

# Application of the contingent valuation method in a developing country: a case study of the Yusufeli Dam in northeast Turkey

Emre Alp and Ülkü Yetiş

## ABSTRACT

Hydroelectric power plants and dams often play an important role in developing countries in terms of their contribution to economy. In accordance with the energy policies of Turkish Republic, Yusufeli Dam and Hydroelectric Power Plant in Northeastern Turkey have been initiated. In this study, the Contingent Valuation Method (CVM) was conducted in Yusufeli Village to determine the environmental costs of the Yusufeli Project. The purpose is to assess the willingness to pay (WTP) of Yusufeli Village residents for restoration of the environmental impacts of the dam project and also to investigate the underlying economic, psychological, and social motivations for WTP. WTP was calculated as US\$761 per person which can further be used in the cost–benefit analysis. The results from the study suggest that application of the CVM in rural and urban areas located in the same region can show differences.

**Key words** | contingent valuation, developing countries, hydroelectric power plants, non-market valuation, willingness to pay

**Emre Alp** (corresponding author)  
**Ülkü Yetiş**  
Department of Environmental Engineering,  
Middle East Technical University İnönü Bulvarı,  
Ankara,  
Turkey  
E-mail: [emrealp@metu.edu.tr](mailto:emrealp@metu.edu.tr);  
[uyetis@metu.edu.tr](mailto:uyetis@metu.edu.tr)

## INTRODUCTION

Turkey, as a rapidly developing and industrializing country, is in need of reliable, inexpensive, and high quality energy. The use of hydraulic energy sources is rather low when compared to the existing potential in Turkey. In accordance with the energy policies of the Turkish Republic, the Ministry of Energy and Natural Resources decided to build the Yusufeli Dam and Hydroelectric Power Plant as a part of the development of Çoruh River. The Yusufeli Project is located on Çoruh River, which flows through the eastern Turkey and the east Black Sea regions and into the Black Sea through Batum located in Georgia (Figure 1). The gross storage capacity and the effective storage capacity of the Yusufeli Dam Reservoir are  $2.130 \times 10^6 \text{ m}^3$  and  $1.080 \times 10^6 \text{ m}^3$ , respectively.

The feasibility report of Çoruh River Hydroelectric Power Development Project states that the benefit–cost ratio was calculated as 1.65 by Japan International Cooperation Agency (JICA 1996). The present value of the

total cost, excluding environmental damage throughout project life, was calculated as US\$261 million, whereas the total (electricity sales) benefit was US\$430 million. In the feasibility report, environmental costs that may result from the dam were not considered. The cost of environment damage caused by hydroelectric power projects is difficult to determine since there are no related markets for all environmental goods and uses.

The aim of this study is to estimate the cost of environmental damage caused by the Yusufeli Dam by a non-market valuation technique: Contingent Valuation Method (CVM). In particular, the purpose is to assess the willingness to pay (WTP) of Yusufeli Village residents for restoration of the environmental impacts of the dam project and investigate the underlying economic, psychological, and social motivations for WTP. Although there are many ongoing and planned large projects, which can directly affect the environment (e.g. dam projects, highway and train

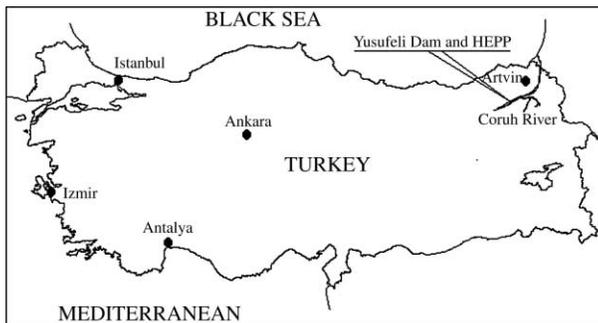


Figure 1 | Location of the Yusufeli Dam and Hydroelectric Power Plant (HEPP).

projects, mining facilities, etc.), so far there are just a few non-market valuation applications in Turkey. Therefore, this study will contribute to the CVM applications for Turkey, as well as other developing countries.

## CONTINGENT VALUATION METHOD

It is very difficult to deal with valuation problems, since they tend to occur in non-market situations. It is impossible to buy or sell peace, quietness or clean air in the open market (Barde & Pearce 1986). According to Hanley *et al.* (1998) environmental resources such as ecosystem and biodiversity services are systematically mispriced by the market and this has forced policy makers to consider other means to assess the value of these resources. This recognition resulted in development of new techniques to deal with non-market situation.

