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**39<sup>th</sup> WEDC International Conference, Kumasi, Ghana, 2016****ENSURING AVAILABILITY AND SUSTAINABLE MANAGEMENT  
OF WATER AND SANITATION FOR ALL****High-risk water and sanitation practices:  
evidence of underreporting from eight countries***S. Vedachalam, L.H. MacDonald, E. Otupiri, E.K. Nakua & K.J. Schwab (USA)***BRIEFING PAPER 2445**

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*Water and sanitation indicators in the erstwhile Millennium Development Goals (MDGs) failed to capture high-risk practices such as unimproved water consumption and open defecation undertaken on a regular basis. In conjunction with local partners, we used a mobile platform to implement representative randomized household surveys in eight countries across Asia and Africa (n=245,054) to quantify the presence and magnitude of such underreporting. Our study identified the use of high-risk practices as a regular option to be greater than their use as the main option. Across the study areas, this consistent underreporting amounted to 26 million (unimproved water) and 50 million (open defecation) people not being targeted for suitable policy interventions. A deeper analysis of Ghana shows poor and rural households are more likely to engage in high-risk practices. Current metrics inflate water and sanitation progress, and need to be adapted for the complex world we live in.*

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**Introduction**

The Millennium Development Goals (MDGs) and ongoing Sustainable Development Goals (SDGs) have served as critical global development policy tools used to set national priorities for Water, Sanitation, and Hygiene (WASH). Operationally, the MDGs were tracked by WHO/UNICEF's Joint Monitoring Programme (JMP). JMP indicators on progress towards safe water and improved sanitation are frequently used to provide justification for development assistance in the forms of philanthropy, grants, or loans; set national policy; and often prominently cited in scholarly work (e.g. Bain et al, 2012; Cumming et al., 2014). Therefore, the need for accuracy of these metrics cannot be overstated. That said, the JMP indicators have several notable shortcomings inherent in their design that make them insufficient to be used as drivers of national and global policy. These shortcomings must be addressed to ensure a better understanding of WASH use behaviour and make substantive progress.

The JMP indicators suffered from three critical limitations. First, the JMP indicators rely on the category of infrastructure rather than the quality of services provided. For example, improved water sources are not necessarily safe (Bain et al., 2012). As a result, the JMP's monitoring of the household drinking water is based, not on water quality results, but on the type of water source.

Second, JMP indicators capture the presence or absence of the water or sanitation facility without assessing the routine proper functioning of the facility. Questionnaires developed by the USAID-led Demographic and Health Surveys (DHS), which form the basis for JMP estimates, ask respondents to self-identify their main drinking water source or main sanitation facility. The indicators do not address the reliability of these sources. Evidence suggests that poor reliability of water sources, and maintenance and cleanliness of sanitation facilities present an important barrier to widespread use (Hunter et al., 2009; Nakagiri et al., 2015).

Finally, the third and most critical shortcoming of JMP indicators is their inability to capture the widespread use of multiple water sources and sanitation options. This limitation leads to underreporting of the consumption of unsafe water and the practice of open defecation. Underreporting arises because the JMP tracks only a single main source of water or sanitation. However, this assessment is fraught with errors due to its central assumption that a "main" source exists. Households rarely rely on a single source to meet their

water and sanitation needs (Coffey et al., 2014). The concept of a main source also discounts intra-household variation in water and sanitation use. Even when households rely on a single primary source, they often use other “regular” sources to augment the main source, a concept sometimes called source-switching (Lucas et al., 2011).

For the purposes of this article, unimproved water (UW) consumption and open defecation (OD) were targeted as high-risk practices, and underreporting was defined as the difference between the regular and main use of such high-risk practices. This paper documents and quantifies the presence of underreporting, which suggests that high-level reports indicating consistent progress towards development targets do not accurately reflect the day-to-day lives of residents of developing countries. The regular use of secondary unimproved water or sanitation facilities in conjunction with the use of an improved main option raises the possibility that individuals primarily using an improved main option could be exposing themselves to pathogens via their own intermittent high-risk use or through contact with other household members who use high-risk practices.

The primary goals of this paper are to: (1) demonstrate and quantify the occurrence of underreporting in key water and sanitation metrics used globally to measure public health progress, (2) identify association between high-risk practices and socio-demographic characteristics such as residence and wealth in one study area, and (3) explore policy recommendations to address this critical shortcoming.

