BEAM EXCHANGE

Increasing the uptake of new technologies:

Using a behavioural, market-based approach

Briefing note

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This practitioner brief represents the output of a facilitated engagement between practitioners facing specific challenges in programme design, implementation and evaluation, and academic specialists from relevant disciplines outside market systems development. The aim was to bring together practitioner challenges, academic theory and empirical evidence, in order to generate new learning and knowledge relevant for market systems practice. It is one of two briefs produced through these processes. Both briefs are available at www.beamexchange.org/practitionerbrief.

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1. Introduction

This brief explores how humanitarian and development programming impact the uptake of household water treatment products and long-term resilience to waterborne diseases, providing an answer grounded in economic theory and empirical evidence. The eventual goal is to aid in the design of public health interventions at the intersection of humanitarian, development and market systems programming.

One of the catalysts for this study was the observed recurrence of waterborne disease outbreaks in Zimbabwe by Oxfam. A recent pre-crisis market analysis in the capital, Harare, raised concerns that predictably recurring free distributions of household water treatment technologies (HWT) during an outbreak, among other non-food items and water services, could be affecting the sustained uptake and use of HWT and other good hygiene behaviours in non-outbreak periods. This reduced uptake could thereby reduce barriers to infection and weaken local HWT markets (Oxfam 2016).

In this brief we therefore focus on HWT, and in particular on water chlorination, in locations at risk of cholera and typhoid outbreaks, but the principles and concepts presented may be applied to other health technologies as well. While the brief focuses on health consumption behaviours, the concepts can be used to inform diagnosis and design of interventions in other sectors.

This brief has emerged through a facilitated dialogue between an economist and a group of humanitarian and market systems practitioners grappling with questions about how to balance the humanitarian imperative to provide HWT in the context of crisis, and the need to create a functioning market system for these products in the long term. A central feature of market systems development is behaviour change. This is where economics, and in particular behavioural economics as a burgeoning field of research, can provide insights.

Practitioners recognise that markets for health goods are complicated by differing perspectives on whether and how much citizens should be expected to pay. This tension is not just an ideological one: the problem diagnosis underpinning humanitarian interventions during crises has a material impact on the context for development-focused programmes that seek to build market systems, which are inclusive in nature. It was this inherent dilemma that brought the practitioners in this group together in the first place.

The rest of the brief proceeds as follows. We start with a background on the specific context explored here: waterborne diseases, specifically cholera and typhoid, and common humanitarian responses to outbreaks. We then present the core conceptual framework, drawing on economics, and behavioural economics in particular, to identify alternative approaches. We proceed by providing input into monitoring and evaluation strategies, and conclude with reflections on the relationship between humanitarian, development and market (systems) programming.

2. Background

Waterborne diseases are caused by ingestion of contaminated water from pathogens contained in human or animal excreta. They are typically transmitted by the faecal–oral route, and the infection is predominantly contracted by the ingestion of faecally contaminated water and food. Cholera is caused by ingestion of the bacterium *Vibrio cholerae* and leads to severe acute diarrhoeal disease that can cause death from dehydration within hours if untreated.

Cholera is an extremely virulent disease that affects children and adults. Individuals with lower immunity, such as malnourished children and individuals with HIV, are at greater risk of death if infected by cholera (WHO 2016).

A systematic infection by the bacterium *Salmonella enterica serovar Typhi* causes typhoid fever by ingestion of contaminated food or water. Typhoid fever is characterised by prolonged fever, headache, nausea, loss of appetite, and constipation or sometimes diarrhoea. Most cases occur in people aged 3–19 years and infected children are more likely to experience diarrhoea.

Cholera in particular is a public health problem in sub-Saharan Africa, which is characterised by a high disease burden, frequent outbreaks, persistent endemicity and high case fatality ratios, particularly in the region of the Central Africa and the Great Lakes. There, cases occur year-round, with a rise in incidence during the rainy season. Elsewhere in sub-Saharan Africa, cholera occurs mostly in outbreaks of varying size, with a constant threat of widespread epidemics.

