Source: Haub 2009, DHS 2005 Ethiopia

However, here it is important to keep in mind what different metrics show and to place them into context. Although the TFR may be lower in urban areas, the proportion of young women may be high, due to rural/urban migration. Therefore, the CBR may be high.

Other major disparities in countries are with regard to education or income. The least educated/wealthy may have fertility levels several times higher than the most educated/wealthy.

It is also essential to keep age structure in mind if you want to interpret other trends, e.g. in health. For instance, age at childbearing is significant with respect to health, with girls who give birth at very young ages (e.g. under 15) and older women, especially those who have had five children or more, estimated to have higher mortality (Kassebaum *et al*, 2014).

Emergencies – what may be different?

At the macro level, long term variations in fertility have an impact on population growth and urbanization.

At the micro (household) level, women who have fewer children generally have higher income/education and better health, which is generally expected to be associated with resilience to risk. However, women themselves at times see having many children as security.

In an emergency, one can expect birth rates to remain similar to pre-emergency levels for nine months, given that they are the result of existing pregnancies. There is some evidence of increased levels of miscarriage/still births after emergencies, including in epidemics or famines, leading to limited reductions in birth rates (Bloom-Feschbach 2011, UN 2011). There is also evidence that the sex ratio at birth may change, as miscarriages increase disproportionally for males (Yong 2005). In the longer term, there is evidence that, in some settings, fertility may increase short term in the years following the onset of emergency, both natural and armed conflict (Finlay 2009, Solo 2008). However, these changes are relatively minor.

Rule-of-thumb standards and sources

If you know the TFR, you can make rule-of-thumb estimates of other measures:

- In a very low-fertility country such as Japan (TFR at 1.4), the CBR is around 1%
- In a high fertility country as Niger (TFR at 7.5), CBR is around 5%
- Therefore, expect CBRs between 1-5%.

Source: The United Nations Population Division http://esa.un.org/wpp/unpp/panel_indicators.htm

b. MORTALITY (Deaths)

Metrics and terminology

The most commonly used metrics for deaths are:

- **Number of deaths,** e.g. per year
- **Crude Death Rate (CDR):** number of deaths per 1,000 mid-year population per year. It can also be expressed as percent.
- **Under Five Mortality (U5M):** proportion of children dying before exact age 5
- **Life expectancy**: the average number of years a person can expect to live
- **Age specific mortality**: the annual number of deaths to people of a certain age group, per 1,000 people of that age group.
- **Maternal Mortality Ratio (MMR):** the number of pregnancy related deaths per 100,000 live births. This metric is usually not realistic to calculate during an emergency, but pre-emergency levels are often included in assessments, as an indicator of maternal health as well as the overall functioning of the health services of a country.

In emergencies the most widely used demographic metric is mortality. Given that levels can change dramatically within days, some additional, more time sensitive and simple, disaster metrics have been established:

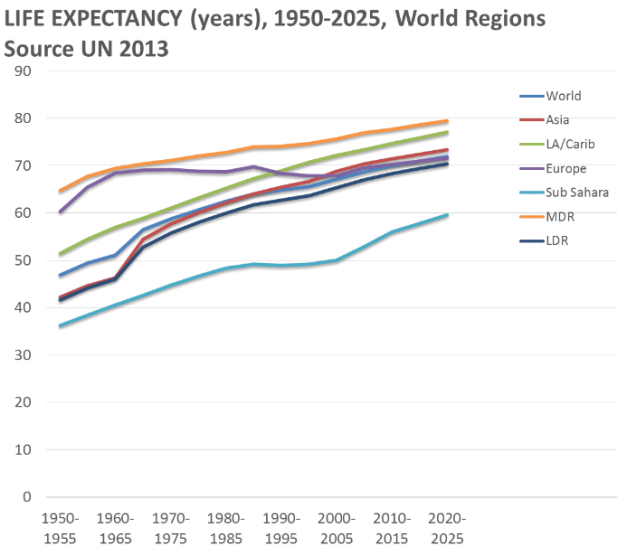
- **Crude Mortality Rate (CMR):** deaths per 10,000 population per day
- **Under Five Mortality Rate (U5MR):** deaths of children <5 per 10,000 children <5 per day.

It is important to note the difference between the metrics describing U5M and U5MR in non-emergency and emergency situations. U5M is a probability of dying, whereas U5MR is a simple rate.

A CMR of 1/10,000 per day translates into a CDR of 36.5 per 1,000 per year, and an U5MR of 2/10,000 per day translates into an U5M of 36.5 (36.5% of all children dying before their 5th birthday).

Global mega-trends – the baseline

200 years ago, life expectancy was estimated at 30-40 years in most regions of the world. With modernization, divergence began. Life expectancy rose in what are now High Income Countries. Around 1950 it also began to rise in most Middle and Low Income Countries, with the only exceptions being short term deteriorations in Europe and Southern Africa in the 1990s (coinciding with the end of the USSR and the AIDS epidemic respectively). Globally, life expectancy has improved by more than 20 years since 1950.



The early phases of improved life expectancy were usually driven by improvements in child mortality resulting from advances in housing, nutrition, water and sanitation, and vaccination coverage. These have caused child mortality to drop dramatically, from 3-400 per thousand (30-40% of children dying before their 5th birthday) to a situation today where the global average is around 6/1,000 dying before age five, with 3/1,000 in Japan, 24/1,000 in Brazil, 124/1,000 in Niger. The maximum is 152/1,000 in Guinea Bissau (Wang, 2014), that is, no country now has more than around 15% of children dying at ages <5. As a result, life expectancy has improved by up to 10 years per decade in a number of countries since 1990 (WHO, 2014).

MMR has also declined dramatically. For example, the estimated MMR for Niger a few decades ago was around 2,000/100,000, today it is estimated at around 600.

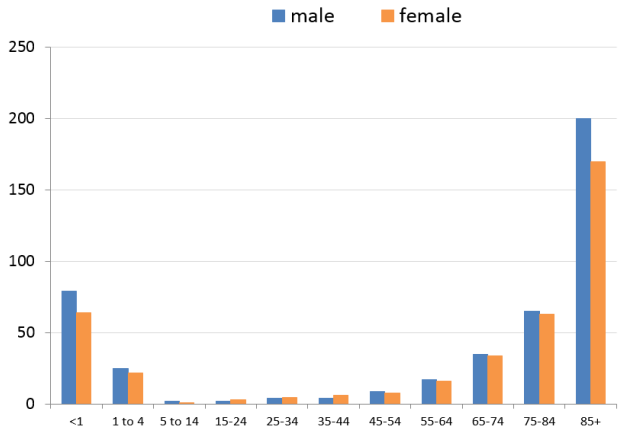
This improvement was part of the so-called *epidemiologic transition.* This refers to a shift from a situation where communicable diseases and malnutrition (particularly affecting children), and maternal deaths (affecting young women) were the main cause of death, to the present situation, where non-communicable diseases (particularly affecting older people) are the main cause. This dramatic shift has sometimes happened in a few decades

As noted, mortality patterns are closely related to the age and sex of the population concerned.