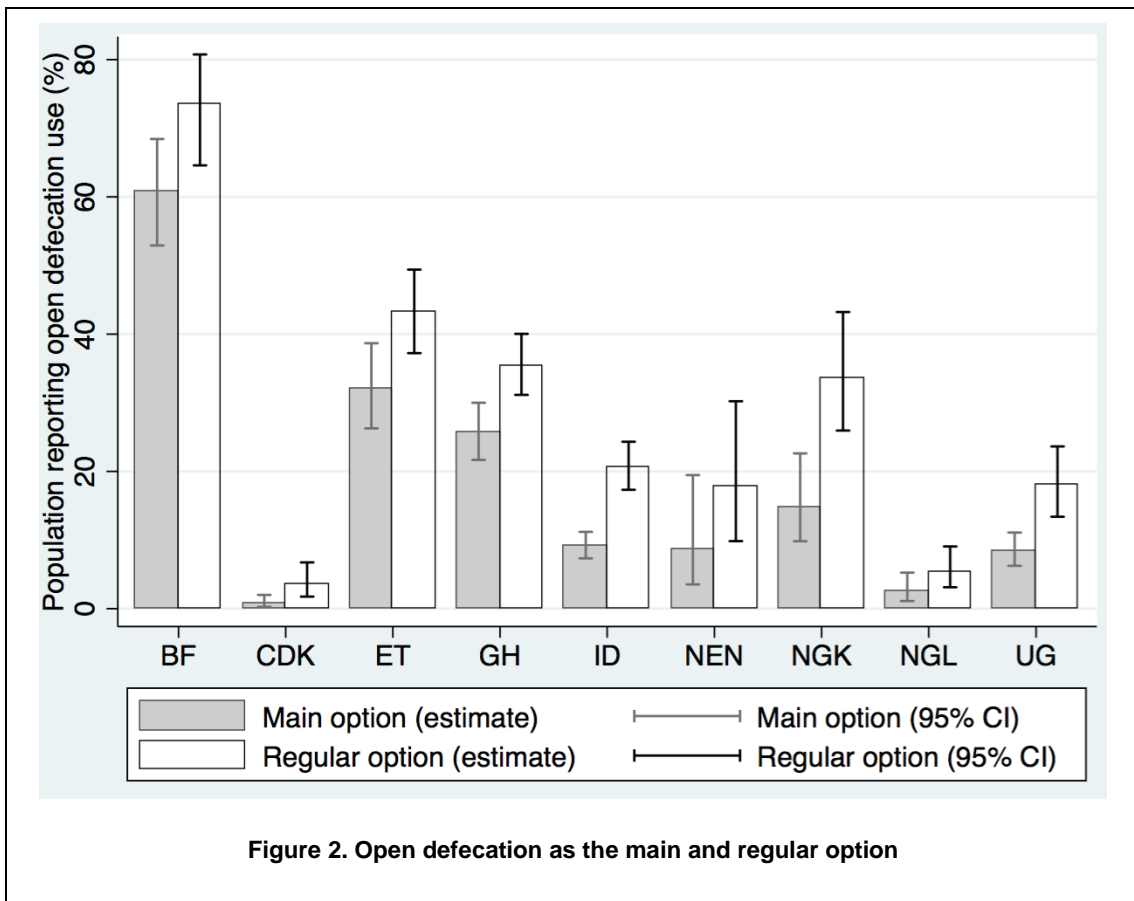
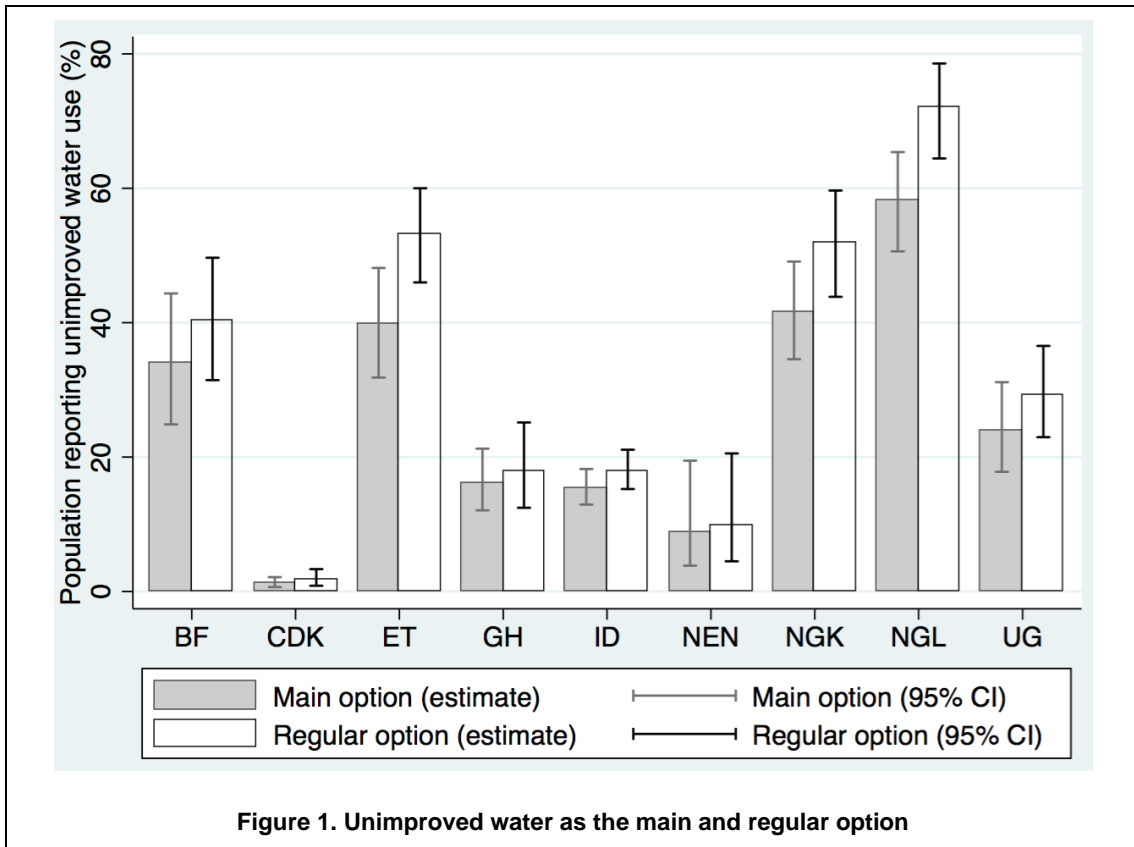
## Methods

