

DO CONTINGENT CONTRIBUTIONS IMPLY CONTINGENT VALUATIONS?

ASSESSING WILLINGNESS TO CONTRIBUTE TO LOCAL PUBLIC GOODS IN

KENYA

Brent M. Swallow,¹ Damaris W. Kamara², Protase N. Echessah² and John J. Curry³

- 1 International Livestock Research Institute, P.O. Box 30709, Nairobi, Kenya.
- 2 Kenya Trypanosomiasis Research Institute, P.O. Box 362, Kikuyu, Kenya.
- 3 International Livestock Research Institute, Nairobi, Kenya. Present address: KARI/ODA Socio-economics and epidemiology Project, NARP, British High Commission, P.O. Box 30465, Nairobi, Kenya

Abstract:

Tsetse-transmitted trypanosomiasis is a parasitic disease that affects the health of people and animals across much of Africa. While several traps and targets have been developed to suppress tsetse, there have been few examples of self-sustaining 'community-based' programmes. We are assessing the prospects for community-based tsetse control in Busia District, Kenya.

A contingent valuation survey was implemented to assess willingness to contribute money and labour to tsetse control in 6 villages. Respondents were presented with a hypothetical situation and questioned about the maximum amounts of money and/or labour they would be willing to contribute if the situation became real. Econometric techniques were used to test hypotheses about factors affecting the types and levels of contributions individuals were willing to make.

Two villages were then selected to receive assistance in implementing tsetse control. Those villages have been engaged in a participatory process of education and mobilization for tsetse control. Community organizations have been formed and decisions taken at village meetings. A survey of "planned contributions" was conducted after decisions about the amount of money each household would contribute were made. Actual contributions are being monitored, particularly for the 60 households included in the initial survey. The results show marked differences between contingent, planned and actual contributions. While useful for planning purposes, we postulate that none of those measures reflect the contingent or actual value of the control.

Paper presented at the 5th Conference of the International Association for the Study of Common Property, Bodo, Norway, 24-28 May 1995

DRAFT, DO NOT QUOTE

1. INTRODUCTION

African governments can contribute to sustainable improvements in the health and welfare of their constituents by making better services available in more cost-effective ways. The World Bank (1993) proposes that such improvements are possible if governments adopt a three-pronged approach involving: (i) providing education and economic development so that people are better able to improve their own health and welfare; (ii) re-directing government expenditures toward more cost-effective health programmes; and (iii) promoting greater diversity and competition in the finance and delivery of services. Much of the liberalization and market reform programmes supported by the World Bank and other agencies are based upon this approach. It is, for example, the basis of the strategy the World Bank advocates for reforming animal health delivery systems (de Haan and Bekure, 1991).

Governments, professional organizations, community groups, private firms and farmers all have roles to play in more diverse systems of finance and delivery of animal health inputs. Umali et al. (1994) argue that the appropriate balance between these different types of actors depends upon the public / private nature of the inputs and the presence or absence of moral hazard problems. Leonard (1993) concurs but suggests that other factors also determine the appropriate balance. For example, a private market approach may not be most appropriate if a single firm dominates the industry. Private firms under contract to government agencies may have greater incentives to provide public goods than employees of public agencies. And, we stress in this paper, people may or may not have sufficient incentives to contribute to the provision of public goods through local organizations.

In this paper we consider the applicability of the contingent valuation method for *ex ante* assessment of the incentives that people have to contribute to local public goods. The good considered is the suppression of the tsetse flies that transmit human and livestock trypanosomiasis across large areas of sub-Saharan Africa. *A priori*, several questions were posed regarding the prospects for local participation in tsetse control in our study area: (i) How broad is local support? (ii) What types of contributions -- labour and / or money -- would people be willing to make? (iii) How acceptable or unacceptable would different entry fees be? (iv) How should local participation be facilitated? and (v) What is the social value of the tsetse control programme being proposed? A combination of participatory and formal survey methods, including the contingent valuation method, are being used to address these questions. The results of the study are being used to design a regional tsetse control programme that is to include the study area.

The general objective of this paper is to evaluate contingent valuation as a method for assessing the willingness of rural Africans to contribute to local public goods. The more specific objectives are to: (i) determine how responses to contingent valuation questions are affected by community decisions; and (ii) compare contingent contributions -- elicited as contributions to a tsetse control programme that could take place -- with planned contributions -- elicited as contributions to a control programme that would certainly take place.