In response to a waterborne disease outbreak or epidemic, there are a range of WASH (water, sanitation and hygiene) interventions, which Yates, Allen, Leandre and Lantagne (2017) reviewed. Water interventions aim to increase water quantity and/or improve water quality; sanitation interventions aim to isolate feces from the environment; hygiene interventions aim to prevent transmission through hands, and more broadly, promote awareness among affected populations about the disease and equip these populations to act; and environmental hygiene interventions reduce risks by disinfecting household objects and managing rubbish.

Responses, implemented by government, international and non-governmental actors, often focus on one or more of these interventions. Actors might repair and disinfect boreholes or drill new ones. They might provide free-of-charge HWT at medical facilities or door to door. These efforts are commonly supplemented by information campaigns, alerting citizens to the presence of an epidemic and explaining appropriate responses, through traditional media outlets or door to door. In addition to these interventions, medical care might be provided free of charge. In terms of HWT, chlorine tablets are often the preferred approach. When appropriately used, these tablets inactivate most bacterial and viral pathogens and lead to residual protection. In addition, the tablets are relatively easy to transport and use. While reviewing the effectiveness of HWT is not within the scope of this summary, there is a significant amount of evidence on the effectiveness of these various HWT products. In review of the evidence, Taylor, Kahawita, Cairncross and Ensink (2015), for instance, note that in an endemic setting in India, incidence of cholera infection was reduced by 58 per cent ($p<0.01$) in the chlorination group compared to the control group after five days (using a randomised controlled trial).[1]

1 See also Harshfield; Lantagne, Turbes and Null (2012) for recent evidence from Haiti.

3. Conceptual framework

The conceptual framework builds on academic theory and evidence in (behavioural) economics and aims to develop insights on how to improve programming from both humanitarian and development angles. Although waterborne diseases occur in multiple scenarios, this framework is more relevant to areas with recurrent outbreaks in permanent settings (or internally displaced people or refugees in extremely prolonged displacement), given the focus on creating effective short-term responses without compromising long-term resilience objectives in local market systems.

The focus is also on demand for HWT. While understanding the supply side – in this case the traders selling HWT – is important as well, less empirical research has been done on it. We will, however, touch on the supply side at the end of this section.

Lastly, an in-depth discussion of the role of social norms was considered but omitted from the conceptual framework. Social norms theory has been the focus of a second brief developed through a parallel process (see Klassen, Shakya, Cislaghi, Markel, Merrill, Jenal, Vasudevan. and Garloch 2017).

Demand for household water treatment

As health goods, HWTs differ from standard goods in two ways. First, adoption of HWT reflects an investment in one's future health, or 'human capital', which has implications for behaviour. Behavioural economics tells us that people often underinvest in the future, not paying enough attention to their pension or health for that matter.[2] And second, adoption of HWT by one household can have an 'externality' effect on other households, meaning that when a household adopts HWT, it not only reduces the chances of someone in that household getting ill, but it may reduce the chances of getting ill for nearby households, too. This 'externality' effect is the reason we often mandate vaccinations.

We are starting from a situation in which we expect households to under-adopt (or under-invest) in HWT. This under-adoption can have severe, irreversible consequences: waterborne illnesses can result in death, an extreme case of human capital loss.

To understand the further adoption of HWT, we now need to look at the role of other factors: prices and beliefs about HWT.

Prices

Prices relate to the concept of 'affordability', a common concept that practitioners use, which broadly refers to the ratio of price to (average) income. Price indeed plays a key role as to whether or not a household will adopt HWT. Although it is not the only factor, this is where we will start our discussion. For most goods, a price increase results in decreased consumption and a price decrease results in increased consumption. In the case of preventative health products, it has been shown that a high price can deter adoption (Dupas 2009) and hence subsidies can be expected to increase adoption. Subsidies increase the price on the supply side, while decreasing the price on the demand side, with the price differential between the two covered by an external actor, such as a non-governmental organisation (NGO), government, etc.