The Contingent Valuation Method (CVM) that attempts to determine the market price of non-market goods and services is a widely used nonmarket valuation method especially in the areas of environmental cost–benefit analysis and environmental impact assessment (Cummings *et al.* 1986; Mitchell & Carson 1989). Lesser *et al.* (1997) state that the premise of the CVM is straightforward: if you wish to know the value that people place on something, just ask them. Thus, CVM involves the use of surveys to value the non-use values and asks people how much they would be willing to pay for environmental benefits and/or what they are willing to receive by way of compensation to tolerate a cost (Pearce & Turner 1990).

CVM has principally been applied in highly-industrialized economies to measure the value of environmental services;

however, in the last decade; the CVM has been applied extensively to the valuation of environmental quality and to a variety of public projects in developing countries (Whittington 1998; Merrett 2002). Contingent valuation surveys have been administered to obtain residents' WTP for improved water supply in numerous localities of India, Pakistan, and Nigeria. CVM applied to value sanitation (toilets, connections to the sewage system, region-wide waste water treatment) in Burkina Faso (Altaf & Hughes 1994), Ghana (Whittington *et al.* 1990, 1993) and the Philippines (Choe *et al.* 1996). Surveys have also given to place a value to the preservation of national parks in Kenya (Navrud & Mungatana 1994) and India (Hadker *et al.* 1997), explore setting of entrance fees to national parks in Costa Rica (Shultz *et al.* 1998), and determine priorities for tropical forest protection (Shyamsundar & Kramer 1996).

There are a few non-market valuation studies related to the dams published in the literature. In these studies, non market valuation methods were used as a tool to assist decision makers in large projects with multiple dimensions such as dam projects. Biro (1998) described and evaluated the environmental impacts of the Kayraktepe Dam and Hydroelectric Power Plant in Turkey. Biro (1998) used the CVM to estimate the project's local environmental costs. When the Kayraktepe Project's external costs are internalized, its benefit–cost ratio decreased from 1.35 to 0.84, indicating that the project was economically undesirable and the decision for its construction needs to be reconsidered. Han *et al.* (2008) measured economic value of multiple environmental impacts of large dam construction as a case study of Korea, using a Choice Experiment Method, a non market valuation technique. Han *et al.* (2008) states that non-market valuation of environmental costs of the dam project provided policy-makers with quantitative information that can be useful in the cost–benefit analysis related to large dam construction projects. Gonzales & Loomis (1997) performed a contingent valuation in-person survey of Puerto Rican households to estimate their willingness to pay for preserving instream flows in the Rio Mameyes and avoiding a dam on the Rio Fajardo. Gonzales & Loomis (1997) mentions that the household values can be compared to the costs of repairing water lines and in-home water conservation measures to

determine whether there are more net benefits to these alternative sources of water than withdrawals from the Rio Mameyes.

## APPLICATION OF CVM TO YUSUFELI PROJECT, TURKEY

### Questionnaire

In order to apply CVM, it is necessary to apply interviews or surveys using questionnaires to drive expression of a willingness to pay by the individual for some quantity of a good (benefit) via some payment mechanisms.

The survey consists of four sections and a total of 46 questions. Fourteen of them are open-ended, while 32 of the 46 are close-ended questions. There are 8 demographic questions in the first section. The second section inquires about the individual's opinions about his/her environment. The third section focuses on the individual's opinions concerning other species. In the last section, there are 23 questions, which aim at capturing the individual's opinions about the Yusufeli Project. A brief explanation of the Yusufeli Project is given and probable advantages and disadvantages of the project are briefly explained. The opinions and expectations about the project are asked in the fourth section. Willingness to pay questions are also in this section.

The questionnaire was designed to be completed in less than 30 minutes. It was presented and designed for clarity and ease of answering. The map that shows the location of the dam, the present situation and the future situation of the area was also prepared. All the interviewers were trained before conducting the survey. The interviewers were warned not to orient the respondents in the direction of their opinion. Aim of this study and the questions were explained in detailed to the interviewers. By this way it was aimed to decrease interviewer bias.