Performance Monitoring and Accountability 2020 (PMA2020) is an international monitoring program that conducts national surveys of public health issues in low-and middle-income countries. Results in this paper come from the surveys conducted in nine study areas across eight countries – most are national-level surveys (countries indicated by a two-alphabet code) but some are sub-national in scope (country code followed by an alphabet denoting the region). PMA2020 surveys were conducted in Burkina Faso (BF), Dem. Rep. of Congo (Kinshasa) (CDK), Ethiopia (ET), Ghana (GH), Indonesia (ID), Niger (Niamey) (NEN), Nigeria (Kaduna state) (NGK), Nigeria (Lagos state) (NGL), and Uganda (UG).

In each country, a local research institution manages the training, data collection, and dissemination with technical support provided by Johns Hopkins University (JHU) located in Baltimore, Maryland, USA. The program design and content were approved by ethical institutional review boards in each country and at JHU. PMA2020 relies on a system of female resident enumerators (REs), recruited from nearby study clusters, who collect data from household interviews and health care service delivery points on a mobile phone using a customized version of the open source Open Data Kit (ODK) Collect, available for Android phones. Data are then uploaded on a central server for cleaning and processing.

## Results

Results from PMA2020 surveys in the nine study areas show that estimates for high-risk practices as the regular option are always higher compared to the main option (Figures 1 and 2). The gap between the regular option and the main option reveals a consistent underreporting of high-risk practices that are unhygienic and detrimental to public health. The magnitude of underreporting varies widely across our study areas, but overall, OD underreporting (median 9.60%) is much higher than UW underreporting (median 5.45%).



Low levels of underreporting may not necessarily mean that the current metrics are fully capturing high-risk practices. For example, underreporting in CDK is the lowest across all study areas. Underreporting in CDK, however, is the highest when calculated as a percentage of the main use estimate for both UW (43 percent) and OD (375 percent) use. This suggests that even in countries with low levels of absolute underreporting, the reliance on the use of main water and sanitation options to track progress in hygiene and human health is a strong limitation of our current monitoring paradigm.

Based on the nine study areas, we identified an underreported population of 26 million regularly consuming UW, and 50 million regularly practicing OD. Though we observe wide variation in the underreported population across the study areas, these numbers were approximately 6 and 11 percent of the total population under study. These numbers highlight significant gaps in our current assessment and monitoring metrics, as a result of which a notable fraction of the population is not targeted for suitable policy interventions.