2. BACKGROUND

2.1 *The problem of trypanosomiasis*

Trypanosomiasis is a parasitic disease of African people and their livestock that is primarily transmitted by the tsetse fly (*Glossina* genus). Tsetse flies infest an area of about 10 million km² stretching across at least 36 countries in sub-Saharan Africa. About 50 million people (Kuzoe, 1991), 44 million cattle (IBAR, 1989) and 100 million sheep and goats (based on Jahnke *et al.*, 1988 and Jahnke, 1982) are exposed to the diseases in that region. In cattle trypanosomiasis causes poor growth, weight loss, low milk yield, reduced work capacity, infertility, abortion and death. By constraining the productivity and number of cattle, trypanosomiasis also limits the opportunities for intensification of agricultural production through animal traction and nutrient cycling.

Bovine trypanosomiasis can be controlled through herd movement, administration of trypanocidal drugs, use of trypanotolerant animals, and suppression of the tsetse flies that transmit the disease. Combinations of these techniques are often used. Until the mid-1980s, tsetse control was primarily accomplished by insecticide spraying, bush clearing and wildlife destruction. None of those techniques are widely used now because of concerns for their negative environmental effects, their reliance on central government agencies, and their high costs.

Targets and traps have become more widely used for controlling tsetse in recent years. Targets are rectangular pieces of coloured cloth that are impregnated with insecticides and traps are more complicated constructions of coloured cloth and netting. Both traps and targets are hung on metal or wood frames and placed in tsetse-affected areas at densities of about 4-8 per km². Odour attractants such as acetone and cow urine are often used with the traps and targets. Flies die when they come in contact with the insecticide or are caught inside the traps. Targets and traps have been shown to be technically effective under some conditions. They also have few direct effects on the environment and are more suitable for implementation by farmers than previous techniques for controlling tsetse.

Across Africa there has been a limited number of programmes in which local residents have been actively involved in tsetse control using targets and traps. Trials in which targets and traps have been implemented with substantial participation by local residents have been undertaken in Uganda (Okoth *et al.*, 1991), Congo (Gouteux and Sinda, 1990) and Kenya (Dransfield *et al.*, 1991; Ssenyonga *et al.*, 1994). These trials show that local residents can be mobilized to contribute to tsetse control when they are engaged in a participatory process with external agencies providing capital, education and expert advice. Other experiments show that targets and traps are vulnerable to damage and theft by residents and transients (Swallow and Woudyalew, 1994; Willemse, 1991).

Four conclusions can be drawn from the previous experiments in which local residents have contributed to tsetse control using traps and targets. First, tsetse control programmes involving the active participation of local residents have only been implemented as experiments for relatively short periods of time. Second, local participation in tsetse control can range from very active to passive to destructive. Third, active participation can contribute

to the success of a trap or target programme, but is neither a sufficient nor necessary condition for success. Fourth, a necessary condition for success is that residents acquiesce enough to prevent theft.

2.2 *The contingent valuation method*

Contingent valuation is a survey method that is primarily used to place monetary values on products and services for which market prices do not exist or do not reflect the social value of the products or services. Respondents are presented with a realistic but hypothetical scenario and asked questions about the maximum amount of money they would be willing to pay (WTP), or the minimum amount of compensation they would be willing to accept (WTA), if that scenario became reality. The elicitation of those values can be 'closed ended' (e.g. Would you be willing to pay \$X?) or 'open ended' (e.g. How much would you willing to pay?). The values that are derived are 'contingent' upon the realization of the scenario. The method is frequently used in North America to place values on environmental amenities such as sport fishing and river rafting and public goods such as national parks and endangered species (see reviews by Bishop, 1990 and Mitchell and Carson, 1989). The contingent valuation method has been used to estimate the value of trees in Zimbabwe (Campbell *et al.*, 1991), the willingness to pay for wildlife viewing in Kenya (Navrud and Mungatana, 1994), and the willingness to accept compensation for access to a forest area in Benin (Treiman, 1993). It has also been used to assess the contribution that people living in rural areas of Africa are willing to make towards the finance of local public goods. The applications to the financing of water supplies are probably the best documented example of this (Boadu, 1992; McPhail, 1993; Whittington *et al.*, 1989, 1991, 1992).

Contingent valuation studies need to be designed to eliminate or reduce biases in WTP estimates and account for factors that are likely to condition WTP. The following model illustrates the possible biases and conditioning factors. Let $V(P, SD, X, Q)$ be the indirect utility function for a representative individual; P is a vector of prices of other outputs and inputs; SD is a measure of the 'social desirability' of the good or service¹ (Laughland *et al.*, 1994); X is a vector of characteristics of the respondent; and Q is the character of the good or service under consideration. The maximum amount that a person would be willing to pay for a change from Q_0 to Q_1 is defined by WTP in equation (1).

$$(1) \quad V(Y_0 - WTP, P_0, SD_0, X_0, Q_1) = V(Y_0, P_0, SD_0, X_0, Q_0)$$

The revealed willingness to pay (RWTP) that is elicited through a contingent valuation study may differ from the willingness to pay (WTP) defined in equation (1) because of differences between WTP and true willingness to pay (TWTP) and/or because of differences between RWTP and TWTP. True willingness to pay – that is, the maximum amount that the person would be observed to pay if the situation indeed became a reality – may be less