Age-specific mortality generally has three characteristics:

- It has declined dramatically for almost all populations, at all ages, especially the <5 group (although less so for young adults)
- However, it still exhibits a J-shape – with slightly higher levels for the <5 population, low levels in the age group 5-49, and then rising again after age 50.
- It is higher for males than females at almost all ages (with a few exceptions – see the guidance note on sex structure, and the example of Niger below, where females are estimated to have slightly higher mortality than males during their reproductive years)

NIGER, AGE and SEX-SPECIFIC MORTALITY, 2010



Sources: UN Population Prospects, 2012 Rev, IHME Database, accessed 20140523)

The crude death rate, as its name implies, is a crude measure, which does not take age structure into account. Populations with high life expectancy have high proportions of older people, and they in turn have higher age specific mortality rates.

In non-emergency situations, crude death rates (CDR) therefore vary less than crude birth rates (CBR) across populations, as the two tendencies cancel out each other. Thus, whereas life expectancy varies between 84 in Japan and 57 in Niger, their CDRs are similar at 1% and 1.3% respectively. Brazil, with a large proportion of young adults has a lower CDR (0.7%).

Emergencies – what may be different?

Mortality in non-emergency situations may be similar, but in emergencies, it is the demographic metric which can be expected to change most dramatically. In some cases it has been estimated to increase by 30-50 fold from the baseline level (Checchi and Roberts, 2005). Mortality is the most widely used metric to identify the severity of the crisis.

In 1990, it was suggested that the definition of the acute phase of an emergency should be the period when the CMR exceeded 1/10,000 per day, and/or U5MR exceeded 2/10,000 per day (Toole and Waldman, 1990). This represented a doubling of the baseline in sub-Saharan Africa at the time. Today, given that mortality rates have improved in all regions, there is some doubt that those rates are acceptable. Sphere guidelines suggest that the appropriate standard might be a doubling of the regional baseline (Sphere, 2004 and 2011). Other sources also question whether these standards are still applicable (CRED, 2013).

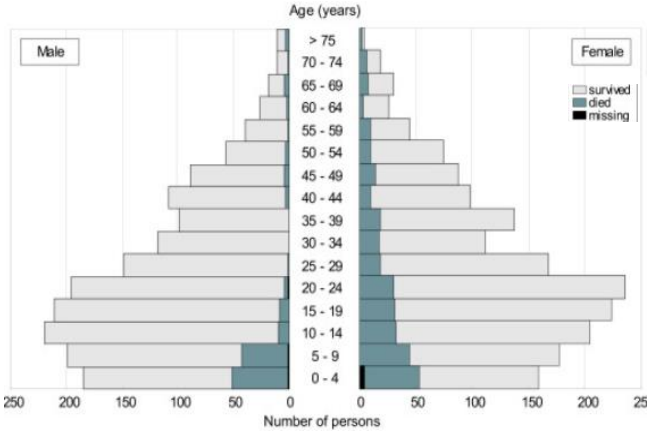
Apart from the discussion about what constitutes emergency levels, it is clear that it is difficult to collect and update primary data on mortality during emergencies. There are suggestions that retrospective data (determining levels during the acute phases) may be too difficult to gather, and that prospective data (in the recovery phases) may be more operationally useful (Checchi and Roberts, 2008).

As always in epidemiology, it is useful to identify to *whom, when, and where* deaths occur to identify why and therefore to reduce the risk and prevent excess mortality. This includes sex and age disaggregating data (usually referred to by the acronym SADD). A prime example is the focus on children under five. In emergencies, the above mentioned *epidemiologic transition* is reversed. Water and sanitation, nutrition, vaccination coverage, and shelter all may deteriorate, and those most vulnerable to this reversal are children under five, with the result that deaths due to communicable diseases and malnutrition may skyrocket. Operationally, this is one reason those response domains are relief priorities.

The pattern may not hold for sudden onset natural disasters, where systems do not erode to the same degree (Sphere 2011, Nishikiori 2006). Increasingly, it is recognized that other groups also may be particularly vulnerable, and a situation may develop with a double burden of communicable and non-communicable disease (Demaio 2013).

More complex analyses of mortality disaggregated by age and sex may also show striking patterns. In the 2004 Sri Lanka tsunami, post-disaster analyses hypothesize that the reasons for higher mortality for women and children in populations of displaced persons were that women were focused on saving their children, were less mobile, and had low swimming capacity. Similar patterns and explanations are given for mortality in the 1991 cyclone in Bangladesh (Eklund, 2012, Nishikiori, 2006).

Sri Lanka Tsunami 2004 (displaced persons)



There is evidence that in natural disasters, on average, there is excess mortality for females, with the degree related to women's status (Neumayer and Plümper, 2007). However, as is often the case, it is context specific. In the analyses of the Guatemala earthquake in 1976, about the same number of males and females died during the earthquake (which happened during the night when males and females were both at home). Proportionally, more males died during the armed conflict in Guatemala (Glass, 1977, Ball 1999).

SADD data may be impossible to collect in acute stages of an emergency, but are essential if post-disaster impact analyses are to be made and practical suggestions developed for how resilience can be improved in post-disaster settings.

Another example of age/sex differentials, as well as the importance of looking at more long term effects, comes from the Philippines, where one study found that excess infant mortality in the year after typhoon exposure outnumbered immediate damages and death tolls roughly 15-to-1, and that those most at risk were second daughters of poor families (Anttila-Hughes, 2013). Recent studies show that for populations affected by conflict, refugees may have the lowest mortality, IDPs the highest, with non-displaced populations occupying a middle position (CRED, 2013).

Rule-of-thumb standards and sources:

- CDRs tend to be constant across populations. Therefore, if you have no precise data, expect 1± 0.5%, per year as a baseline.
- On the other hand, U5M varies greatly among populations, in Niger it is above 127/1,000 (13% of children die before their 5th birthday) whereas in Japan it is 3/1,000.
- As a rule of thumb, one can expect U5M to be at 10-15% in high mortality populations.