In addition, most health products are 'experience goods', meaning that households need to learn how to use them and what their effects are while using them. In theory, subsidies, which create a spike in adoption, might allow households to do just that: to learn about the product. This learning might then incentivise the household to sustain use, even after the subsidies have been removed. Dupas (2014a and 2014b) finds that short-run subsidies for new, improved bed nets in rural Kenya led to high experimentation rates, higher willingness to pay (WTP), and higher adoption of the bed nets in the long run (a year later) among subsidy recipients and their social contacts.

2 See Leonard, Thaler and Sunstein (2008) for an easy read on behavioural economics.

Similarly, Oster (2009) finds that girls in Nepal learnt from each other about the benefits of and how to use a personal hygiene menstrual cup. These two studies point not just to the importance of learning-by-doing but also to the importance of learning from others (also called 'social learning').

However, in the case of chlorine products, one might argue that there is perhaps less to learn as these products are not 100 per cent effective and whether or not one gets ill depends on myriad factors. This limits the scope for learning of any sort. The one thing that households might learn – that the (chlorine) product tastes somewhat odd – is likely to have an opposite effect and deter future use (Jeuland, Orgill, Shaheed, Revell and Brown 2016). Ashraf, Berry and Shapiro (2010) formalise this idea and note that subsidies are unlikely to increase learning if the product being subsidised has a non-monetary usage cost (e.g. a side effect) that people underestimate at the onset. They apply this idea in a randomised study in urban Zambia and find that subsidies for a chlorine HWT product do not increase the level of experimentation in the short run.

The possible positive effects of subsidies specifically are: that a positive increase in adoption 'corrects' for under-investment due to impatience or present-biasedness and externalities indicated earlier; and that they might also allow for learning.

Let us move on to the possible negative effects of subsidies. First, a possible 'anchoring' effect – an effect that can be explained as someone being unwilling to pay more than they have always paid. In this case, it could mean that households anchor on the price during the outbreak and are then unwilling to pay more after the outbreak. Although anchoring has been shown to exist in other situations, in the context of health products in developing countries, no evidence has been produced to date in fields of development or health economics.[3] Reduced pricing might also signal reduced product quality. While this has been shown to exist in some contexts, in the case of health technologies in developing countries we have not been able to identify any studies that show this. If it were to be the case, one strategy would be to communicate the true (unsubsidised) price of the product alongside the subsidised price.

Finally, subsidies pricing might discourage use of the product. Recent literature in behavioural development economics has focused on use, or more precisely, lack of use after purchasing a health product in developing countries. From a theoretical perspective, one knows that if one pays a positive, non-zero price for a health good, then one would expect to use it, at least at the time of purchase. When one has purchased the product, a further 'sunk cost effect' could encourage use – for instance, one might feel guilty about not using a product that one has paid for. This may not be the case for zero price, however, hence the concern of practitioners that zero prices might result in increased (or unchanged) non-usage rates. From an empirical perspective, evidence on this matter has been at best mixed. For example, Cohen and Dupas (2010) find no evidence that cost-sharing reduces wastage and increases the use of bed nets in malaria prevention in Kenya. Ashraf *et al*. (2010) find no evidence of the sunk cost effect, but do find evidence of a screening effect that might increase usage rates at increased prices: households that value a chlorine product more also use the product more. Ritter (2008) notes a positive correlation between zero price and usage in the context of emergency HWT distribution in Haiti. The relationship between pricing and usage rate is likely to be product- and context-dependent. In the midst of a crisis one might not expect a decrease in usage rate even when the product is provided free of charge.

Bringing all of these aspects together leads us to conclude that, in the case of HWT, to create a sustainable, cost-effective but efficient approach, some degree of subsidisation may be needed, but a zero price should be avoided. However, to avoid welfare losses associated with fluctuating subsidies and possible adverse signalling of quality, this subsidy should be explicit and possibly long term.

3 See Dupas (2014b) for a discussion.

To conclude this section, let us introduce a second component of cost, one that is often forgotten but might be even more important than the actual price: the transaction cost. For instance, one might have to travel by bus to go to the store to purchase the HWT, or one might have to queue to receive an HWT. The latter implies an opportunity cost of time, which could be substantial and varies by household. This implies that even if a product's price is zero, having to queue might be 'too costly' for some households.