¹ A person's response to a survey question may result from his or her desire to give a socially acceptable response rather than his or her truly held values for the good or service in question. Social desirability (SD) has two components; it is a motivating factor for real behaviour and a source of bias in self-reported surveys (DeMaio (1984) as cited in Laughland *et al.* (1994)).

than WTP for two reasons. First, the person may experience constraints on the money or labour they have available at particular times that cannot be relaxed through credit or labour markets. Our maintained hypothesis is that all credit and labour markets in rural Africa are imperfect. Second, it is likely that both Q_0 and Q_1 include stochastic components that have different probability distributions. Farmers in less developed countries typically react very conservatively to changes involving risk. True willingness to pay may be greater than WTP if the person is a member of a group that makes binding decisions for its members.

Several factors may contribute to differences between revealed willingness to pay (RWTP) and true willingness to pay (TWTP). First, the respondent may have different conceptions of Q_0 and Q_1 than the person who designed the study. Such differences reduce the validity of the study (Champ, 1994). Different conceptions of Q_0 and Q_1 may result from flaws in the way the question is framed, differences in the information held by the respondent and the researcher, difficulties in responding to hypothetical situations, and problems with interpreting abstract concepts. Second, the survey technique used to elicit values may not generate valid or consistent results. Researchers are particularly concerned about the information that respondents are given the form of the questions used to elicit values (McFadden, 1994; Kealy and Turner, 1993). Third, true willingness to pay may derive from a decision made by a group such as a family or homestead, but the contingent valuation survey may not give opportunities for group discussion or decision-making (Whittington *et al.*, 1992). Fourth, the respondent may have a strategic motivation for biasing his/her SWTP up or down (Mitchell and Carson, 1989). Fifth, the respondent may want to give the impression that he/she will respond to the social desirability of Q more or less than he/she actually would (Laughland *et al.*, 1994).

The next section describes the research design and the ways that the contingent valuation studies were designed to control some of the factors that result in differences between RWTP and TWTP. The implications of differences between WTP and TWTP are discussed in the final section of the paper.

3. THE STUDY OF CONTINGENT CONTRIBUTIONS

3.1 *Population and sample*

The study is being conducted in Busia District of western Kenya, adjacent to the Uganda border. Busia District has had Kenya's worst outbreaks of human sleeping sickness during the last 5 years. Bovine trypanosomiasis is also an important problem (although not as important as at Ghibe) and livestock serve as a reservoir of the human disease. *Glossina fuscipes* is the main species of tsetse in the area (Angus, 1994).

The population for this study is all households resident in the district in September 1993 who were exposed to the risk of bovine or human trypanosomiasis. Six villages were purposively selected to represent the two main ethnic groups (Teso and Luhya) and high and moderate levels of disease risk. The villages varied in size from 44 to 300 households, with an average of 148 households per village. The contingent valuation survey was administered to thirty randomly-selected households in each village (Kamara *et al.*, 1994).

3.2 Knowledge and Information

As discussed above, the validity of a contingent valuation study depends upon the understanding that the researcher and the respondents have concerning the goods or services under study (Mitchell and Carson, 1989). To engender a shared understanding of the state of 'no tsetse control' (Q_0) and 'tsetse control' (Q_1), it was important to convey the following information:

- (1) Property rights -- The benefits of effective tsetse control would be available to all people who keep livestock or otherwise benefit from livestock production within the control area.
- (2) The unit expected to make contributions towards tsetse control -- Household heads were asked to respond on behalf of their households.
- (3) The nature of the public good -- Effective tsetse control would reduce the density of tsetse flies and the risk of trypanosomiasis for people and livestock. Livestock would thus be more productive with less drugs. The traps and targets can not be effective in reducing tsetse density if any of them are damaged or removed. Effective tsetse control would have no affect on other livestock diseases.²
- (4) Conditions for the provision of the good and payments for that provision -- KETRI would provide advise and assistance in organization; local people would have to organize into groups and individuals would have to contribute labour and money to construct and maintain the traps.

