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DELIVERING WATER, SANITATION AND HYGIENE SERVICES
IN AN UNCERTAIN ENVIRONMENT

Beyond improved: monitoring drinking water in the post-MDG era

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The MDGs have been a major driver of public policy in the water and sanitation sectors. The indicators used to measure progress towards MDG Target 7c are based on a technological classification of water and sanitation infrastructure into 'improved' and 'unimproved' classes. While this classification has been useful, it also has shortcomings, notably the lack of consideration of actual drinking water quality. Processes are underway to shape the global development agenda in the post-MDG era, and improved targets for water and sanitation could be developed, based on the human rights framework. This represents an opportunity to improve upon the 'improved/unimproved' indicators. WASH sector professional should advocate for water and sanitation to be well-represented in post-2015 goals and targets. The Joint Monitoring Programme established technical Working Groups which have suggested possible targets and indicators; these would represent a substantial advance in service delivery, but would also require advances in monitoring practices.

Water quality and the MDGs

Since their establishment in 2000, the Millennium Development Goals (MDGs) have driven the global development agenda. Target 7c calls for reducing, by half, the proportion of the population without 'sustainable access to safe drinking water and basic sanitation'. However, there has been no operational definition of what 'safe drinking water' actually means. The WHO defines safe drinking-water as water which 'does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages' (WHO 2011). The WHO Guidelines for Drinking Water Quality sets health-based guideline values for 90 chemicals, as well as microbiological and radiological water quality. It is neither feasible for desirable to monitor all of these for individual water sources, especially if nationally representative estimates are needed for global reporting purposes. In many low and middle income countries, monitoring and surveillance of water quality is weak, particularly in rural areas. This poses a challenge for monitoring progress towards Target 7c.

The Joint Monitoring Programme (JMP) of the WHO and UNICEF, which measures progress towards Target 7c, has addressed this lack of actual water quality measurement by developing a proxy indicator of safety: a technological classification into 'improved' and 'unimproved' water sources (Table 1). The JMP draws upon nationally representative household survey data, which asks respondents to identify the main source of drinking water for members of the household. In its 2012 report, the JMP made use of more than 1,400 data sources covering the period 1980 to 2010.

The JMP has an average of six national datasets for each low or middle income country, and uses linear regression to make best estimates of current and historical use of improved water sources. Urban and rural estimates are then combined, resulting in national coverage figures, which feed into the JMP's global reports. Although the MDG targets were designed to apply at the global rather than national level, many countries strive to achieve national targets linked to Target 7c. The 2012 JMP report showed that use of unimproved water sources had declined from a baseline of 24% in 1990 to 11% in 2010, thereby reaching the drinking-water target, five years ahead of the 2015 deadline (WHO/UNICEF 2012a).

Table 1. Improved and unimproved drinking water sources	
Improved	**Unimproved**
Piped water into dwelling, yard or plot Public tap or standpipe Tubewell or borehole Protected spring Protected dug well Rainwater collection	Unprotected dug well Unprotected spring Cart with small tank or drum Tanker truck Surface water (river, dam, lake, pond, stream, canal, irrigation channel) Bottled water*

* Bottled water is considered to be improved only when the household uses drinking water from an improved source for cooking and personal hygiene.

By the nature of their construction, improved water sources are considered likely to protect water from outside contamination, particularly faecal matter. However, it is recognized that improved sources frequently contain faecal contamination, albeit typically at lower levels than in unimproved sources (Moe, Sobsey et al. 1991; Parker, Youlten et al. 2010). Naturally occurring chemicals can contaminate improved sources; arsenic contamination of groundwater is estimated to affect over 140 million people globally (Ravenscroft, Brammer et al. 2009), while fluoride contamination may affect over 200 million (Fawell, Bailey et al. 2006). Because of the lack of nationally representative data, JMP reports do not consider water quality, with one exception: figures for Bangladesh are adjusted to account for arsenic contamination, with the result that coverage in 2012 is given as 81% rather than 98%, and the country is not on track to meet the MDG target.