Source: United Nations Population Division
http://esa.un.org/wpp/unpp/panel_indicators.htm
World Health Organisation
http://www.who.int/healthinfo/statistics/mortality/en/index2.html
http://www.indepth-network.org/

c. MIGRATION

Metrics and terminology

Migration refers to diverse groups. Some of the most commonly used metrics for migration are:

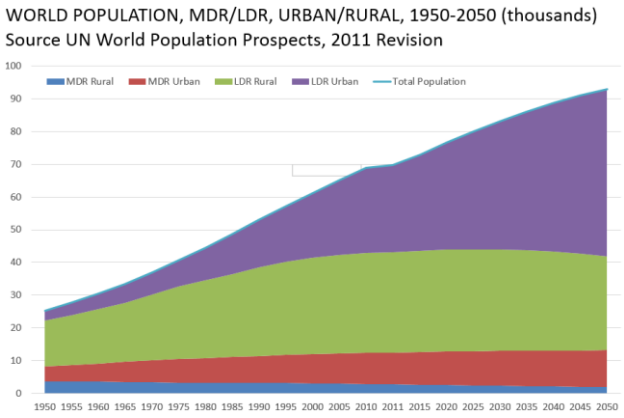
- **International migrants** or persons residing in a country other than that of their birth
- **Urban/rural population**, referring to the number of persons residing in urban or rural areas.
- **Population in slums:** The definition of 'slum' was only adopted in 2002, referring to urban areas with limited access to e.g. potable water (UNHabitat, 2008)
- **Refugees:** "Persons 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 to or, owing to such fear, is unwilling to avail himself of the protection of that country or return there because there is a fear of persecution..." (UN, 1951)
- **Internally Displaced Persons** (IDPs): "Persons who have been forced to flee their homes suddenly or unexpectedly in large numbers, as a result of armed conflict, internal strife, systematic violations of human rights or natural or made-man disasters; and who are within the territory of their own country" (UN 1992).

The metrics for migration are less standardized than for other aspects of demography, and the trends less predictable, even in non-emergency situations:

- Definitions are often inconsistent, e.g. the period of *residence*, what an *urban area* is, etc.
- Displacement is often difficult to measure and track: how do you aggregate figures of people who have been displaced several times (i.e. D.R.C., Somalia, Colombia, etc.)? When do you stop being displaced (i.e. Colombia)?
- How do you categorize the causes of displacement and distinguish from 'voluntary' migration – conflict, sudden onset and slow onset disasters?
- Data collection mandates and methodologies have been weak. It is only in the last decade that especially the Internal Displacement Monitoring Centre/NRC, (established in 1998 at the request of the IASC) has established global estimates for various types of IDPs, including weather related displacement. Many organizations are working to improve methods for identifying IDPs (e.g. JIPS).

Global mega-trends – the baseline

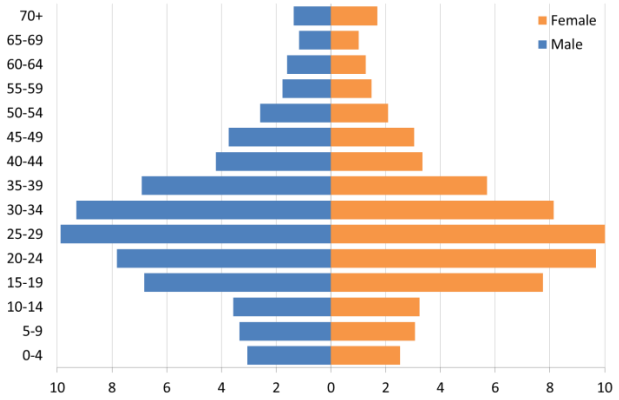
Globally, the most massive development is urbanization. In 2009, the global urban population for the first time exceeded rural population. Almost all future global population growth is expected to happen in urban areas.



UN-HABITAT estimates indicate that in 2001, about a billion people (or a third of the world's urban population) lived in slums. It projects this will increase to 2 billion unless major efforts are made to arrest the trend (UN-HABITAT, 2011).

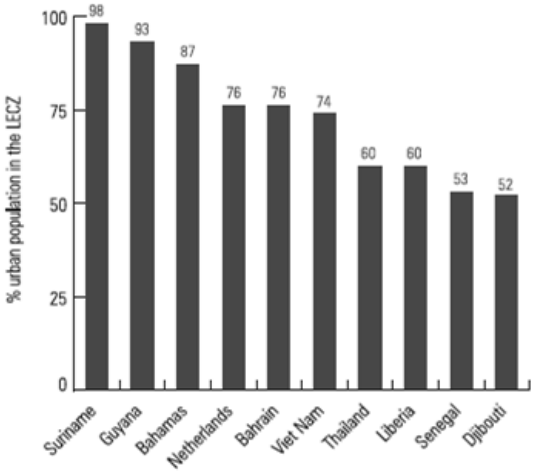
Age and sex composition of migrant populations often vary from the rest of the population. Those who migrate for economic purposes (both internally and internationally) often have disproportionally many working-age adults, who may have left their older parents, and sometimes their children, behind. Sex composition varies, with some migrant populations having more females, some more males, but global averages are about equal numbers of males and females.

AGE PYRAMID OF MIGRANTS IN CHINA, 2000
Source Population census, 2000



In many cases, recent urban migrants settle in areas that are more exposed to disaster risk, e.g. hillsides exposed to the risk of mudslides, or 'Low Elevation Coastal Zones' (LECZs) with an elevation of less than 10m over sea level and sometimes dense settlement patterns.

Countries with the largest urban population in the low elevation coastal zone



Source: McGranahan, Balk and Anderson (2008), A summary of the risks of climate change and urban settlement in low elevation coastal zones. In The New Global Frontier: Cities, Poverty and Environment in the 21st Century, G. Martine, G. McGranahan, M. Montgomery and R. Fernandez-Castilla (eds). Earthscan: London. Based on data generated for McGranahan, Balk and Anderson (2007)
** Countries with an urban population of fewer than 100,000 were excluded from this list.*

LECZ presently host 2/3 of human settlements with more than 5 million inhabitants, 21% of populations in developing countries. Whereas the populations concerned are larger in Asian countries, African cities are more vulnerable, given that they are less resilient to sea rise (Mysla 2012, UN-HABITAT 2008).

With respect to internal displacement and refugees, the global tendency until recently was that the number of refugees was stable or decreasing (estimated at around 16M in 2013) whereas the number of conflict related IDPs increased during the last two decades (33M in 2013). Thus, the total level of conflict related displacement increased, and estimates which take into account recent events may be even higher (UNHCR 2013).

Recent estimates put the number of displaced people by extreme weather events at 25-30M per year (quite variable from year to year, with 32.4 M in 2012) (IDMC, various years). There is no robust estimate of persons displaced by slow onset climate change.

Emergencies – what is different?

Displacement is another demographic metric which may increase dramatically in emergencies, in unpredictable ways.