In most contingent valuation surveys, this information is provided to the respondent as part of the questionnaire. That approach was deemed to be inappropriate for four reasons. First, other studies have shown the importance of giving people time to think about information contained in contingent valuation surveys. Whittington *et al.* (1992) found that respondents who were given time to evaluate a water system proposed in rural Ghana bid significantly less than those who did not have that time. Second, it was intended that people respond to the contingent valuation questions on behalf of their households. It was therefore appropriate that the members of the household had time to discuss the proposed project. Third, it was hypothesized that people would consider the 'social desirability' of tsetse control when they contemplated the amount they would be willing to contribute (Laughland *et al.*, 1994). People would gain a better perception of the value that other community members placed on tsetse control by attending an educational event and discussing the information with their neighbours. And fourth, previous stages of the study -- utilizing key informant interviews, community profiling and focus groups -- had established that most people in the study villages believed that trypanosomiasis was caused by supernatural phenomena (e.g. witchcraft). Few people could identify the tsetse fly or the symptoms of human and livestock trypanosomiasis.³

² Traps and targets are more specific to tsetse than pour-ons. Pour-ons have been shown to have effects on ticks and other biting flies (e.g. Bauer *et al.*, 1992; Leak *et al.*, 1995). Farmers value the control of ticks and biting flies that pour-ons provide (Swallow *et al.*, 1993).

³ A sequence of qualitative and quantitative research techniques were utilized in the Busia study. Community profiles were developed through interviews with community leaders, transect walks and social mapping. Focus groups of men and women were then convened to

An ambitious programme of information dissemination was implemented to convey this information. An outline of the information to be communicated was developed and used as a basis for a set of posters and a drama. A professional artist volunteered to prepare sketches for the posters. Groups of people who live in the villages covered by the survey, including volunteer community health workers, volunteered to stage the drama in their local languages (Teso and Luhya). Educational events were then held in each of the 6 villages included in the study. Each event began with one of the researchers guiding people through the poster in the appropriate local language. This was followed by a staging of the drama. A period of question and answer then concluded the event. About 100-150 people attended each educational event.

3.3 *Questionnaire and elicitation method*

Pre-coded questionnaires were prepared in English, translated to the local languages (Teso and Luhya), then pre-tested and revised to clarify the questions, anticipate the responses and ensure that the average time taken to administer the questionnaire was less than an hour. Enumerators were trained for several days before going to the villages to administer the questionnaire. The survey was conducted in September 1993.

Respondents were asked if they would be willing to make monthly contributions of money and / or labour to tsetse control. Open-ended questions were then posed to elicit the maximum amounts of labour and money that the respondents would be willing to contribute each month. Respondents who only volunteered money were asked: "What would be the maximum amount of money per month that your household would be willing to contribute to a fund for the purchase of materials during the first year of the programme?" Then in order to evaluate their willingness to substitute labour for money they were asked: "The trap programme may be organized in such a way that only labour contributions would be necessary. If no money contribution was necessary, what is the maximum number of days per month that your household would be willing to contribute during the first year?" A similar set of questions were presented to respondents who volunteered only labour. Respondents who volunteered both money and labour were asked to state the maximum numbers of days and shillings they would be willing to contribute each month. The amounts elicited through these questions are 'revealed' willingness to contribute money and revealed willingness to contribute labour.

3.4 *Factors affecting willingness to contribute*

An important objective was to evaluate the breadth of community support for effective tsetse control. It was necessary to assess the interest and potential support of different types of households. This required three types of data analysis. First, an analysis of variance was conducted to identify villages to be included in a second phase of the research as described below. Second, a probit model was estimated to test hypotheses about factors affecting the

assess the socio-economic impacts of trypanosomiasis and people's knowledge, attitudes and beliefs about the disease. Output from the community profiles and focus groups was used to assess the information needed by the respondents to provide accurate responses to the contingent valuation questions (Kamara *et al.*, 1994).

likelihood that a household was willing to contribute both money and labour. Third, multiple regression analysis was conducted to test hypotheses about factors affecting the levels of money and labour contributions that people were willing to make. The survey thus included questions on a number of household variables that were hypothesized to affect willingness to contribute (X_1, X_2, \dots, X_n). Because labour and money contributions were simultaneously determined by the households, it was necessary to estimate a two-equation system of equations as indicated by equations (2a and 2b). The SHAZAM three-stage-least-squares routine (White, 1993) was used to estimate the system of equations.

$$(2a) \quad \text{Days} = \alpha_1 + \beta_1 \text{Money} + \beta_2 X_2 + \dots + \beta_n X_n$$

$$(2b) \quad \text{Money} = \alpha_2 + \omega_1 \text{Days} + \omega_2 X_2 + \dots + \omega_n X_n$$

3.5 Summary of contingent contribution results

The results from the analysis of contingent contributions show general enthusiasm for tsetse control in the 6 villages. Fifty-seven percent of households volunteered both money and labour, 28 percent volunteered only labour, 10 percent volunteered only money; and 4 percent volunteered neither money nor labour. The results from the simultaneous-equations model indicate that three variables had significant effects on the levels of money and labour contributions that people volunteered: education, gender and participation in the educational event. Household heads with more education and households headed by women were willing to contribute more money; household heads that participated in the educational event were willing to contribute more labour.