Practitioners can also exploit this opportunity cost of time to create a 'micro-ordeal' or small hurdle. For instance, suppose one has decided to provide HWT free of charge to users. In this case, one might have significant concerns about use. Dupas, Hoffmann, Kremer and Zwane (2013) show that in Kenya households that were required to go to a store to redeem coupons for a chlorine product were more likely to use the product, and also more likely to purchase and use the product a year after the coupon programme had ended. The latter is likely to be due to 'habit formation'. During the programme, the household got used to going to the store on a monthly basis; and when the programme ended the household was more likely to continue. In the realm of health care, the importance of habit formation, cannot be understated: habits essentially imply that one does things on 'autopilot' without thinking. Households in developing countries need to make many difficult decisions on a daily basis, so having an established health care routine is crucial to ensuring investment in one's health.

Beliefs

When a household decides to obtain and use HWT, three types of beliefs will enter this decision: (1) belief about the prevalence of the illness and in particular the chances of becoming infected; (2) belief about the effectiveness of HWT; and (3) beliefs about the remedial care and recovery process if one becomes ill. Understanding these beliefs is particularly important, as we know that households are subject to behavioural biases when making decisions. Households that have known situations of conflict and war, for instance, are known to be less risk-averse. We discuss these beliefs in turn.

Beliefs regarding the chances of becoming infected

We used the Zimbabwean Demographic and Health Surveys from 2010–11 and 2015 to investigate the determinants of HWT use in this context. We find that, in this context, the uptake of HWT relates to the water source. Compared to an unprotected well, households that have access to a bore well or tube well are 12 percentage points less likely to use HWT and 8 percentage points less likely to use chlorine products. Similarly, when one has access to piped water one is also about 8 percentage points less likely to use either HWT or chlorine products. This suggests that households believe – whether this view is substantiated or not – that piped water sources and bore wells or tube wells are safer compared to surface water or unprotected wells. Brown, Hamoudi, Jeuland and Turrini (forthcoming) find similar results in Cambodia. A more recent pre-crisis market analysis in Harare conducted in 2016 by Oxfam (Oxfam 2016), though less comprehensive, shows very low levels of chlorine use for any water source. The primary water source in the areas surveyed was groundwater from boreholes or shallow wells, and the vast majority of respondents did nothing to their water or boiled it to treat it. However, in our view this should not discourage actors from building these structures, as access to piped water, in particular, decreases the prevalence of waterborne diseases and increases health outcomes substantially in the long term (Jalan and Ravallion 2003).

One might conclude that providing information about the actual safety of these water sources – by using spot checks – would be a cost-effective method to increase uptake of HWT, but this is not necessarily the case. While we have evidence that delivering salient information about household water quality increases adoption of protective behaviours and technologies (see Jalan and Somanathan 2008), most of this evidence indicates only small and short-lived effects

of information on demand for HWT (i.e. beliefs in this regard appeared to be 'sticky'). However, if one targets the information at households that are likely to have an incorrectly optimistic view of their water quality, prospects improve, and information about the actual water quality might result in a change in the long-term beliefs they hold (Brown *et al*. forthcoming). However, the latter still does not necessarily result in a change in long-term behaviour.

Using the same data, we note that the use of HWT changed from month to month, possibly reflecting the perceived threat of the illness. Waterborne illnesses are more common in the rainy season, and correspondingly we find an increased uptake during this period. This seasonality also implies that a dip in the use of HWT post-outbreak should not necessarily be seen as an effect of any public health programme, as this dip might be a rational response of households responding to a lower threat level.

This does not mean that the presence of NGOs does not affect beliefs. Although there is no evidence in this area, we would hypothesise that despite the 'stickiness' of the beliefs referred to earlier, the presence (or absence) of NGOs and media campaigns signals the presence (or absence) of a waterborne illness and results in adoption or rejection of HWT.

Beliefs regarding the effectiveness of household water treatment technologies

Beliefs about the effectiveness of HWT are likely to be more stable over time, as these beliefs capture a technological relationship between inputs (use of HWT) and outputs (health), and these are a (perceived) attribute of the product itself.