Often displaced populations are the ones to settle in the most vulnerable areas, e.g. urban/slum/LECZ, placing them at increased risk from both slow and sudden onset disasters (e.g. most ad hoc displacement settlements in South Sudan after the conflict in 2014 were located in flood prone areas).

One often-quoted statistic is that 80% of all refugees (or IDPs) are women and children.

Eighty percent of the world's refugees are women and children. As we mark World will join us in celebrating the strength, boldness, and untapped potential of refugee

Sources: World refugee day 2013, Women refugee commission

It may be true that in emergencies it may be the most vulnerable who are displaced, rather than the most resilient, whereas in economic migration it is often the more resourceful who migrate, and migration is seen as an essential part of development (UN, 2013). However, the statistic of 80% should be taken with a grain of salt.

Displaced populations vary greatly in their composition. The statistic does not define what is meant by 'children', and the baseline population in many Low Income Countries would have 70-80% women and children before displacement. Thus, it does not automatically signify that disproportionate numbers of women and children become refugees. It may be a useful statistic for advocacy purposes and as a rule of thumb, but not as any kind of general rule.

In case or urban disaster, certain demographic characteristics of urban residents may influence risk and needed response – including the decreasing household size and generational separation. The fact that urban populations are, on average, disproportionally composed of young adults means that generally they need less health care, but also that reproductive health will be a priority, and that they have relatively high birth rates. Disaster response needs to take this into account.

Rule-of-thumb standards and sources:

The 80% statistic is OK, in the absence of anything else, but references to it should make it clear that it is not definite.

Source:
http://www.internal-displacement.org/ (data on IDPs)
http://www.unhcr.org/pages/49c3646c4d6.html (data on refugees, asylum seekers)
http://esa.un.org/unup/ (data on urbanization)
http://sedac.ciesin.columbia.edu/data/collection/lecz/maps/gallery/search (LECZ)

d. AGE

Metrics and terminology

The most widely used metric/tool is the "population pyramid", a graphic presentation of the age and sex of a population, often by five-year groupings.

Age groupings tend to be ill-defined in humanitarian guidelines, especially sub-categories of children. The following should be used:

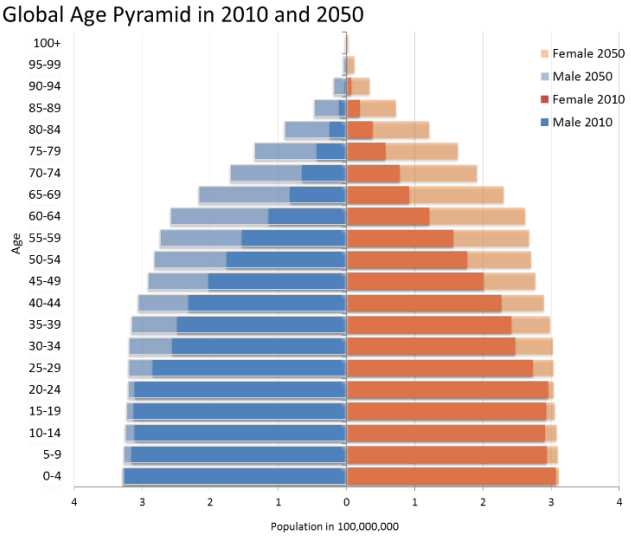
- New-borns: children 0-27 days of age
- Infants: children under one year (0-11 months)
- Young children: usually referring to children under five (0-59 months)
- Older people: UN expresses this as persons aged 60+ years, WHO usually 65+. There is no agreed standard.
- Dependency ratio: the number of dependents (people aged 0-14 and those aged 65+) divided by the number of people of (formal) working age (aged 15-64).
- Women of reproductive age: females aged 15-49/total population

In humanitarian operational guidelines, *standard populations* estimates of age structure, and recommendations for services specific to those age groups, are at times extremely detailed and precise. For example, Sphere refers to expected prevalence of Bitot's spots (a symptom of vitamin A deficiency) in 6-71 month-olds, or estimates that children 4-6 years constitute 6.41% of the population. However, this may be inappropriately precise, and not reflective of context specific rates.

The metric for women of reproductive age varies. In non-emergency situations, it is often given as percentage of the female population (rather than total population, as above).

Global mega-trends – the baseline

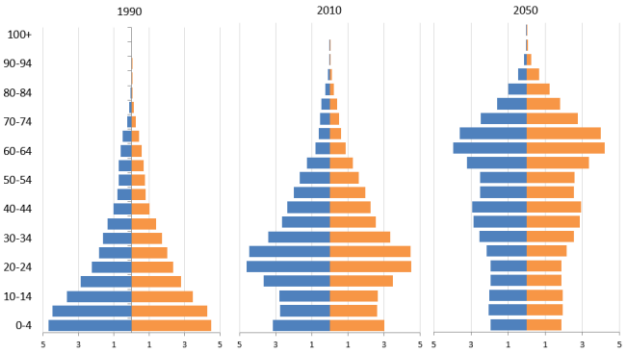
Globally, fertility and mortality rates have declined in almost all countries, and this has caused a mega-trend of ageing. In 2000, for the first time, there were more persons aged 60+ than 0-4, and today there are 9% at ages 0-4 and 11% at ages 60+. Almost all future population growth will be at older ages.



Source: UN Population Prospects, 2012 Rev

In countries where the transition has happened most rapidly, populations have gone from having a child bulge, to a youth bulge, and are projected to have an elderly bulge, within a few decades.

Iran changing age structure, 1990, 2010, 2050

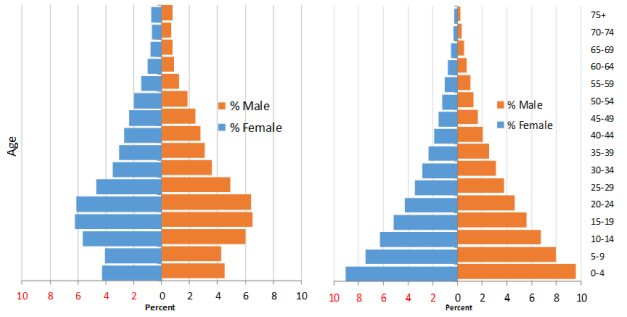


Source: UN Population Prospects, 2012 Rev

This is a global tendency, but the situation varies greatly among countries, driven by their TFR. Thus, in Japan and Niger, the proportion of persons aged 60+ is 33% and 4% respectively. Niger is one of the few countries where ageing has not yet in earnest begun, since TFR remains at 7.5.

Even neighbouring countries may have very different structures, e.g. in Afghanistan the proportion of women aged 15-49 is about 20%, in Iran it is approximately 30%.