The results from the probit model indicate that several household characteristics affected people's willingness to contribute both money and labour. The households that were most likely to volunteer both money and labour were those that: had the most members, had the highest monthly cash income, had experiences with cattle trypanosomiasis and human trypanosomiasis, had good knowledge about tsetse and trypanosomiasis, and had few men employed outside of the household. (More details are given in Echessah et al., 1994).

4. COMMUNITY ACTION AND ANALYSIS OF PLANNED CONTRIBUTIONS

From the outset it was intended that results from the participatory appraisal and contingent valuation studies would be used to facilitate local participation in tsetse control programmes in Busia. Results from the previous phases of the research were used to select two of the six villages (Rukada and Apatit) to receive assistance in implementing a pilot programme of tsetse control using traps. To begin, village meetings were convened in both villages. The results from the previous phase of research were presented and an offer made that the villages could have some external support for tsetse control using traps. Both villages accepted the offer and formed executive committees to oversee the projects. Both villages decided that all households should contribute equal amounts of money to purchase materials for the traps. In Apatit it turned out that the contribution needed from each household was twice as high as the average contingent contribution from the first survey (37.5 compared to 15.7 shillings). In Rukada the required contribution was about 20 percent lower than the average contribution from the first survey (13 shillings compared to 21.5 shillings).

A survey of "planned contributions" was conducted soon after these group decisions were made (September 1994). The 60 households, 30 from each villages, that had been included in the survey of contingent contributions were re-interviewed. After being reminded about the decisions that their communities had made, they were asked the same questions about labour and money contributions that had been posed to them during the previous survey.

Results from the survey of contingent contributions were compared to those of the survey of planned contributions. As stated above, there were two main objectives of these comparisons. We wanted to determine how people's responses to the contingent valuation questions were affected by the community decisions and we wanted to compare contingent contributions to planned contributions.

The results indicate that in Apatit the average contribution of money increased from 15.7 shillings per month (contingent) to 27.5 shillings per month (planned); while the average contribution of labour decreased from 3.8 days per month (contingent) to 2.3 days per month (planned). The difference in money contributions is statistically significant. While 66 percent of households volunteered to contribute both labour and money during the survey of contingent contributions, 80 percent volunteered to contribute both during the survey of planned contributions.

In Rukada, the average contributions were very similar in the two surveys. Planned money contributions averaged 21.5 shillings per month, while contingent money contributions averaged 21.7 shillings. Planned labour contributions averaged 5.4 days per month, while contingent labour contributions averaged 5.4 days per month. None of the differences was statistically significant. The most striking result from Rukada was the percentage of households willing to contribute both labour and money. During the survey of contingent contributions only 23 percent of Rukada households indicated that they were willing to contribute both labour and money. During the survey of planned contributions, 83 percent were planning to contribute both.

The results presented in Table 1 indicates that about a third of the households in both villages planned to comply with the decisions that had been reached during the community barazas. In Apatit about half of the household planned to contribute less and 10 percent planned to contribute more than the amount mandated by the communities. In Rukada about one third planned to contribute less and one third more than the amount mandated by the community.

One measure of the validity of results from a contingent valuation survey is the consistency of results when values are elicited in different ways (Kealy and Turner, 1993). Results from the two surveys were compared to determine the consistency of the contingent and planned contributions. Correlation coefficients were calculated for the four measures of willingness to contribute -- contingent labour contribution, contingent money contribution, planned labour contribution and planned money contribution -- for the two villages. The results for Apatit indicate very consistent results; the six correlation coefficients that were estimated were all positive and statistically significant (Table 2). The results for Rukada, on the other hand, indicate inconsistent results. Only one of the six correlation coefficients is statistically significant (between contingent and planned labour contributions) (Table 3).

5. THE NEXT STEPS

The people of Rukada and Apatit have been engaged in a participatory process of mobilization and participation in tsetse control since the groups decided to accept the offer KETRI made. Both groups have been registered as official 'clubs' by the Ministry of Culture and Social Services and have opened bank accounts. A few local taylorers have been trained to make tsetse traps and small groups of people have been trained in some of the technical and organizational issues involved in community-based tsetse control. For example, people have been trained to identify different species of tsetse, identify the best spots to place tsetse traps around their villages, and maintain the traps in good working order. Secretaries and treasurers have been trained in record keeping and accounts. Monetary contributions have been collected from the village members and deposited in the bank account.

Once the people had collected about half of the total cost of the traps, KETRI agreed to help install the traps with the understanding that the remainder was a loan that has to be repaid in short order. The traps were installed by the leaders of the tsetse control committees with advice from KETRI technicians. The areas covered by the traps were divided into 'blocks,' each containing about 10 targets, with leaders and assistant leaders volunteering to coordinate the programme in their block. Block leaders are responsible for organizing the protection and maintenance of traps in their areas.