However, it is well known that the effectiveness of many health products is difficult, if not impossible, to learn from using the product. For instance, many factors contribute to whether or not a child gets diarrhoea and attributing this directly to the presence or absence of chlorine products is difficult. This limits the scope for learning-by-doing and social learning, as explored in the previous sub-section.

The implication is that humanitarian and development actors could play a significant role in affecting this belief. Specifically, we know that individuals often fail to clearly understand and process probabilistic messages – messages that involve a percentage chance. Salient, simple messages that do not overstate the probabilistic effect of the product are most likely to work.

Finally, effectiveness depends on using the product correctly. As noted earlier, using a product involves a certain opportunity cost of time. Also, people may look to extend the life of a product by, for instance, using less than the recommended dosing level of the product for each use. Knowing how to use the product correctly also involves a certain amount of cognitive effort. Evidence suggests that households in developing countries are often cognitively constrained (Mani, Mullainathan, Shafir and Zhao 2013). This implies that reminder messages are quite effective in encouraging (correct) use. Indeed, while reminding individuals does not provide any new information in and of itself, it puts one aspect at the forefront of one's mind at that point in time.

Beliefs regarding remedial care and recovery

Availability, price and quality of medical care affect the belief that one will be cured if one contracts a waterborne illness. Indeed, one can see preventative care and remedial care as two aspects of care, but with very different costs and benefits. While remedial care treats an actual condition, preventative care does not treat but prevents a potential condition in the future. A present-biased individual might prefer remedial care. If then, preventative care comes at a cost, whereas remedial care is relatively cheap and quite effective, it might be a rational response to focus one's efforts on remedial care only. This might particularly be the case when remedial care is not provided free of charge during an outbreak, as in Zimbabwe. Although there might still

be considerable opportunity costs of time (e.g. queuing), in these cases households might be seen to substitute preventative care, such as using HWT, for remedial care, such as going to the doctor for oral rehydration.

Gender

It is not uncommon in developing countries to see multiple types of household constructs; for example, but not limited to, polygamous families living in family compounds, economically active family members living away from home or multiple families living in one household unit. The household structure matters, and who one approaches in any programme matters too. Dupas (2009), for instance, randomly varied who in the household a promotion campaign for antimalarial bed nets in Kenya targeted. Handing out a voucher in the presence of both household heads increased uptake by about 20 per cent compared to targeting either of them alone. This indicates the presence of within-household dynamics. In particular, information might not always be shared within the household. Or, even when information is shared, preferences might differ and the resulting decision will depend on the bargaining power of household members. There is evidence that mothers and fathers value the health of their children differently, with mothers attaching more importance. This implies that when a programme increases a woman's bargaining power, we can expect investment to go up in health and, among other things, the purchase of HWT. If preferences for health differ, one should consider targeting the household member who values health more, as this individual will be more likely to correctly use the product, perhaps even unbeknownst to the other household members.

Household water treatment supply

In many countries, one can purchase HWT at local stores, pharmacies and health care centres. However, availability of HWT in such locations and the supply chains to them are likely to vary. In the case of Zimbabwe, few local stores supply HWT and only a few manufacturers supply the stores. If a manufacturer is private, this monopoly could drive up the prices and government intervention would be warranted. However, if the manufacturer is a government monopoly or an external actor, and the price is set at cost of production, then there is no reason to intervene on the manufacturer's side. Changes to the price or availability of HWT can be expected to affect the stores that sell HWT, assuming that these stores are private. For instance, by fixing a maximum price, or even distributing products imported from abroad free of charge, in effect driving down the price, one might crowd local stores and manufacturers out of the market, discouraging them from stocking the product now or in the future. This does not mean the product cannot be provided free of charge; it can, but this should be done through a subsidy, so that both households and stores benefit. A voucher programme can implement subsidies quite effectively. To further encourage local manufacturers, one will need to source the product locally, rather than importing it from abroad. Currently, liquid chlorine can be manufactured locally in many developing countries; however, tablets are only centrally produced in the United Kingdom and Ireland. Local manufacturing constraints may exist to reaching this objective in the first instance. Ultimately, predictable availability of the products and predictability of prices is essential to sustain a habit (Chaudhury, Hammer, Kremer, Muralidharan and Rogers 2006). This implies that these products need to become available throughout the year at local stores.