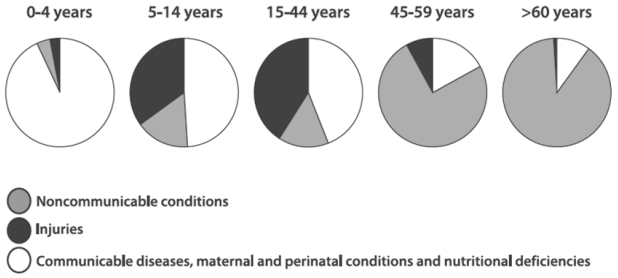
Two neighbouring countries, very different structures (Iran and Afghanistan, 2010)



Source: UN Population Prospects, 2012 Rev

This has major implications for the burden of disease, including what may be expected in emergencies. On average, communicable diseases are the main cause of death for the young, trauma/accidents for adults, and non-communicable diseases for those aged 45 and above. As the proportion of older people increases, and as we are getting better at controlling communicable diseases and nutritional deficiencies (including in emergencies), globally non communicable diseases (NDCs) are now the cause of 65% of deaths.

Leading causes of death, both sexes, 1998, low and middle income countries by age



Source: World health report 1999 Database

Another metric which is important at the global level is the *dependency ratio*. For example, many countries in Asia (e.g. Iran) have had rapid drops in TFR over the last decades that has resulted in high proportions of working age populations. Some estimates are that this 'demographic dividend' has contributed substantially to East Asia's so-called economic miracle (Bloom, 1998). However, this will only be the case for a few decades, and is only a positive factor if education, health and jobs are available. After that, the high proportion of older people can become a challenge. See the example of Iran above.

Furthermore, 'working age' is not equivalent to 'working'; unemployment, women's participation in the work force, as well as health and productivity are important factors. Thus, the dependency ratio is only a very rough indicator of the dependency status of a population.

Emergencies – what is different?

There is a large body of literature which lauds the economic possibilities of the demographic dividend. There is also much literature which cautions that countries with particularly large proportions of young adults are more likely to experience civil unrest, and there seems to be fairly robust data to support that.

Age structure will also have an impact on health. In emergencies, preventing epidemics of communicable diseases has traditionally been a top concern. With higher proportions of older people, and an epidemiological transition

toward NCDs, health concerns may shift. Older people may also have different exposures, vulnerabilities, and capacities (slower at getting out of harm's way, more fragile, but also as repositories of knowledge of past emergencies).

Reproductive health services are especially relevant for women aged 15-49, and therefore it is important to know what proportion of women are in those age groups. Especially in protracted emergencies, it may become increasingly important to look at the dependency ratio, to supplement the 'women and children' metric, perhaps developing a more intelligent metric which reflects human capital and resilience.

Rule-of-thumb standards and sources:

- Children under five on average constitute 5-22% of the population, depending on the TFR.
- One quick estimate of children 0-4 years is to multiply the CBR by five (e.g. in Japan, if the CBR is around 1%, then you can estimate the proportion 0-4 years as around 5%). In Niger, where CBR is 5%, children aged 0-4 are 22% (given 13% child mortality).
- To establish other age groupings, you can interpolate (e.g. if you want the proportion 4-6 year olds in Japan, you can estimate 3%).
- Women of reproductive age can be assumed to be 20-30% of the total population, unless the population structure is skewed due to migration/displacement.
- Persons aged 60+ years constitute anywhere from over 30% to less than 5% - the mirror image of how many are aged 0-4 years.

Source: United Nations Population Division
http://esa.un.org/wpp/unpp/panel_indicators.htm

e. SEX

Metrics and terminology

The most commonly used metrics are:

- **Sex ratio at birth**, the number of males born per 100 females.
- **Sex ratio of age specific mortality**, the number of deaths to males per death to females by age group.
- **Sex ratio in the total population**, the number of males per 100 females in the total population.

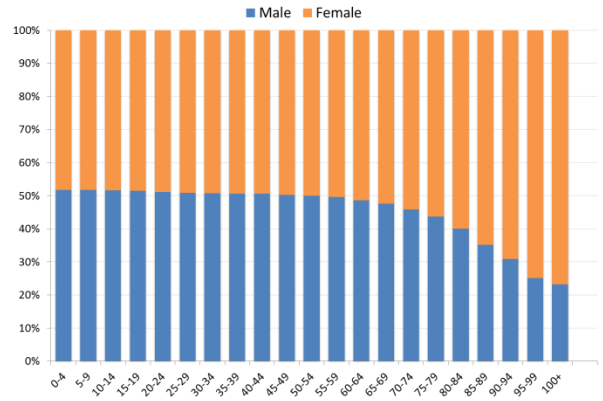
Some countries, such as India, routinely publish data on sex ratio for 0-6 year olds, rather than at birth. That means both sex ratio at birth and subsequent sex differentiated mortality have contributed to the result. India inverts the metric and cites number of females per 1,000 males.

Global mega-trends – the baseline

Globally, in most populations, the sex ratio at birth is between 102-107, with 105 being the average.

Mortality rates at all ages are generally higher for males than for females. At the global level, infant mortality for males is 10% higher than for females. The result is that the older the population, the more female.

PROPORTION OF POPULATION MALE/FEMALE, WORLD, 2010 *(UN, WPP, 2012 Revision)*



There are exceptions to this megatrend. Historically, a dozen or so countries have had higher mortality for females, with the result that the sex ratio in the general population was skewed toward more males. This has been explained by female infanticide and neglect, and continues to be a factor in some countries.

Since around 1980, technology which allows for pre-natal sex selection has become increasingly available. The result is that a number of countries exhibit highly skewed sex ratios at birth, e.g. China (120), India (estimated at 111), the Republic of Korea (109, down from around 116 in 1993), as well as Vietnam, Armenia, Georgia, Azerbaijan, Albania, Nepal, Pakistan, Macedonia, and certain sub

populations in the US and UK. On the other hand, it seems that post-natal sex selection has declined, along with child mortality in general.

Emergencies – what is different?

Parallel to the literature on a youth bulge, there is also a body of literature which postulates that when the cohorts of young people with skewed sex ratios reach marriageable age, this will lead to a marriage squeeze and subsequent civil unrest. However, the evidence on this is as yet contested.

Older women may be particularly vulnerable in emergencies. Given that they have higher rates of morbidity but also the fact that they often constitute the poorest segments of society, they may have less access to pensions, and may live alone (given that they outlive their husbands).

Rule-of-thumb standards and sources:

- Expect sex ratios at birth at around 105, and male mortality rates 10% higher than for females at ages 0-11 months. Exceptions should be noted and addressed (Checchi and Roberts, 2008).
- Expect higher proportions of males at young ages, and higher proportions of females at older ages.