### Implementation of the survey

The surveys were implemented in Çeltikdüzü, Tekkale, Çevreli villages and Yusufeli (center). Although it is the most expensive survey method, face-to-face survey was

conducted because of its numerous advantages. Most of the respondents were primary school graduates (42.4%). The literate proportion in Yusufeli (93% for male, 81% for female) is higher than in the villages (76% male, 60% female), and it is higher among the males. Most of the literate people had graduated from the primary school (63%). Using face-to-face survey, higher response rate was obtained and possible misunderstanding of the hypothetical questions like willingness to pay questions was decreased even though education level is not high in the project site. After conducting the survey, interviewers' feedback showed that face-to-face survey was and continues to be the best method to use in such an area with a lower education level.

Two hundred and eighty nine surveys were completed. Respondents were selected by random sampling. Interviewers conducted surveys on streets, in governmental offices, houses, coffee-houses, markets, etc. Respondents who agreed to complete the surveys were enthusiastic about answering the questions because of the importance of the Yusufeli dam project. The surveys were conducted between 10:00 am and 6:00 pm. During this time interval, most of the villagers were either in Yusufeli (center) or in the fields, hence, it was impossible to find as many respondents as planned in the villages. However, some of the respondents interviewed in Yusufeli (center) were from villages. The season of the year and the time of the day are important factors that should be considered in such a rural area where agricultural activities are important.

### Willingness to pay questions

Individuals were presented with a hypothetical effort to restore the environmental impacts of the dam after it is built and they were asked if they were willing to contribute to this effort. The most important objection was that it is not their responsibility to restore the environment since they will not be responsible for damaging their environment. Villagers believe that government should take care of restoring the environment. The exact wording of the WTP question was:

"It will be very difficult and costly to repair the environmental damage done by the Yusufeli Project. Contributions from local villages might be necessary. To help restore the local environment that will be damaged by the Yusufeli

Project, would you be willing to contribute to a local effort, which will include everyone in the region?”

If they responded “yes”, they were asked which payment vehicle they would choose. As Sanders *et al.* (1990) suggested, the economic value questions are designed to be as realistic and credible as possible. There were two optional vehicles: monetary contribution in terms of percentage of the annual income of respondents and contribution in terms of days that they would work voluntarily. They were allowed to select both of the payment vehicles or just one of the payment vehicles. Following the selection of a payment vehicle, individuals were asked to state their maximum willingness to pay as an open-ended question. Since WTP amount is bounded by the annual income, this question can be considered as the restricted open-ended question.

It was observed that some of the respondents had difficulty stating their maximum willingness to pay amount. This may have happened because of the open ended

question format. Although there is no consensus about the best elicitation format for developing countries, in this study dichotomous choice format or bidding game could also have been tested to decide the best format.

## RESULTS

A total of 289 surveys were available for statistical analysis. Statistical results of some variables are given in Table 1. Income level, mean age of household, size of household, occupational distribution, and level of education are compared with those of the population of Yusufeli for the 1990 census. Examination of these variables shows that, some demographic characteristics of the sample are a little different than the actual population. As mentioned earlier, during survey time, most of the villagers were not in their villages, so a fewer number of surveys than planned were completed in the villages. Since most of the questionnaires

**Table 1** | Description of the variables used in the multivariate regression analysis of CV responses

| Variable name    | Question/information   | Possible response  | Mean   | STD      |
|------------------|--|--|--------|----------|
| Sex              | Respondent's gender  | 1 = Male, 0 = Female   | 0.90   | 0.30     |
| Age              | Respondent's age   | Continuous variable  | 40.8   | 12.78    |
| Marital          | Respondent's marital status  | 1 = Married, 0 = Single  | 0.84   | 0.36     |
| Education        | Highest level of formal schooling the respondent has completed?                        | 1 = Literate, 5 = Primary, 8 = Middle, 11 = High, 15 = College | 8.3    | 3.52     |
| Occupation       | Category best describes the respondent's occupation                                    | 1 = Farmer, 2 = Commerce, 3 = Official, 4 = Other              | 2.5    | 1.10     |
| Number in house  | Number of people living in the household   | Continuous variable  | 4.9    | 2.072    |
| Owner house      | Is the responded the owner of his/her house?   | 1 = Yes, 0 = otherwise   | 0.72   | 0.45     |
| Need for dam     | Does the respondent thinks there is a need for the dam in the area                     | 1 = Yes, 0 = otherwise   | 0.46   | 0.49     |
| Personal benefit | Does the respondent think dam will be beneficial for him/her?                          | 1 = Yes, 0 = otherwise   | 0.35   | 0.47     |
| Future benefit   | Does the respondent thinks the dam will be beneficial for the future generations?      | 1 = Yes, 0 = otherwise   | 0.55   | 0.48     |
| Reaction         | Is the respondent comfortable with moving to a different city because of the dam?      | 1 = Yes, 0 = otherwise   | 0.26   | 0.44     |
| Worth borrowing  | Does the respondent think it is worth the government borrowing money to build the dam? | 1 = Yes, 0 = otherwise   | 0.66   | 0.45     |
| Income           | Annual income of the respondent in the U.S dollars                                     | Continuous variable  | \$4351 | 1,371.07 |