Detailed records of the process and accomplishments of the village groups are being maintained. As of May 1, 1995, about 60 percent of the funds needed to purchase the traps had been collected. The sixty households included in the previous surveys are being monitored particularly closely. All of their labour contributions -- attending meetings, installing traps, maintaining traps -- are recorded by research assistants resident in the villages. After one year another survey will be administered to those households. Their opinions of the programme will be solicited and they will be asked about their actual contributions during the year as well as their planned contributions for the next year. With those data we will be able to compare five types of money and labour contributions.

6. DISCUSSION AND CONCLUSIONS

After collecting the information on planned contributions, and monitoring people's actual contributions for several months, we believe that the results of the contingent valuation survey were useful for determining the breadth of community support for tsetse control. Over 95 percent of the respondents indicated that they were willing to make monthly contributions of labour, money or both. These results are very similar to those found by Swallow and Woudyalew (1994) concerning tsetse control in south-west Ethiopia. The contingent contribution results generated in this study were validated by the results of the survey of planned contributions and, as the pilot control programme proceeds, by their actual contributions. We also believe that the analysis of factors affecting types and amounts of contingent contributions generated important information for actual programme design. For example, it appears that the active involvement of women is crucial for actual programme success.

The educational events were essential for developing a shared understanding of the objects to be 'valued' (Q_0 and Q_1). The drama was an excellent way for researchers and

respondents to share information across the filters of literacy, language and culture. By staging the educational events 2-4 weeks before the survey, we provided time for discussion and household decision making. But drama is no replacement for actual experience with the possible human consequences of the disease. The comparisons of contingent and planned contributions across the two villages indicate that the responses to the survey questions were much more consistent in the village with the most experience with human trypanosomiasis. In fact, trypanosomiasis caused many human deaths in Apatit between 1987 and 1990; the main effects of trypanosomiasis in Rukada have been the deaths of cattle. The inconsistency of the Rukada results suggests that they should be interpreted with great caution.

Overall, we propose that the contingent contributions resulting from the surveys (RWTP) are considerably different than the concept of willingness to pay (WTP) indicated in equation (1). As described in section 2.1, RWTP will not equal true willingness to pay (TWTP) and TWTP will not equal WTP. We propose that RWTP will not equal TWTP for the reasons given above and because other external factors, represented by P_0 , will change as the programme is put in place. For example, a successful tsetse control programme will undoubtedly attract a considerable amount of attention from outside agencies. This attention could promote or retard people's willingness to contribute. Also, we expect that, *ceteris paribus*, TWTP will converge to WTP over time as people gain experience with Q_1 , especially with the differences in risk between Q_0 and Q_1 .

The data do not lend themselves to estimation of the total value of the tsetse control trial to the local population. This could be considered to be a draw-back of applying the method in the poorly developed market economies of rural Africa. However, we postulate that an estimate of total benefits derived through a contingent valuation exercise would be biased downward because of people's severe income constraints. Such a biased estimate would be misleading if used in benefit-cost analysis. Estimates of total benefits should instead come from other sources.

Contingent valuation can be a useful research technique when integrated into a participatory research approach. Chambers (1992) discusses some of the techniques that might be employed along with contingent valuation in a participatory approach. When engaged in a process in which their knowledge and opinions are acknowledged as being important, villagers are likely to find survey questions less intrusive and be more willing to give careful consideration to contingent valuation scenarios.