Of course, in certain crisis circumstances, supply chains may not be functioning because they do not exist or have been damaged or destroyed. In other cases they may not meet the quality standards required to support public health objectives. This highlights the tension between humanitarian objectives of providing minimum-quality products to those in crisis and development objectives of supporting local suppliers to maintain stable prices and stocks of goods so that consumers can form and sustain health habits.

In summary, the conceptual framework has highlighted multiple factors that affect people's decisions about how they purchase and use products, and these are subject to local norms, beliefs and social structures, as well as market conditions. The next section applies this framework specifically to the case of HWT, leading to recommendations for improved programming.

Evidence-based programmes

Based on our analysis above, we would recommend the following for programmes that aim to increase the uptake of HWT. These recommendations relate to practitioners in both the humanitarian and development spheres. The two sectors should recognise the effect of each other's work on HWT uptake, so that they do not undermine each other's efforts, but rather are complementary in their programme designs to ultimately reduce occurrences of outbreaks.

Four recommended approaches:

1. **Provide information about the effectiveness of HWT through the media year-round** – Pre-test the effectiveness of simple messages by eliciting beliefs through household questionnaires, SMS (text messages) or a locally preferred equivalent (see the next section on elicitation of beliefs). Provide information on how to use the product in easy-to-spot places, 'nudging' household into correct behaviour (Leonard, Thaler and Sunstein 2008).

2. **Form habits** – At the start of an outbreak, set up a mechanism for distribution of HWT that encourages households to visit a trader on a regular basis to obtain the product (e.g. using vouchers; see point 3). Then, nudge households into regular use. SMS reminders (or a locally preferred equivalent) can play a role. To avoid SMS fatigue, one could combine messages with a quiz question on an unrelated but popular topic, with a chance to win something. Alternatively, one could use the exchange to obtain information relevant to programme objectives, as suggested in point 1.

3. **Price appropriately and encourage use** – While subsidies are appropriate, the level of subsidy needs to be determined through an analysis of WTP (see the next section on elicitation of WTP). This analysis needs to anticipate the joint effects of the other approaches suggested here, which can be done using a small randomised controlled trial (Ashraf *et al*. 2010). The subsidy needs to be visible, such as with a voucher that clearly states the subsidy provided; and, in the case of chlorine products, ideally long term, which would require collaboration between humanitarian, development and government bodies. Subsidies can target the lower socio-economic strata, but errors and corruption in targeting should be expected. Finally, one should be aware of the non-monetary cost of a product, and in particular the opportunity cost of time. While door-to-door distribution is not needed, and possibly not desirable, local availability is crucial, although a micro-ordeal can be considered.

4. **Work through market actors** – HWT must be available, at predictable prices, year-round at local trading points. These can be small stores or pharmacies.

4. Monitoring and evaluation

Current monitoring and evaluation (M&E) practices tend to focus on collecting information on programme activities, such as the number of chlorine products distributed, rather than the – especially longer-term – effects of such programmes on correlates of behaviour and health and market outcomes (Yates *et al*. 2017). We recommend expanding M&E to further inform interventions and policies and evaluate their effectiveness accurately. In this section, we provide suggestions on how to measure the indicators mentioned in the previous section, and give seven tips to strengthen current M&E practices.

Seven tips:

1. **Exploit secondary data** – For instance, demographic and health surveys and living standards measurement surveys. These datasets can have information on household assets, household location (GPS), access to media, sanitation facilities and water sources, and also adoption of WASH practices.

2. **Collect supplementary data from non-household sources** – For instance, from private, public and other traders and medical facilities; on prices, availability, sanitation facilities and water sources; and on disease prevalence.

