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Consumer preferences for household water treatment products in Andhra Pradesh, India

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ABSTRACT

Over 5 billion people worldwide are exposed to unsafe water. Given the obstacles to ensuring sustainable improvements in water supply infrastructure and the unhygienic handling of water after collection, household water treatment and storage (HWTS) products have been viewed as important mechanisms for increasing access to safe water. Although studies have shown that HWTS technologies can reduce the likelihood of diarrheal illness by about 30%, levels of adoption and continued use remain low. An understanding of household preferences for HWTS products can be used to create demand through effective product positioning and social marketing, and ultimately improve and ensure commercial sustainability and scalability of these products. However, there has been little systematic research on consumer preferences for HWTS products.

This paper reports the results of the first state-of-the-art conjoint analysis study of HWTS products. In 2008, we conducted a conjoint analysis survey of a representative sample of households in Andhra Pradesh (AP), India to elicit and quantify household preferences for commercial HWTS products. Controlling for attribute non-attendance in an error components mixed logit model, the study results indicate that the most important features to respondents, in terms of the effect on utility, were the type of product, followed by the extent to which the product removes pathogens, the retail outlet and, the time required to treat 10 L. Holding all other product attributes constant, filters were preferred to combination products and chemical additives. Department stores and weekly markets were the most favorable sales outlets, followed by mobile salespeople. In general, households do not prefer to purchase HWTS products at local shops.

Our results can inform the types of products and sales outlets that are likely to be successful in commercial HWTS markets in AP, as well as the influence of different pricing and financing strategies on product demand and uptake.

Introduction

There are nearly one billion people worldwide relying on unimproved sources of drinking water that are not protected from contamination and may cause illness or death (UNICEF & WHO, 2008). Further, the World Health Organization estimates that 83% of households using improved sources drink water that has been contaminated, either at the source or during collection, storage, and handling (WHO, 2005).

India has made good progress toward the Millennium Development Goal of halving the proportion of people without sustainable access to safe drinking water by 2015 (WHO, 2005). However, given the obstacles to ensuring sustainable improvements to water supply infrastructure (e.g., installing or improving piped water networks) and the unhygienic handling of water after collection, household drinking water treatment is viewed as an important mechanism for increasing access to safe water (UNICEF & WHO, 2008; WHO, 2005). This strategy embodies the new consensus that universal access to safe water is only feasible if public-private initiatives motivate household behavior that complements government, community, and commercial efforts (Pattanayak, Poulos, Yang, Patil, & Wendland, 2009a).

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Household drinking water treatment technologies, including products that chlorinate (e.g., tablets or liquids) and/or filtrate (e.g., candle filters), reduce the likelihood of diarrheal illness by about 30% (depending on the technology the range is from 3 to 70%) (Clasen, Roberts, Rabie, Schmidt, & Cairncross, 2006; Fewtrell et al., 2005). Despite their demonstrated effectiveness, levels of adoption and continued use of these products remain low.

To improve public health and ensure commercial sustainability and scalability of household water treatment and storage (HWTS) products, there is an urgent need to understand consumer preferences for HWTS products in order to create demand through effective product positioning and social marketing (Harris, 2005; Pattanayak & Pfaff, 2009; Pattanayak, Yang, et al., 2009b). However, there has been little systematic research on consumer preferences for HWTS products. There have only been a handful of studies that have measured willingness-to-pay (WTP) for or uptake of HWTS products (Ashraf, Berry, & Shapiro, 2010; Clasen, Brown, Collin, Suntura, & Cairncross, 2004; Luby, Mendoza, Keswick, Chiller, & Hoekstra, 2008; Quick et al., 2002; Yildizbayrak, Moschos, Tamar, & Le tallec, 2004), but these have tended to focus only on one product or technology at a time, did not assess consumers' preferences for different product attributes, and have relied on small samples that are not representative of the regions or nations in which projects hope to scale up.