had to be completed in Yusufeli (center), the socio-economic characteristics of the respondents were very similar to Yusufeli (center) rather than its villages. It was concluded that special sampling strategies should be applied if the study site is a mixture of urban and rural area populations. A previous assessment concluded that several conditions should be met if willingness to pay questions are to provide reasonably accurate measures of the value of environmental resources. Respondents are required to be familiar with the resource to be valued (Sanders *et al.* 1990). Since 90% of the respondents had prior knowledge about Yusufeli Dam and Hydroelectric Power Plant, this criterion was thought to be satisfied in this survey.

In some of the settlements, people were optimistic about the project, anticipating the employment that might be created during the construction period. On the other hand, villagers were apprehensive about the loss of land and the amount of compensation to be paid. The results showed that the respondents did not find the project beneficial for themselves in the short term. Since they would be forced to move from Yusufeli, the respondents usually underestimated the possible benefits of the project. When they were asked to state their opinion about the benefits to be gained by their grandchildren, their responses changed slightly. Their opinion was that the project would be beneficial for their grandchildren in the long run. There was no consensus about need for such a dam specifically in this area. Although there is an uncertainty about the benefits of the project from the point of view of the respondents, they were certain about the necessity of this dam and hydroelectric power plant from the point of view of energy demand of the country.

About 60% of the households responded “yes” to the WTP question. The rest said “no”. It is a common practice in CV studies to examine data for outliers and protest zero responses. A protest zero response is a zero WTP reported by a respondent even though the good does have some value for him or her. Respondents who have chosen to pay zero were not asked why they did so. The effect of this practice may be an underestimation of the average WTP (Jordan & Elnagheeb 1993).

Ordinary least square (OLS) method was used to examine effects of different variables on WTP. The set of

independent variables used to explain variations in WTP is similar to what has been used in other studies. Descriptions of the variables are given in Table 1. Using sample data, the following model was used to predict WTP:

$$WTP = C + \alpha_x D_x + \beta_y O_y \quad (1)$$

where WTP = Willingness to pay;  $D_x$  = Demographic variables (sex, age, marital status, education, occupation, etc);  $O_y$  = Variables related to opinion about the dam (need for dam in the area, beneficial for future generations, etc);  $C$  = Constant;  $\alpha_x, \beta_y$  = Coefficients of the variables.

WTP bids were regressed against the variables listed in Table 1 using SPSS statistical package and the results including  $t$  statistics, coefficients of the variables as well as the coefficient of correlation,  $R$  are listed in Table 2. The highest  $t$  value calculated for the INCOME indicated that it is the most important parameter. The second most significant one appeared to be “HOUSE” parameter. Unexpectedly, the respondents who live in rented houses declared that they were willing to pay more. In general, men were willing to pay more than women. The coefficient