3. **Pilot measures** – Pay particular attention to: (a) how to include recall questions (i.e. questions that ask respondents to remember information about the past) (Beegle, Carletto and Himelein 2012); (b) how to approach subjective measures of belief, health and access (Grosh and Glewwe 2000); and (c) who the respondents should be.

4. **Consider using ICT to collect data** – For instance, data on market prices and availability could be collected from market actors weekly by phone; data on daily household use could be collected from households by SMS (Dillon 2012).

5. **Ensure responsiveness** – While refusal to participate in in-person surveys is rare in developing countries, refusal rates go up when one uses alternative methods. Depending on context, one might consider rewarding respondents financially. A chance to win a substantial prize often produces better results.

6. **Consider lab-in-the-field experiments** – This is a cost-effective method of gathering evidence. One simulates a programme using a realistic, but smaller-scale version, inviting 20–30 people to take part, and dividing them into a treatment group and a control group. The treatment group receives the programme, whereas the control does not. Differences between the two groups can shed light on what might work in 'real life' (Levitt and List 2009).

7. **Use common indicators** – Given the clear relationship between humanitarian and development programme objectives, programmes of both types could benefit from agreeing on a small number of reliable behavioural indicators that could be measured in both contexts to foster collaboration.

The next section describes simple, non-resource-intensive techniques to elicit specific data-sets (that are often perceived as too complex or time-consuming to gather) to support M&E and programme design.

Elicitation of subjective beliefs

Beliefs about the threat of an illness, the effectiveness of preventative treatment and recovery scenarios after remedial treatment are subjective and vary over time. To elicit these beliefs, we recommend a visual probabilistic approach. For instance, for a binary indicator, the enumerator would draw two equally sized circles on the ground and hand respondents a set of ten equal sized stones. Each stone represents a one in ten or 10 per cent chance. One circle could be red – a child getting diarrhoea that week – and the other green – a child not getting diarrhoea that week. The enumerator would then ask the respondents to divide the ten stones between the two circles according to the perceived chances of the two scenarios. By repeating the question for two hypothetical scenarios – using chlorine products or not – one can obtain a measure of perceived effectiveness.[4]

Elicitation of willingness to pay

To elicit the WTP we recommend a Becker-DeGroot-Marschak method. For instance, for a durable good such as a ceramic water filter, the enumerator would ask, 'Would you be willing to pay US$10 for this filter?'. If the answer is 'no', the enumerator would continue, and ask, 'Would you be willing to pay US$9 for this filter?' If the answer is again 'no', the enumerator would continue with US$8, etc., all the way down to US$0. The point at which the respondent switches from 'no' to 'yes' is the WTP for the product. This answer is sensitive to how the question is framed: using a downward ladder (as we did) versus an upward ladder and the starting point of the ladder. Hypothetical frames are known to give less precise information compared to incentivised frames. In the latter, after having elicited the WTP, one would draw a random price between US$10 and US$0, and have the respondent actually purchase the product if his/her WTP equalled or exceeded this random price. Examples in practice can be found in Berry, Fischer and Guiteras (2015) and Null, Kremer, Miguel, Hombrados, Meeks, and Zwane (2012). Alternative methods are stated preferences – useful for non-durable goods such as chlorine tablets (Mobarak, Dwivedi, Bailis, Hildemann and Miller 2012) – and auction-based methods – useful if a group approach is more cost-effective (De Groote, Chege Kimenju and Morawetz 2011).

Elicitation of wealth, costs and prices

To elicit wealth, we would recommend an index-based approach (Grosh and Glewwe 2000); and if time is restricted, key assets, such as land, phone and media access. To elicit opportunity cost of time, we would encourage collecting select GPS data, mapping distances between households and markets, as well as including the time needed and transportation mode used to access these markets. One can elicit (recent) prices directly from households and local traders. The latter should also include information on inventory, even if the trader is out of stock on a particular day.

4 For a detailed narrative and the procedure for non-binary indicators, see: Maertens (2011) and Delavande *et al*. (2011).

5. Conclusion

We started this summary with the question, 'Can the common responses of humanitarian actors to outbreaks in waterborne diseases… impact future uptake of these [HWT] products and decrease long-term resilience?' The answer to the question about future uptake is 'yes', whereas the answer to the second question about long-term resilience is 'it depends'. We elaborate below.