Rapid assessments of drinking water quality

In an effort to collect nationally representative data about water safety, the WHO supported a series of Rapid Assessment of Drinking Water Quality (RADWQ) surveys in five countries, in 2004-2005. These surveys measured thermotolerant coliform (TTC) levels in different improved sources. However, a single measure of microbial quality is not a good measure of the likelihood of the source to consistently provide safe drinking water. To get a more robust indicator of the safety of the source, Sanitary Inspections were also conducted, using standardized lists to identify common hazards which might compromise water quality (WHO/UNICEF 2012b).

The RADWQ surveys showed that TTC contamination could be found in all improved sources, with piped water supply demonstrating the highest quality water, followed by boreholes, protected springs, and protected wells. Rainwater harvesting was not included in any of the surveys, because of relatively low numbers of systems in the study countries. Sanitary inspections showed a similar trend to TTC levels, though the proportion of sources with significant risk (3 or more hazards identified) was generally larger than the proportion of sources showing measurable TTC contamination.

Using principal component analysis, Onda et al. applied the water quality and sanitary inspection data from the RADWQ countries to 150 countries accounting for over 90% of the world population (Onda, LoBuglio et al. 2012). The resulting dataset allows modelling of global progress towards improving water access including water quality. When water quality measurements are considered (TTC < 1 CFU/100 mL), the 1990 baseline shifts to 37%, implying a target of 19% by 2015 (Figure 1). With actual progress projected to reach 26% by this time, the world would be significantly off track to meet the MDG target. If ‘safe water’ were operationally defined as water having no measurable thermotolerant coliforms, but also collected from a source having less than three hazards identified through sanitary inspection, the situation would be even worse: global access to unsafe water would decrease only from 53% to 46%, missing the target by 1.5 billion people.

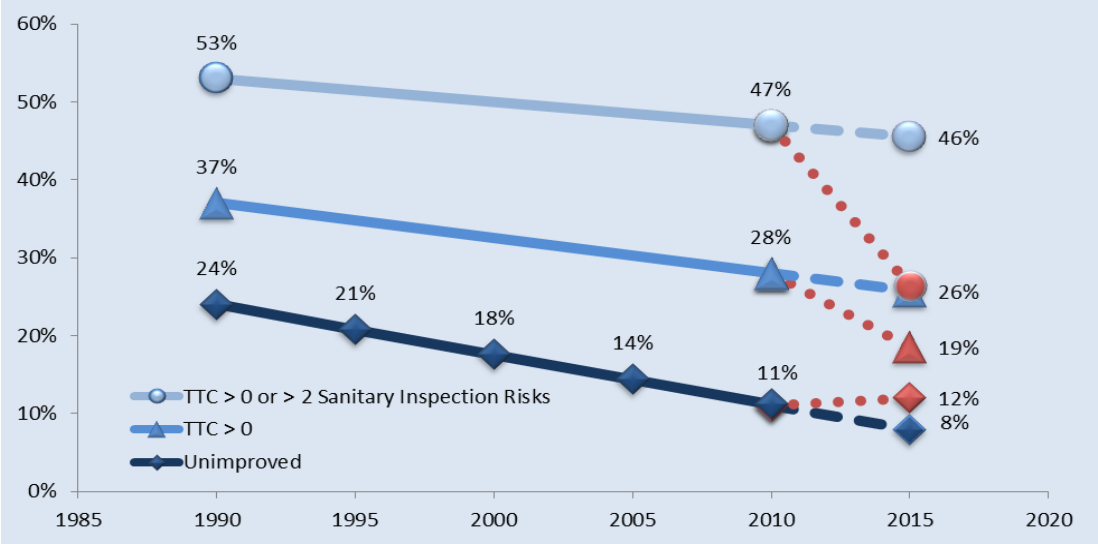

Figure 1. Global use of unsafe water. Dotted lines indicate progress which would be needed to halve the proportion from baseline by 2015; dashed lines project progress at current rates.