**Table 2** | Regression estimates of willingness to pay for restoration of the environment

| Variable name      | Coefficients | Std. error | t-ratio |
|--------------------|--------------|------------|---------|
|                    | 213.885      | 100.08     | 2.137   |
| Sex                | 23.2752      | 51.146     | 0.455   |
| Age                | −1.17611     | 1.3379     | −0.87   |
| Marital            | −38.713      | 45.439     | −0.851  |
| Education          | 1.41386      | 4.5184     | 0.312   |
| Occupation         | −3.33181     | 13.378     | −0.249  |
| Number in house    | 1.71055      | 6.9123     | 0.2474  |
| Owner house        | −89.3286     | 32.888     | −2.716  |
| Need for dam       | −36.5808     | 33.074     | −1.106  |
| Personal benefit   | 48.9091      | 35.514     | 1.377   |
| Future benefit     | 71.5726      | 34.317     | 2.085   |
| Reaction           | −45.6851     | 34.009     | −1.343  |
| Worth borrowing    | −6.57929     | 32.833     | −0.200  |
| Income             | 0.05849      | 0.0104     | 5.582   |
| $R$                | 0.42         |            |         |
| $R^2$              | 0.17         |            |         |
| Adjusted $R^2$     | 0.13         |            |         |
| $F$ value          | 4.397        |            |         |
| Degrees of freedom | 288          |            |         |

on education was positive, indicating higher contribution from highly educated respondents.

The OLS model shows that younger and unmarried respondents were more concerned about their environment. When we look at the variables related the opinion of the respondents about the dam, interesting conclusions can be driven. The respondents who declared negative opinion about moving to the other areas stated lower WTP. Same situation is also valid for when they were asked if it is worthy to borrow money by government. Respondents who declared negative opinions about these questions stated lower WTP values even though they really like their environment and village. This behavior can be considered as the protest action. We observed the same type of behavior when they are asked if there is a need for a dam in the area. Respondents who think that there is no need for a dam declared lower WTP values. We observed higher WTP values from respondents who think that the dam will be beneficial for future generations and country's energy demands. Although all of the respondents enjoy living in their villages and they really concern about the environment without any doubt, the stated WTP values are mostly driven by their opinion related to the dam and their future life situation.

The mean WTP was calculated as US\$761 per person by plugging the estimated coefficients of the parameters listed in Table 2 back in to the regression Equation (1) together with the mean values of the variables listed in Table 1. It can be seen that this value is high if we consider that the annual income of Yusufeli and respondents is US\$2300 and US\$435, respectively. Because of non-homogenous socio-economic distribution of the region, randomly selected respondents appeared to be from higher income level. Second, as in other applications of CVM, the data set of Yusufeli study contains extremely high responses. [Kahnemann & Knetsch \(1992\)](#) state that there is no agreed way to draw a line beyond which responses will be rejected. So that none of the data was rejected as the outliers. This process may lead to increase in mean WTP unlike existence of zero responses. [Biro \(1998\)](#) estimated the average, local rural annual willingness to pay for the restoration of the environmental impacts of the Kayraktepe Dam project as US\$300 per person which is comparable to the average WTP amount calculated for the Yusufeli Project.

## CONCLUSIONS

This study was designed to provide three objectives: (1) to value the local environmental damage that would be caused by the Yusufeli Dam and Hydroelectric Power Plant using Contingent Valuation Method (CVM); (2) to capture individuals' opinion about the Yusufeli Dam Project; (3) to contribute CVM literature in developing countries by presenting experiences gained in the application of CVM.

Ordinary least square (OLS) method was used to evaluate WTP which is calculated as US\$761 per person. Calculated WTP value can be aggregated to the entire Yusufeli population to be further used in the benefit–cost analysis. Survey questions were not only about measuring WTP. Even though individuals were sure about the need for the project in terms of country's energy demands, they did not find the project beneficial for themselves in the short term.

Application of the CVM in developing countries is challenging and may show some differences from the applications in developed countries. Sampling frame, time and season of the survey period, hypothetical market stated in WTP question are important factors that should be carefully taken in to consideration in designing and conducting the survey in developing countries. Geographical location and demographic characteristics of the study area are the other considerations in application of the CVM. Since population characteristic is not homogenous throughout Turkey, it is obvious that application of CVM would be different in a cosmopolitan city like İstanbul than that of a small town in northeastern Turkey, like Yusufeli. However, as the number of CVM studies increases in Turkey as well as in other developing countries, it will be possible to determine similarities that can be applied to similar cases and areas in developing countries.

The authors believe that the decision-making process for a dam with many environmental and sociological impacts should include environmental, economic and social evaluations. Preliminary results of this study suggests contingent valuation surveys are feasible methods for estimating individuals' willingness to pay for restoring the environmental damage and outcomes of this study provides important policy relevant information that can be used at different levels of the decision-making process.