First, as with other emergency aid, such as food aid, emergency WASH interventions can expect to impact market systems. By expanding the local supply of HWT, for instance, one might discourage local production and distribution (Barrett and Maxwell 2007). However, the degree to which this happens depends on various factors: in particular, whether HWT is procured locally and the distribution involved (vouchers or direct distribution) (Abdulai, Barrett and Hazell 2004). Using local procurement and vouchers, for instance, one can expect to enhance local supply rather than decrease it (e.g. of a large-scale voucher programme embedded in private markets; see Dorward and Chirwa 2011). This implies that there is scope for complementarities between the actions of humanitarian and development actors. While development actors can focus on improving infrastructure to ease market access, humanitarian actors can – through local procurement and voucher programmes – increase demand and supply of HWT.

Second, as opposed to popular perception, there is little evidence of households anchoring their WTP of HWT on particular prices (in the case of an outbreak zero price) (Dupas 2014a and 2014b). As households might be learning about the effectiveness of the product and an outbreak represents a clear case of externalities (a situation in which the health of one person affects the health of another), subsidising HWT remains the main recommendation. Given concerns that those people most vulnerable to waterborne disease are generally the poorest, the idea of subsidies to support HWT uptake may find greater acceptance than expecting poor communities to bear the full cost of HWT, in light of their economic circumstances and inability to access safe drinking water. The degree and length of this subsidisation needs to be embedded in a more careful analysis of WTP of households and the structure and dynamics of the supply side of the market. In addition, the method of subsidisation needs to set itself the goal of habit formation (Dupas *et al*. 2013).

The current practice of temporary, free door-to-door distribution of HWT does not succeed on either front. It is therefore unlikely to contribute to sustained use in the context of recurrent waterborne disease, where alongside effective short-term responses to outbreak events, the longer-term aim is to reduce recurrence and increase resilience. A cost-share option, such as through a subsidy, might allow for the implementation of a cost-effective, longer-term programme. Development programmes can support this habit formation through salient, simple, year-round information media campaigns on the effectiveness of HWT.

Third, it is well known that improving access to water sources, and in particular piped water, improves long-term health outcomes (Jalan and Ravallion 2003). However, as evident from our regression analysis on the case study in Harare, it might also increase expectations of clean water, whether justified or not (similar results are found in Cambodia by Brown *et al*. forthcoming). A similarly complex dynamic regarding beliefs and expectations relates to people's understanding of the effectiveness of chlorination. A recent comparative study on well chlorination concluded that in multiple locations chlorination resulted in people mistakenly believing that their water was safe to drink for months afterwards. However, the dosing was actually effective for less than 48 hours in some cases (Rowe, Angulo, Roberts and Tauxe 1998; Branz, Levine, Lehmann, Bastable, Ali, Kadir, Yates, Bloom and Lantagne 2017). This again emphasises the importance of programmes gathering qualitative data to identify beliefs, understandings and expectations about the impact of different water sources and treatment

methods, as this may influence the choice of intervention strategy.

Similarly, the presence of free government medical care, which is common during periods of crisis, might discourage households from using preventative measures, as they expect treatment free of charge. While we would not recommend reducing investment in improved water sources, or reducing access to medical care during periods of crisis, humanitarian actors need to be aware of these interlinkages. It is important to acknowledge programme influences on behaviour and the implications for effectiveness, whether for that programme or a parallel one. Awareness and coordination of the implications of different programmes on each other is just as important as the design of individual interventions.

Drawing on insight from (behavioural) economics, these recommendations are intended to support humanitarian, development and market systems practitioners working together towards not only short-term wellbeing but also sustained local resilience through strengthened local market systems for HWT. The learning can equally be applied to other similar health products, while the broad principles can inform the diagnosis of market failures and design of interventions in other sectors. In addition, through improved approaches to M&E, which take into account behavioural factors, particularly on the demand side of market systems, we hope that better evidence and learning will be generated, further aiding in the design of coordinated humanitarian and development practice.

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