Source http://esa.un.org/wpp/unpp/panel_indicators.htm

f. POPULATION GROWTH

Metrics and terminology

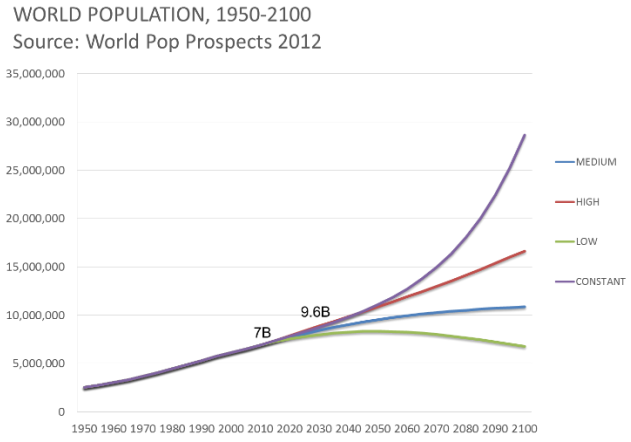
The metrics often used in describing population growth include:

- **Absolute number of growth** which is the number of births less the number of deaths plus net migration.
- **Growth rate**, calculated at the CBR less the CDR plus the net migration rate.
- **Replacement level** which is usually given as TFR of 2.1, the level of fertility which in the long run would give stable population size, in most populations.
- **Population denominator:** Rates are often stated as a number of events divided by the total population at risk for the event. Usually, the mid-period population size is used as an approximation. In emergencies, population size may change radically in a short time, therefore, it becomes even more important to judge whether mid-period population is the correct denominator (Checchi, 2005)

There are no special metrics for population growth in emergencies. However, change is at times very rapid and uneven (due to displacement and mortality). As one of the purposes for estimating overall population growth is to serve as the denominator for other rates, methods for calculation can be important, especially when collecting primary data.

Global mega-trends – the baseline

Globally, population is growing at around 80 million a year (appr.135 million births minus 55 million deaths, with no migration at the global level). Projections for 2100 population totals vary between 29 billion and six billion, with the 'most likely' projection at around 11 billion. The main difference between the projections is due to differing scenarios related to TFR. Thus, the medium projection assumes a decline from the present TFR of around 2.5 to 2.1, the high and low projections assume TFR at 2.6 and 1.6 respectively, and the constant projection assumes that all countries continue at the same TFR as they are experiencing now. In other words, even small differences in TFR will have major impact on growth.



A common misunderstanding is that population growth will stop the moment TFR reaches the replacement level of 2.1. In actuality, it may take decades since there may be a particularly high proportion of women of reproductive ages (see the case of Iran in the graph above). This

is referred to as *population momentum*. Thus, the population of the European Union still is experiencing a birth surplus, even though TFR is only 1.6. Also, replacement levels are higher than 2.1 in populations with high mortality or skewed sex ratio at birth.

Emergencies – what is different?

Long-term, global population increase is leading to higher population density, increasingly located in potentially high risk locations (e.g. LECZ).

Some authors relate this to risks associated with climate change, using the formula:

I = P x A x T

Where environmental impact depends on population size, affluence/consumption per person, and the available technology (Ehrlich, 1971). Whereas other writings by Ehrlich may be considered controversial, this formula is often quoted.

By this logic, population growth may contribute to future extreme weather events, albeit by all estimates much less so than consumption patterns. This is also the implication in the outcomes of the Stockholm Conference in 1972, the 'Brundtland report' in 1987, the Rio Conference in 1992, and the Cairo Conference in 1994.

In emergencies, if you wish to calculate population growth for operational purposes, you may need to calculate the baseline population size at the onset of the emergency, by sub-national (say district) region. This is important in its own right, but also as the denominator for other rates.

Data at sub-national level are usually not available from global databases. However, census data are often available online from most countries, often at ten year intervals. Statistical offices may also have data on births, deaths and migration through civil registration systems, although the majority do not (see box below).

There are two main methods to calculate sub-national pre-emergency population size and growth rate:

1. If you need data for the present (i.e. 2012) and have estimates from two censuses (for 2002 and 1992), then you can compare the estimates from the 2002 and 1992 censuses, calculate the percent growth between those two years, and then use that percentage to project 2002-2012 very roughly.
2. If you have yearly civil registration estimates for the period since the last census, then you can calculate the present level by taking the level in 2002, and then adding the births, subtracting the deaths, and adding net migration in the period 2002-2012, through the basic population growth formula:

P1 = Po + births - deaths -/+ migration.

However, that may be troublesome, as civil registration systems are even less complete than censuses. In this case, demographic projections using more complex methodologies are necessary, which are beyond the scope of this brief.

Rule-of-thumb standards and sources:

- For national data, use http://esa.un.org/wpp/unpp/panel_indicators.htm
- For sub-national data, you may need the national statistics office, linked for example at http://data.un.org
- Other data banks with sub-national data include the DHS http://www.measuredhs.com and http://dhsprogram.com/What-We-Do/survey-search.cfm?pgtype=main&SrvyTp=countryo and MICS data http://www.unicef.org/statistics/index_step1.php, http://www.indepth-network.org/, http://www.childinfo.org/mics_available.html

For more information on calculating mortality and population size in emergency situations, see Checchi and Roberts, 2005.

In addition to the six basic dimensions of demography as mentioned above, the following may be of particular interest: disability and household size.

g. DISABILITY

Metrics and terminology

In 2001, WHO adopted the International Classification of Functioning, Disability and Health (ICF), which has been endorsed by 191 Member States. The ICF uses a definition of disability based on activity limitation and participation restrictions (social, environmental, attitudinal, etc.) rather than only on physical attributes. It is the revision of the International Classification of Impairments, Disabilities, and Handicaps (ICIDH), first published by WHO for trial purposes in 1980.

However, even with global guidance, definitions are not comparable across countries. Rates of disability found in household surveys and censuses therefore varies dramatically. This variation results from differing measures of disability, different data collection techniques, and different reactions to survey questions by respondents.

Even countries which include issues on disability in their census are presumably greatly under-estimating levels (e.g. India census 2011 estimated a prevalence of 3-4%). The type of disability may be more interesting than the absolute number, e.g. countries with high levels of unexploded ordnance may have higher prevalence of amputations.