REFERENCES

- Angus, S.D., 1994. *O.D.A./K.E.T.R.I. Animal Trypanosomiasis Research Project, Busia Report, Final Report.*
- Bauer, B., I. Kabore, A. Liebisch, F. Meyer and J. Petrick-Bauer, 1992. "Simultaneous control of ticks and tsetse flies in Satiri, Burkina Faso, by the use of flumethrin pour-on for cattle." *Tropical Medical Parasitology* 43(1): 41-46.
- Bishop, R.C., 1990. "The contingent valuation method," In: (R.L. Johnson and G.V. Johnson) Economic Valuation of Natural Resources: Issues, Theory and Applications. Westview Press, Boulder, CO.
- Boadu, F.O., 1992. "Contingent valuation for household water in rural Ghana," *Journal of Agricultural Economics* 43(3): 458-465.
- Campbell, B.M., S.J. Vermeulen and T. Lynam, *Value of Trees in the Small-Scale Farming Sector of Zimbabwe* (Ottawa, Canada: International Development Research Centre, 1991).
- Chambers, R., 1992. "Rural appraisal: rapid, relaxed and participatory." Institute of Development Studies Discussion Paper 311. University of Sussex, Brighton, England.
- Champ, P.A., R.C. Bishop, T.C. Brown and D.W. McCollum, 1994. "Some evidence concerning the validity of contingent valuation: preliminary results of an experiment." Proceedings from the 1994 Western Committee on the Benefits and Costs of Natural Resource Planning (W133) Meeting, Tucson, Arizona.
- Codjia, V., Woudyalew Mulatu, Majiwa, P.A.O., Leak, S.G.A., Rowlands, G.J., Authié, E., d'Ieteren, G.D.M. and Peregrine A.S., 1993. Epidemiology of cattle trypanosomiasis in the Ghibe Valley, southwest Ethiopia. 3. Occurrence of populations of *Trypanosoma congolense* resistant to diminazene, isometamidium and homidium. *Acta Tropica*, 53(2): 151-163.
- Cummings, R.G., D.S. Brookshire and W.D. Schulze, 1986. Valuing Environmental Goods. Rowman & Allanheld, Totowa, N.J.
- DaMaio, T.J., 1984. "Social desirability and survey measurement: a review." In *Surveying Statistical Phenomena*, Vol. 2, edited by C.F. Turner and E. Martin. New York: Russell Sage Foundation.
- Dransfield, R.D., R. Brightwell, B. Williams and J.L. Kanunka, 1991. "Control of tsetse flies and trypanosomiasis - myth or reality?" Paper presented at the Workshop on Tsetse and Trypanosomiasis Control in Kenya for Farmers with Limited Resources. Nguruman, June 12-15.
- Echessah, P.N., B.M. Swallow, D.W. Kamara and J.J. Curry, 1994. "Willingness to contribute labour and money to tsetse control in Busia District, Kenya." (Mimeo, submitted to *World Development*).

Gouteux, J.-P. and D. Sinda, 1990. "Community participation in the control of tsetse flies. Large scale trials using the pyramid trap in the Congo." Tropical Medicine and Parasitology 41: 49-55.

IBAR (Inter-African Bureau for Animal Resources), 1989. Cattle Distribution Maps. Nairobi: IBAR.

Jahnke, H.E., 1982. Livestock Production Systems in Livestock Development in Tropical Africa. Kieler Wissenschaftsverlag Vauk, Kiel, Germany.

Jahnke, H.E., G. Tacher, P. Keil and D. Rojat, 1988. "Livestock production in tropical Africa, with special reference to the tsetse-affected zone," In ILCA/ILRAD, Livestock Production in Tsetse Affected Areas of Africa, Nairobi, Kenya.

Kamara, D.W., P.N. Echessah, B.M. Swallow and J.J. Curry, 1994. *Assessment of the socio-economic factors affecting implementation of community-based tsetse control in Busia, Kenya*. KETRI Publication No. 51 of 1994. Kikuyu, Kenya: Kenya Trypanosomiasis Research Institute.

Kealy, M.J. and R.W. Turner, 1993. "A test of the equality of closed-ended and open-ended contingent valuations," American Journal of Agricultural Economics 75(2): 321-331.

Kuzoe, F.A.S., 1991. "Perspectives in research on and control of African trypanosomiasis." Annals of Tropical Medicine and Parasitology 85(1): 33-41.

Laughland, A.S., W.N. Musser and Lynn M. Musser, 1994. "An experiment in contingent valuation and social desirability," Agricultural and Resource Economics Review 23/1: 29-36.

Leak, S.G.A., Woudyalew Mulatu, G.J. Rowlands and G.D.M. d'Ieteren, 1995. "A trial of a cypermethrin 'pour-on' insecticide to control *Glossina pallidipes*, *G. fuscipes fuscipes* and *G. morsitans submorsitans* (Diptera: Glossinidae) in southwest Ethiopia." Bulletin of Entomological Research forthcoming.

McFadden, D., 1994. "Contingent valuation and social choice." American Journal of Agricultural Economics 76: 689-708.

McPhail, A.A., 1993. "The 'five percent rule' for improved water service: can households afford more?" World Development 21(6): 963-973.

Mitchell, R.C. and R.T. Carson, 1989. Using Surveys to Value Public Goods: The Contingent Valuation Method. Resources for the Future, Washington, D.C.

Navrud, S. and E.D. Mungatana, "Environmental valuation in developing countries: the recreational value of wildlife viewing," Ecological Economics, Vol. 11, No. 2 (1994), pp. 135-151.

Okoth, J.O., E.K. Kirumira and R. Kapaata, 1991. "A new approach to community participation in tsetse control in the Busoga sleeping sickness focus, Uganda. A preliminary report." Annals of Tropical Medicine and Parasitology 85(3): 315-322.

Rowlands, G.J., Woudyalew Mulatu, Authié, E., d'Ieteren, G.D.M., Leak, S.G.A., Nagda, S.M. and Peregrine, A.S., 1993. Epidemiology of bovine trypanosomiasis in the Ghibe valley, southwest Ethiopia 2. Factors associated with variations in trypanosome prevalence, incidence of new infections and prevalence of recurrent infections. Acta Tropica, 53(2): 135-150.