Ideally, consumers' preferences can be elicited by observing HWTS purchases. However, the market for commercial HWTS products in India is nascent, as it is in many countries (Harris, 2005; Luby et al., 2008). The range of currently available commercial products is limited and they typically cost approximately $40 (Indian Rs. 1600). These products are only sold in urban areas and only wealthier households can afford them. According to the 2006 National Family Health Survey, the majority of households in India (51% of the urban population and 73% of the rural population) do not treat their drinking water in any way. In urban areas, only 16.8% of the households use commercial HWTS products, which include ceramic, sand or other water filters (13.4%) and electronic purifiers (3.4%). In rural areas, only 3.4% of rural households use commercial HWTS products (3.3% use ceramic, sand or other water filters and 0.1% use electronic purifiers). Some products, such as net sieves, are widely available and among the most frequently used commercially available HWTS products, but they are ineffective at removing waterborne pathogens. Given the limited availability of commercial HWTS products, it is not possible to determine whether the rates of water treatment would increase with access to affordable and effective products or are limited by the perceptions about water quality.

Further, observing consumer behavior would be insufficient for learning about preferences for a broad range of HWTS products or specific product attributes. As part of PATH's Safe Water Project, which is catalyzing commercial markets for HWTS products, this study, led by Research Triangle Institute (RTI), used a choice-format conjoint analysis (CA) survey to elicit household preferences for commercial HWTS products and product attributes in Andhra Pradesh (AP), India. CA methods recognize that products have value because of their characteristics or attributes. By varying the attributes of the HWTS products, respondents' choices among the alternatives provide information on their preferences for attributes, or the amount of utility (satisfaction) provided by each attribute. These choices are analyzed to estimate the weights people assign to various product attributes and predicted choice probabilities. In addition to a long history of market-research applications, researchers have more recently adapted CA methods to evaluate environmental policies, public-health interventions, and pharmaceutical treatments (for example, Brown, Johnson, Poulos, & Messonnier, 2010; Johnson et al., 2006; Mansfield, Phaneuf, Johnson, Yang, & Beach, 2008; Ryan, 1999). These methods have been successfully applied to measure the demand for improvements in domestic water service (Hurlimann & McKay, 2007; Kanyoka, Farolfi, & Morardet, 2008; Snowball, Willis, & Jeurissen, 2009; Yang, Pattanayak, Johnson, Mansfield, & Jones, 2006) and vaccines (Cook, Whittington, Canh, Johnson, & Nyamete, 2007; Poulos et al., 2011). To our knowledge, this paper represents the first application of CA to measure relative preferences for commercial HWTS product attributes and preferences for commercial HWTS products, including products that are not widely available.

Methods

Conjoint analysis

The variant of choice-format CA used in this study involves asking respondents to complete several choice tasks, in which they choose one of two competing options that are characterized by different characteristics or attributes (Louviere, Hensher, & Swait, 2000). The interpretation and analysis of these data are based on random utility theory (Louviere et al., 2000), which posits that respondents choose the alternative that provides them with the most utility.

Survey design and development

A draft survey instrument was developed based on a literature review, previous surveys of water-related practices in India, publicly available surveys, and the results of a qualitative rapid appraisal study (RAP) focused on household water-related practices. The RAP study comprised 24 focus groups, 48 in-depth interviews, and 80 h of direct observation and was conducted by an Indian research firm with experience in qualitative research and the water and sanitation sector. The RAP findings informed the types of questions and the response categories included in the survey. Findings about water quality perceptions and water treatment experience informed the descriptions of HWTS product features, as well as attribute levels for price, treatment time, and retail locations, in particular. On the basis of the RAP study finding that men and women both influence household decisions about household water treatment, the study sought to interview a mix of men and women.

The draft survey instrument was refined based on 25 in-depth interviews, feedback from interviewer training, and 75 field pretests. The in-depth interviews were conducted with heads of households or their spouses in three communities in AP. The interviews were conducted by experienced interviewers, each of which had more than 10 years of research experience. The interviewers employed a "think aloud" technique to examine subjects' understanding of the attributes, understand their perceptions of the constructed products, and assess ranges of the attribute levels over which they had experiences and/or preferences. Interviewers' and observers' notes were reviewed and discussed each day to inform revisions to the draft survey before the next day's interviews. These revisions included changes to the wording of attribute definitions, changes in the order of text and questions, and changes to the attribute levels. The pretest interviews identified errors in the survey instrument and also informed the final price levels.

To address potential enumerator bias, we trained enumerators to administer the survey exactly as written, and also emphasized that the best quality data would reflect respondents' true preferences.

The survey had 6 sections: locational characteristics, demographics, water-related illnesses, water-related practices