Global mega-trends – the baseline:

There is no global database or repository with robust data per country, so much must be roughly estimated:

- In 2011, WHO estimated that 15% of the global population is living with some type of disability (WHO/World Bank, 2011)
- The older the population, the higher the prevalence of disability. Thus, with ageing populations, the estimates are that the proportion is increasing. This is not always true - some countries have experienced decreasing rates of age-adjusted disability, as a result of, inter alia, better health care/technology.
- Rates in L/MICs are likely to be higher than in HICs, e.g. WHO estimated the rates of disability for 65+ year olds in Africa to be double those of HICs (WHO, 2004).

Emergencies – what is different?

Several small scale or localized studies have been conducted, but little conclusive and generalizable empirical evidence has been produced. Yet, there is consensus among researchers and practitioners that there is a correlation between living with a disability and being vulnerable to hazards or having specific needs. Given that the Convention on the Rights of Persons with Disabilities was adopted recently, its implementation is still at early stages, and data are limited. The evaluation of the Haiti health response is one of the first to address the issue, but does not contain estimates of rates (PAHO (2010).

Rule-of-thumb standard and sources

- Probably the best estimate is that 15% can be expected to have some type of functional disability, but the precise type must be estimated locally.
- The type of disaster will influence the proportion and type of injury and disability (i.e. Earthquake, conflict, cyclone, etc.)
- To obtain more precise numbers, and to estimate the type of disability, consult a collection of surveys which have been conducted at: http://documents.worldbank.org/curated/en/2011/01/14440066/world-report-disability
- The best source may be to contact a disabled people's organization such as Handicap International or local organization operating in the affected area.

h. Households, Female Headed Households

Metrics and terminology:

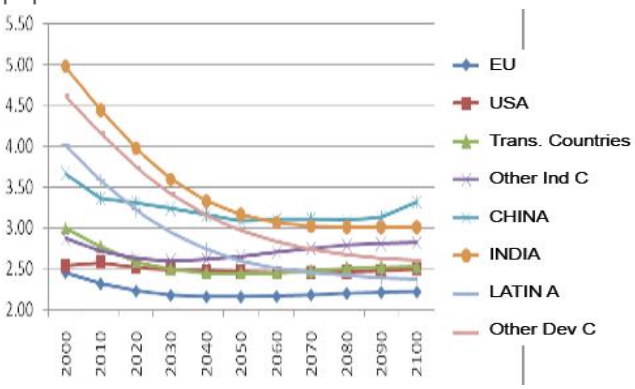
A **household** is defined as a group of one or more persons living together who make common provision for food or other essentials for living (UN, 2004).

A **female headed household** is one where there is no male adult acting as decision maker. In many censuses, the designation as head of household is automatically given to any male who indicates himself as such, in others any household member is accepted, no matter what sex.

Global mega-trends – the baseline:

Household size is decreasing, and is projected to continue to decrease, with urbanization. Thus, in predominantly rural populations, household size is on average higher than five persons, but in urban populations, no matter for which geographic region, it averages 1.5-3.5.

Changes in average HH size under the medium population scenario



Source: PAI (Jiang) 2009, MacKeller et al 1995, Jiang 199, Liu et al 2003

For female headed households, data are not complete, but in many it is close to a third of all households, both in HICs and L/MICs.

Emergencies – what is different?

Data are limited on the exact effect of female headed households. In Haiti, where an estimated 45% of households are headed by women, where a large part of the population lived in tent cities long after the 2010 quake, where violence levels were already high before the quake, and where food distribution targeted women, levels of violence perpetrated against women living in female headed household have escalated, although the precise inter-relationships are difficult to assess (PAHO 2010, Hart 2011).

Rule-of-thumb values and sources

- Expect household size to be between two and five persons depending on whether the area is mainly rural or urban. This may change with displacement patterns.
- Expect a sizeable proportion of households to be headed by women.

Source:
https://unstats.un.org/unsd/demographic/sconcerns/housing/comp1995/TABLE06.pdf
http://data.worldbank.org/indicator/SP.HOU.FEMA.ZS

4. Quick-start - *if you have one hour*

a. WHY?

To plan operational response, and report to the outside world.

b. WHAT?

The demographic metrics which are priority for planning response and reporting include:

- **Total population** which provides a denominator and an overall framework
- **Birth rate** which is used to calculate births and plan needs for birthing services and kits
- **Death rates**, including total death rates and those for children <5, which are used to judge how acute the disaster is
- **Population age/sex structure**, especially for children <5, people aged 60+, women of reproductive age (15-49), which can be used to plan for meeting basic needs including food, vaccinations, contraception, etc.
- **Household size** and structure (including male vs female headed households), which inform shelter and WASH response.

c. WHEN?

As for other areas of humanitarian work, preparedness is good, and is rarely done. That goes for data too. Ideally, detailed demographic profiles should be established for emergency-prone countries. If that has not been done, a short version can be established within an hour, and the more detailed data assembled over time.

As many demographic data remain fairly constant in an emergency (e.g. age), better data preparedness will lessen the need for detailed and possibly misleading primary data collected on the spot. In addition, it will help to make sense of any data which are collected in later phases of assessments.

d. HOW?

If you have only one hour, find the following data by searching google *population prospects* or using the link http://esa.un.org/unpd/wpp/unpp/panel_population.htm and looking in the *on-line database* section.

For MMR (or other mortality, use UNdata (http://data.un.org/CountryProfile.aspx#Social) or WHO Global Health Observatory http://apps.who.int/gho/data/?theme=main.

You can quickly fill a small table with the key data:

	World	'your' country
Population	7.3B	
TFR	2.5	
CBR %	1.8	
CDR %	0.8	
U5M per 1000	52	
MMR	210	
CU5 % (aged 0-4)	9	
WRA % (15-49)	25	
'Older'% (60+)	11	

To give an indication of the range of values, here are three country profiles for 2010-15:

	Japan	Brazil	Niger
Population, M	126	200	20
TFR	1.4	1.8	7.5
CBR %	0.8	1.5	5
CDR %	1	0.7	1.3
U5M per 1000	3	24	127
MMR per 100,000	5	56	590
CU5% (aged 0-4)	4	7.5	22
WRA% (15-49)	21	27	20
'Older'% (60+)	33	12	4

A CMR of 1/10,000/day translates into a CDR of 36.5 per 1,000/year. An U5MR of 2/10,000/day translates roughly into an U5M of 350 (35% of children dying before 5th birthday).

We recommend memorizing a few ranges:

- CBR is in the range of 1-5%
- CDR is around 1% (± 0.5%)
- U5M in the range of 5–150/1000 (0.5-15%)
- % Children aged 0-4: in the range of 5-22%
- % WRA: in the range of 20-30%
- % Older people (60+): 5 - 30%.