Ssenonnyonga, J.W., A. Oendo, G.T. Lako, M.M. Ahmed, F.G. Kiros, L.H. Otieno, E.O. Omolo, and A. Ngugi, 1994. "The development and validation of a model of community managed tsetse trapping technology." Paper presented at the Satellite Meeting on Tsetse Behavior and Ecology, Mombasa, Kenya, November 6-9.

Swallow, B.M. and M. Woudyalew, "Evaluating willingness to contribute to a local public good: application of contingent valuation to tsetse control in Ethiopia," Ecological Economics, Vol. 11, No. 2 (1994), pp. 153-161.

Treiman, T.B., *Conflicts over Resource Valuation and Use in the Pendjari, Benin: The Chief has No Share*. Ph.D. dissertation (Department of Agricultural Economics, University of Wisconsin, Madison, 1993).

Willemse, L., 1991. "A trial of odour baited targets to control the tsetse fly, *Glossina morsitans centralis* (Diptera: Glossinidae) in west Zambia." Bulletin of Entomological Research 81: 351-357.

White, K.J. 1993. *SHAZAM Econometrics Computer Program: User's Reference Manual (Version 7.0)*. New York: McGraw Hill.

Whittington, D., M. Mujwahuzi, G. McMahon and K. Choe, 1989. Willingness to Pay for Water in Newala District, Tanzania: Strategies for Cost Recovery. WAS Field Report 246. Water and Sanitation for Health Project, The World Bank, Washington D.C.

Whittington, D., J. Briscoe, X. Mu and W. Barron, 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," Economic Development and Cultural Change 38(2): 293-311.

Whittington, D., V.K. Smith, A. Okorafor, A. Okore, J.L. Liu and A. McPhail, 1992. "Giving respondents time to think in contingent valuation studies: a developing country application," Journal of Environmental Economics and Management 22: 205-225.

Whittington, D., D.T. Lauria and X. Mu. 1991. "A study of water vending and willingness to pay for water in Onitsha, Nigeria." World Development 19(2/3): 179-198.

Willemse, L., 1991. "A trial of odour baited targets to control the tsetse fly, *Glossina morsitans centralis* (Diptera: Glossinidae) in West Zambia," Bulletin of Entomological Research 81: 351-357.

Woudyalew Mulatu, S.G.A. Leak, E. Authie, G. d'Ieteren, A. Peregrine and G.J. Rowlands, 1993. "Preliminary results of a tsetse control campaign using deltamethrin impregnated targets to alleviate a drug-resistance problem in bovine trypanosomiasis." In Proceedings of 21st meeting of the International Scientific Council for Trypanosomiasis Research and Control, Yamoussoukro, Côte d'Ivoire, pp. 203-204.

ACKNOWLEDGEMENTS

The authors would like to thank Steve Ashley for his participation in the formative stages of this project and the directors and staff of the Kenya Trypanosomiasis Research Institute (KETRI), the International Livestock Centre for Africa (ILCA), and the International Laboratory for Research on Animal Diseases (ILRAD) for facilitating the successful collaboration between the authors. In Busia we received kind cooperation from District administrators and village chiefs, District Zoologists and other staff of the Kenyan Ministry of Agriculture, Livestock Development, Supplies and Marketing. We especially thank the enumerators and the people of Apatit, Apakor, Ngelechom, Rukada, Esikoma and Mudoma who participated in the survey and other activities carried out in the course of this study. Financial assistance was received from the UNDP / World Bank / WHO Special Programme for Research and Training in Tropical Diseases.

Figure 1. Households' planned contributions compared to amounts mandated by communities - Apatit and Rukada

	Amount required by community (sh/mo)	% hhs planning to contribute		
		<amount required	=amount required	>amount required
Apatit	37	53	37	10
Rukada	13	30	33	37

Figure 2. Correlation between contingent and planned contributions to tsetse control Apatit (n=29)

	<u>Contingent</u>		<u>Planned</u>	
	Labour	Money	Labour	Money
Contingent - labour	r=1	r=0.44*	r=0.63**	r=0.60***
- money		r=1	r=0.44*	r=0.46*
Planned - labour			r=1	r=0.72**
- money				r=1

* significant at 5% level of confidence

** significant at 1% level of confidence

*** significant at 0.1% level of confidence

Figure 3. Correlation between contingent and planned contributions to tsetse control Rukada (n=30)

		<u>Contingent</u>		<u>Planned</u>	
		Labour	Money	Labour	Money
Contingent	- labour	r=1	r=0.15	r=0.43*	r=-0.18
	- money		r=1	r=0.02	r=0.03
Planned	- labour			r=1	r=0.21
	- money				r=1

* significant at 5% level of confidence