Source: (Onda, LoBuglio et al. 2012)

While JMP reports have shown good progress towards reaching the water target, this progress is highly dependent on the indicators used. Likewise, progress towards the sanitation target has been lamented as being far off track – from a baseline of 51% using unimproved sanitation in 1990, estimates predict that 33% of the population will still use such facilities in 2015. However, again the definitions and indicators determine the progress. The JMP defines improved and unimproved sanitation facilities, as for water sources. But it is recognized that when numerous people use one facility, the quality of the service may be degraded, both in terms of cleanliness and accessibility. Shared sanitation is widespread, accounting for 11% of the world population in 2010, and efforts are underway to quantify the relationship between latrine quality and the number of users. If shared sanitation were counted as improved, the 1990 baseline would shift to 45%, and projections indicate that by 2015 unimproved sanitation would drop to 21% by 2015, meeting the target of 50% reduction by 2013.

In summary, while the world celebrates meeting the water target and laments missing the sanitation target, both are highly dependent on the definitions and indicators used.

Human rights framework for drinking water

The improved/unimproved classification scheme has been most criticized for not considering water quality, but it also neglects other aspects of 'sustainable access to safe drinking water'. In 2010 the United Nations General Assembly recognized the right to 'safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights' (UNGA 2010a). The Committee on Economic, Social and Cultural Rights described the normative content of the right to water in its general comment 15 (UNCESCR 2002), and the UN Special Rapporteur for the Human Right to Water and Sanitation has elaborated on General Comment 15, defining normative aspects of the right to water (UNGA 2010b):

Table 2. Normative criteria for drinking-water

Criterion	Description
Quality/Safety	Water should be safe for health, but also aesthetically acceptable. The suggested limits described in the WHO Guidelines for Drinking-Water Quality can serve as reference points for safety.

Availability	Water should be available in sufficient quantity for personal and domestic uses. Supply needs to be continuous enough to meet basic needs, without compromising water quality.
Accessibility	Drinking-water sources should be within reach of every household, and paths to reach them should be safe and convenient for all users, including the elderly, children, pregnant women, and those with physical disabilities.
Affordability	Paying for water (and sanitation) must not compromise peoples' ability to pay for other basic services guaranteed by human rights, including food, shelter, education and health services.

Source: UNGA (2010b)

Service delivery ladders

In preparation for the end of the MDGs, and the possible setting of new global development targets, the JMP established in 2011 technical working groups to assess the feasibility of potential targets and indicators for water and sanitation which improve upon the existing improved/unimproved classification. The Water Working Group made use of the human rights framework as well as the concept of service levels, which can be progressively improved. The group proposed three types of targets (WHO/UNICEF 2012c):

- Universal access to a basic level of service
- Progress towards an intermediate level of service
- Sustainable and equitable service delivery

Definitions of 'basic' and 'intermediate' service levels were proposed taking into consideration quality, availability, and accessibility. Service levels were proposed for households, schools, and health facilities.

Table 3. Proposed criteria for drinking-water service delivery (household level)

Criterion	Basic service	Intermediate service
Quality/Safety	Improved source: Rural areas, existing 'improved' classification Urban areas, piped water, standpipe/ public tap, or tubewell/borehole	Basic service, plus: *E. coli* < 10 CFU/100 mL year-round at source
Availability	Improved source: Rural areas, existing 'improved' classification Urban areas, piped water, standpipe/ public tap, or tubewell/borehole	Improved source on premises Moderate discontinuity (<2 days in preceding 2 weeks)
Accessibility	Collection time <30 minutes for roundtrip including queuing	Improved source on premises Accessible to all household members at the times they need it

Source: WHO/UNICEF (2012c)

In this scheme, 'basic service' is similar to the current 'improved' water supply, with two important differences. First, due to concerns that certain water sources would provide worse water quality in urban settings than in urban ones, protected wells, protected springs, and rainwater collection would not be considered as improved sources in urban areas. Second, the collection time, including queuing, should not exceed 30 minutes. These data are currently collected in most national surveys, so recalibration of coverage under the new definitions would be easy, and monitoring could proceed using the same mechanisms as at present. A target of universal access to basic drinking-water services by 2030 is ambitious and would pose a challenge for many low and middle income countries, but is not completely unrealistic.