Child mortality has dropped to below 15% in almost all countries. Therefore, if you know the CBR, you can estimate the percent of children aged 0-4 by multiplying CBR by five, allowing for context specific U5M:

- Japan, 0.8% x 5=4% no need adjust for U5M
- Niger, 5% x 5=25%, adjust down by ~13% = 22%

Similarly you can interpolate other age groups if you need others than the 5-year groupings given by the UN. It will not be accurate, but a lot more so than standard populations. E.g. for the world, the proportion of children aged 4-6 is around 3 X 1.8 or around 5.4%.

Full population pyramids are easy to download or create. To download existing age pyramids: http://esa.un.org/unpd/wpp/Demographic-Profiles/index.shtm
http://www.census.gov/population/international/data/idb/informationGateway.php

To create your own pyramid:
http://www.prb.org/Publications/Lesson-Plans/PopulationPyramidsExcelPPT.aspx

5. Abbreviations, Definitions and Formulas

Population Growth: the population in year 1 equals the population in year 0 plus the births in the intervening year, minus the deaths, plus the net migration. Formula: P1= Po + births – deaths -/+ migration.

Urban population: de facto population living in areas classified as urban according to the criteria used by each area. Data refer to 1 July of the year indicated.

Rural population: de facto population living in areas classified as rural according to the criteria used by each area. Data refer to 1 July of the year indicated. It is the difference between the total population and the population classified as urban.

Rate: an event divided by the population at risk for the event and a time period constituting the exposure.

Ratio: an event, divided by something else such as another event (e.g. MMR) and therefore not necessarily with a time period of exposure

TFR – Total Fertility Rate, expressed as children per women. The average number of children a hypothetical cohort of women would have at the end of their reproductive period if they were subject during their whole lives to the fertility rates of a given period and not subject to mortality. TFR is not a true rate. This, and other age-specific metrics, are usually not realistic to collect/use during an emergency, but can be useful to quickly establish a population profile

CBR - Crude Birth Rate. The number of live births per 1,000 population per year, determined by calculating the number of births over the period/population at mid period x 1,000. E.g. births during 2013 divided by population at 1 July 2013 x 1,000. If you know the pre-emergency CBR, you can calculate the number of births expected over a shorter period. If the CBR is 5% for a year, the number of births expected in a population of 10,000 in three months will be approximately 167.

CDR - Crude Death Rate. Number of deaths per 1,000 population per year. Usually the CDR is approximated as the population at mid-year (1 July). If you know the CDR, you can calculate the number of deaths expected over a shorter period. If the CDR is 1% for a year, then the number of deaths expected in a population of 10,000 per day is approximately 0.3.

U5M – Under Five Mortality which is the proportion (probability) of children dying between birth and exact age five. It is expressed as deaths per 1,000 live births.
NB: this differs from the **U5MR**, Under Five Mortality Rate, which estimates the rate at which children below the age of 5 have died over a defined period of time.
In emergency situations, the most commonly used population denominator and time period for U5MR is per 10,000 under-5 population per day (i.e. number of deaths/10,000/day). However, it can also be per 1,000 <5 population per year, or per 1,000 <5 population per month.

CMR – Crude Mortality Rate which estimates the rate at which members of a population have died over a defined period of time. A CMR is applicable to an entire population, including both sexes and all age groups. In emergency situations, the most commonly used population denominator and time period for CMR is per 10,000 population per day (i.e. number of deaths/10,000/day). However, it can also be per 1,000 population per year, or per 1,000 population per month

WRA – women of reproductive age refers to the number of females aged 15-49 divided by the total population. Sometimes it refers to females aged 15-49 divided by the total number of females.

MMR – maternal mortality ratio: The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO ICD10). This metric is usually not realistic to calculate during an emergency, but the pre-emergency level can be useful as an indicator of maternal health as well as the overall functioning of the health services of a country.

Fertility - The term 'fertility' in English is used to denote number of births, whereas the term 'fecundity' is used to denote the ability to become pregnant (or to impregnate). Please note that the terminology differs in different languages (e.g. in French it is the opposite for fertilité and fécondité).

Dependency ratio: the population aged 0-14 + 65+/population aged 15-64 x 1,000

Household:
a) A one-person household, defined as an arrangement in which one person makes provision for his or her food or other essentials for living without combining with any other person to form part of a multi-person household
Or,
b) A multi-person household, defined as a group of two or more persons living together who make common provision for food or other essentials for living (UN 2004).

For more demographic terms/definition, refer to: http://esa.un.org/unpd/wpp/Documentation/glossary.htm

6. Sample calculations

1. An earthquake has just occurred in a West African country whose demographic characteristics resemble those of Niger. You have been deployed to act as health coordinator for the peaceful city of *Urbana*, with a population of around 100,000 people and where houses have been completely destroyed. The local health regional hospital and clinics have also been destroyed. *Your first duty is to inform the Flash Appeal and your report is expected within the next 48 hours, giving a rough estimate of needed relief items. It is hopeless to gather sex and age disaggregated data in such a short time frame. How many birthing kits may you need over the next three months? Doses of measles vaccination? Tents? Contraceptives?*
2. The estimate of 100,000 people came from the government. You are not sure how it was calculated, since the last census was 10 years ago, and the one before that 20 years ago. In those censuses, the population was given as 90,000 and 80,000 respectively. *What would you have projected the population to be today?*

Answers 1:

- Tents: 100,000/5 or 20,000 tents.
- Birthing kits: crude birth rate of 5%, meaning 5% of 100,000 or 5,000 births per year, or 1,200 for the next three months.
- Measles vaccination doses: first you estimate the proportion of children aged <5 (0-59 months, 0-4, under five, whatever definition you want to use.) That is 22%, or 22,000.
- If you want one vaccination of every child aged <5, you would need one dose for each, or 22,000 doses. You can reduce by those 0-5 months old (around 10%) but given wastage, that is probably immaterial.
- Also you may need to vaccinate twice and include children 5-14 years old. Finally, you may look up vaccination levels to help you determine whether there is a need.
- Contraceptive supplies: look up the WRA and the contraceptive mix and CPR. You may just wish to order the standard emergency kit, but later on you may wish to review, since baseline CPR may be much lower than world averages, and you would wish to make allowances for modern vs. traditional methods.

Answers 2:

1. Accept the previous census results, which indicate an annual growth of around 1.2% per year, meaning indeed that today's population would be around 100,000.
2. Alternatively, work out your own estimate. You could for example choose the last census, note that with a crude birth rate of 5% and crude death rate of around 1%, you would expect 4% growth per year, barring major migration. On that basis you would expect 90,000 + (rough estimate) 40-50% increase, or around 130,000. That is quite different, so for the time being you may just need to note that you have a range of estimates, and you need to triangulate with other data sources.

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