### Impact of residence and wealth in Ghana

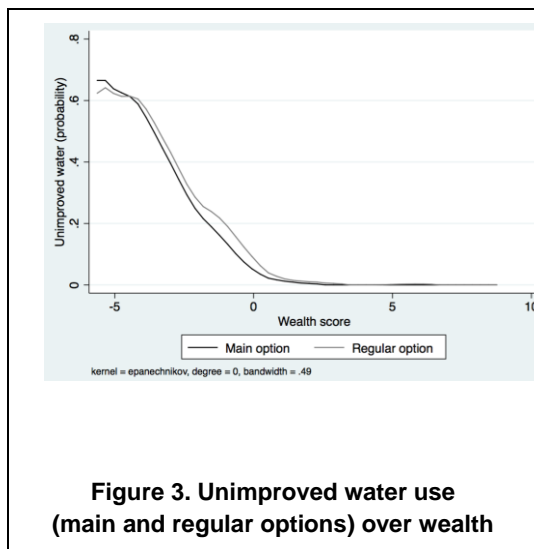
To further explore relationships between the use of high-risk WASH practices and socio-economic characteristics such as location and wealth, we selected Ghana as a case study for additional analysis.

The use of UW as the main and regular option is practiced in rural areas at a much higher rate than in urban areas (Table 1). Even though the absolute underreporting is higher in rural areas (2.58%) over urban areas (1.56%), the underreporting ratio, described as the ratio of underreported users to the main users, is much higher in urban areas. A similar pattern is observed in case of OD use (Table 2). Rural residents use OD as the main and regular options at higher rates than their urban counterparts, but the urban underreporting ratio (10.27 percent) is much higher than that observed in rural areas (7.34 percent). Overall, 2.25 percent (UW) and 8.71 percent (OD) of the Ghanaian population relies on high-risk practices on a regular basis, but is currently not reported as such under JMP metrics.

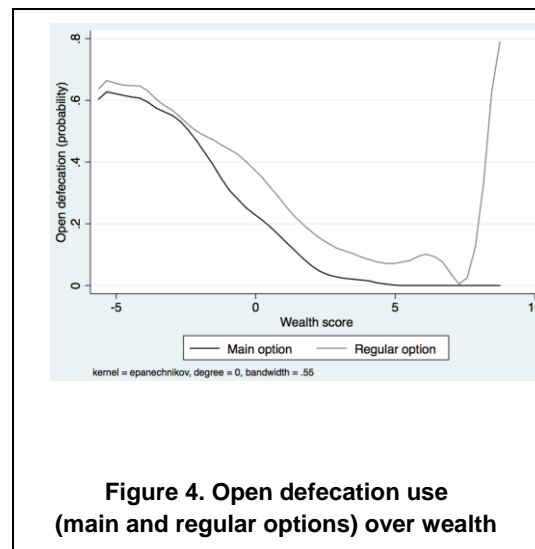
Location	Unimproved water use (percent)			Underreporting ratio
	Main	Regular	Underreported	
Urban	1.09	2.65	1.56	1.43
Rural	28.50	31.08	2.58	0.09
Total	15.69	17.94	2.25	0.14

Location	Unimproved water use (percent)			Underreporting ratio
	Main	Regular	Underreported	
Urban	10.11	20.38	10.27	1.01
Rural	42.06	49.40	7.34	0.18
Total	27.12	35.83	8.71	0.32

The use of UW, both as the main and regular option, declines with greater wealth in Ghana (Figure 3). Underreporting, seen as the difference between regular and main use of UW, stays relatively constant, and then gradually tends to zero at high wealth levels. OD also displays a negative association with wealth (Figure 4). However, underreporting of OD increases at the middle wealth levels and then sharply reduces at high wealth levels. We also observe a spike in underreporting at the highest wealth level, which suggests that wealthy households may often resort to using OD as a regular option due to non-monetary reasons such as lack of access when away from home.



**Figure 3. Unimproved water use (main and regular options) over wealth**



**Figure 4. Open defecation use (main and regular options) over wealth**

## Conclusions

Our results show that existing metrics, which assume the presence of a single option for WASH, are imperfect and thus underreport the use of high-risk practices. The use of multiple options to secure water access is widespread, since the main option is often not always available. Through the novel concept of ‘regular’ options, we uncover previously underreported users of high-risk practices. Across nine study areas, we consistently find the occurrence of underreporting of high-risk practices that amounts to 6 percent (UW) and 11 percent (OD) of the population. This group of underreported users is not considered when setting national or global targets, since they are thought to have access to better WASH options.

A deeper analysis of WASH data from Ghana revealed that users of high-risk practices are generally poor and live in rural areas. Although underreporting in absolute terms is higher in rural Ghana as compared to urban areas, underreporting ratio in urban areas is much higher. As urban migration continues to increase in Ghana and other developing countries, inability to target underreported urban users will be a critical policy blind spot.

This study demonstrated the use of a scalable mobile platform to accurately and rapidly collect household data. The successful implementation of the PMA2020 platform opens the possibility of monitoring a range of human behaviours and health outcomes, with a rapid turnaround ranging from a few days to a couple of weeks between data collection and dissemination. This near-instant feedback means that the results can influence policies and actions immediately.

## Acknowledgements

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