The 'intermediate service' represents a more difficult target, which would not be universally achieved within the target period. Progressive realization of this target would pose a challenge for middle-income and some upper-income countries. The main characteristic of 'intermediate service' is that the source should be on premises – either within the household or within close reach, as in a yard tap. While WHO guidelines recommend that *E. coli* concentration should be <1 CFU/100 mL drinking water, the Working Group has proposed a less strict target of <10 CFU/100 mL, at which level the risk of infection is considered to be low

(WHO, 2011). The Water Working Group considered that faecal contamination is so widespread in many countries that it would be impossible to meet a target using the stricter standard. With water on premises, the quantity used can be much higher, not only for drinking but for sanitation and hygiene purposes. An indicator regarding continuity of service is proposed, as an additional measure of availability. Accessibility is also improved when the source is on premises – collection time becomes negligible. But physical accessibility, especially for sub-populations, should also be monitored.

One of the criticisms of Target 7c is that it has specified ends but not means, and is silent on poverty and equity. It is possible to meet the Target of "halving the proportion without access…" in an inequitable way, by extending services first to relatively well-off groups, and there is some evidence that this in fact has happened. New targets should guard against this possibility. One suggested approach is to target raising the overall service level at the population level, but also to monitor the gap between advantaged and disadvantaged groups, and ensure that this inequality in access narrows over time. This would automatically require that progress be faster in the disadvantaged groups. Such gap analysis could apply to different types of social exclusion: at least rich/poor and urban/rural, and possibly other site-specific groupings.

The JMP Working Groups suggested three time-bound post-2015 targets for water, sanitation, and hygiene, and one non-time bound target about sustainability (WHO/UNICEF 2012c):

- **By 2025**, no one practices open defecation, and inequalities in the practice of open defecation have been progressively eliminated. [Basic sanitation for all]
- **By 2030**, everyone uses basic drinking water supply and handwashing facilities when at home, all schools and health centres provide all users with basic drinking water supply and adequate sanitation, handwashing facilities and menstrual hygiene facilities, and inequalities in access to each of these services have been progressively eliminated. [Basic water for all, including outside the home]
- **By 2040**, everyone uses adequate sanitation when at home, the proportion of the population not using an intermediate drinking water supply service at home has been reduced by half, the excreta from at least half of schools, health centres and households with adequate sanitation are safely managed, and inequalities in access to each of these services have been progressively reduced. [Progress towards intermediate WASH, including outside the home]
- All WASH services are delivered in a progressively affordable, accountable, financially and environmentally sustainable manner.

These new requirements to reach a basic level of service could be monitored with only modest modifications to existing household surveys. Institutional surveys of schools and health clinics are becoming more commonplace and could be adapted to include water and sanitation. However, the proposal also suggests a measurement of water quality at the intermediate service level, which represents a significant challenge. To date there are only a handful of nationally representative surveys which have measured water quality in low and middle income countries: in addition to the RADWQ exercise, two Bangladesh surveys have measured arsenic, and one in Peru checked for residual chlorine. In recent years, the development of simple, inexpensive and relatively rapid tests for faecal indicator bacteria (Bain, Bartram et al. 2012) has opened the door to microbial testing in national surveys. In 2011 a microbial test was piloted in a Peru survey, and in 2012/13 microbial testing (and arsenic measurement) was included in full national surveys in Ghana and Bangladesh. To avoid logistic problems of transporting samples back to laboratories, field teams are trained to conduct tests themselves, with portable equipment which can be operated without electricity. It is too early to say how successful such attempts will be, or how widespread such testing will become. However, given the strong interest in improving measures of 'safe drinking water' for post-2015 monitoring, it seems inevitable that nationally representative data will become increasingly available for use in global monitoring purposes. At the same time, better data on drinking water quality can inform national efforts to improve water quality management, and possibly make progress towards new targets.

Conclusion

The JMP Technical Working Groups are one among many processes contributing towards development of the post-2015 development agenda. During 2013 broad consultations are taking place at the national and global levels, to get diverse inputs as to possible structures for post-2015 goals. Detailed targets such as those suggested by the JMP will not be formalized for some time, but those active in the WASH sector should advocate for adoption of WASH targets which build upon, but go beyond, the experiences from the

MDG era. The human rights framework serves as a useful structure upon which to base criteria regarding differing aspects of sustainable access to safe water and sanitation. The current improved/unimproved classification has been useful, but can be improved in several ways. Direct measures of drinking water quality are increasingly possible and should be included in future targets.

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