## REFERENCES

- Altaf, M. A. & Hughes, J. A. 1994 Measuring the demand for improved urban sanitation services: results of a contingent valuation study in Ouagadougou, Burkina Faso. *Urban Stud.* **31**(4), 1763–1776.
- Barde, J.-P. & Pearce, D. W. 1991 *Valuing the Environment: Six Case Studies*; Earthscan: London.
- Biro, Y. E. K. 1998 Valuation of the environmental impacts of the Kayraktepe Dam Hydroelectric Project, Turkey: an exercise in contingent valuation. *AMBIO* **27**(3), 224–229.
- Choe, K., Whittington, D. & Lauria, D. T. 1996 The economic benefits of surface water quality improvements in developing countries: a case study of Davao, Philippines. *Land Econs.* **72**(4), 519–537.
- Cummings, R. G., Brookshire, D. S. & Schulze, W. D. 1986 *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method*. Totowa, N.J.: Rowman and Allanheld.
- Gonzalez, C. A. & Loomis, J. 1997 Economic benefits of maintaining ecological integrity of Rio Mameyes, in Puerto Rico. *Ecol. Econ.* **21**(1), 63–75.
- Hadker, N., Sharma, S., David, A. & Murateed Haran, T. R. 1997 Willingness to pay for Borivli National Park: evidence from a contingent valuation. *Ecol. Econs.* **21**, 105–122.
- Han, S.-Y., Kwak, S.-J. & Yoo, S.-H. 2008 Valuing environmental impacts of large dam construction in Korea: an application of choice experiments. *Environ. Impact Assess. Rev.* **28**, 256–266.
- Hanley, N., MacMillan, D., Wright, R. E., Bullock, C., Simpson, I., Parsisson, D. & Crabtree, B. 1998 Contingent valuation versus choice experiments: Estimating the benefits of environmentally sensitive areas in Scotland. *J. Agric. Economics* **49**, 1–15.
- Japan International Cooperation Agency (JICA) 1996 *Feasibility Report on Çoruh River Hydroelectric Power Development Project*, JICA, Japan.
- Jordan, J. L. & Elnagheeb, A. H. 1993 Willingness to pay for improvements in drinking water quality. *Water Resour. Res.* **29**(2), 237–245.
- Kahneman, D. & Knetsch, L. J. 1992 Valuing public goods: the purchase of moral satisfaction. *J. Environ. Econ. Manage.* **22**, 57–70.
- Lesser, A. J., Dodds, E. D. & Zerbe, O. R. 1997 *Environmental Economics and Policy*. Addison-Wesley, Reading, MA.
- Merrett, S. 2002 Deconstructing households' willingness-to-pay for water in low-income countries. *Water Policy* **4**, 157–172.
- Mitchell, R. C. & Carson, R. T. 1989 *Using Surveys to Value Public Goods: the Contingent Valuation Method*. Washington, DC: Resources for the Future.
- Navrud, S. & Mungatana, E. D. 1994 Environmental valuation in developing countries: the recreational value of wildlife viewing. *Ecol. Econs.* **11**, 135–151.
- Pearce, W. D. & Turner, R. K. 1990 *Economics of Natural Resources and the Environment*. Harvester Wheatsheaf.
- Sanders, L. D., Walsh, G. R. & Loomis, B. J. 1990 Toward empirical estimation of the total value of protecting rivers. *Water Resour. Res.* **26**(7), 1345–1357.
- Shyamsundar, P. & Kramer, R. 1996 Tropical forest protection: an empirical analysis of the costs borne by local people. *J. Environ. Econ. Manage.* **31**, 129–144.
- Shultz, S., Pinazzo, J. & Cifuentes, M. 1998 Opportunities and limitations of contingent valuation surveys to determine national park entrance fees: evidence from Costa Rica. *Environ. Dev. Econ.* **3**, 131–149.
- Whittington, D. 1998 Administering contingent valuation surveys in developing countries. *World Dev.* **26**, 21–30.
- Whittington, D., Briscoe, J., Mu, X. & Barron, W. 1990 Estimating the willingness to pay for water services in developing countries: a case study of the use of contingent valuation surveys in Southern Haiti. *Econ. Dev. Cult. Change* **38**(2), 293–311.
- Whittington, D., Lauria, D. T., Choe, K., Hughes, J. A. & Swarna, V. 1993 Household sanitation in Kumasi, Ghana: a description of current practices, attitudes, and perceptions. *World Dev.* **21**(5), 733–748.