Indian Journal of Animal Sciences **82** (6): 634–639, June 2012

Are farmers willing to pay for quality improvements in livestock services delivery? Evidence from South India?*

G KATHIRAVAN[1], M THIRUNAVUKKARASU[2] and S SELVAM[3]

Tamil Nadu Veterinary and Animal Sciences University, Namakkal, Tamil Nadu 637 002 India

Received: 17 August 2010; Accepted: 4 April 2011

ABSTRACT

A study was undertaken in southern peninsular State of India, the Tamil Nadu State, to assess the farmers' 'willingness to pay' (WTP) for improving the quality of livestock services delivery, in terms of geographical proximity, waiting time, drug availability and attitude of staff. The districts of the state were categorized as 'livestock developed' (LD) and 'livestock under developed' (LUD) based on initial base line developed. Contingent valuation (CV) approach and Tobit regressions were used to assess (i) the variations in the stated willingness to Pay (WTP) values, and (ii) variations in the probability of stating a positive WTP values for respondents who declared that they were not willing to pay. Overall, the respondents in the study area were willing to pay `8.12 for improving the geographical proximity attribute of the public veterinary centre, while they were ready to pay `8.12 for minimising waiting time in public veterinary centres. To benefit from a better attitude exhibited by the staff of public veterinary centres, the farmers were willing to pay `5.20 and were willing to pay an average of `6.58 as extra user fee on every visit so as to get all the medicines and breeding facilities in the public veterinary centre at all times. An absolute concordance on the levels of attributes and the variations in the stated positive WTP values for quality improvements was noticed. Tobit regression analyses on the improvements of all above attributes indicated that the farmers who were at disadvantaged levels of each attribute were willing to pay more compared to those at an advantaged levels.

Key words: Animal health care, Bovine breeding, Contingent valuation, India, Livestock services, Willingness to pay.

Effective and efficient delivery of animal health and production services is considered as vital for gainful livestock development and hence, efficient delivery of livestock services has become a subject of rising concern to many national and international organisations including FAO (Kleeman 1999). In India, the Government maintains a large public infrastructure on livestock services but there are questions about the service utility and reach to the livestock producers. The Indian Planning Commission (2007) reported that the services are neither sufficient nor free. The Department of Animal Husbandry and Dairying both at Centre and in the States maintain a large infrastructure, and this infrastructure requires institutional restructuring to become effective.

Public sector is believed to be the appropriate means of delivering livestock services, but the government generally could not perform much efficiently (Leonard 1993). GOI (1996) observed that free veterinary and artificial insemination services have resulted in a vast and expensive infrastructure, which the state governments are finding difficult to sustain. Policy initiatives aimed at increased cost recovery, which could alleviate these financial difficulties, however, are often deferred by the policy makers on the assumption that the farmers would not be willing to pay for these services. Ahuja and Sen (2006) indicated that there was significant willingness to pay for animal health services and the households valued these services tremendously and were not looking for subsidies.

In the light of above context, this study was undertaken to assess (i) the variations in the stated willingness to pay (WTP) values, and (ii) variations in the probability of stating a positive WTP values for respondents who declared that they were not willing to pay. The study will provide an idea on the cost recovery, or deciding measures whether the government should provide these services at all.

*Part of Ph D thesis of the first author submitted to TANUVAS, Chennai

Present address: [1]Associate Professor and Head (drkathir@tanuvas.org.in), Department of Animal Husbandry Statistics and Computer Applications, Veterinary College and Research Institute.[2]Professor and Head (drthiruarasu @tanuvas.org.in).

[3]Associate Professor (drsselvam @tanuvas.org.in). Department of Animal Husbandry Statistics and Computer Applications Madras Veterinary College, Chennai 600 007 India.

MATERIALS AND METHODS

The districts of Tamil Nadu State were categorized as 'livestock developed' (LD) and 'livestock under developed' (LUD) based on initial base line data gathered using the value of livestock output, rural human population and common property resources available for livestock farming. Four districts, two each from livestock 'developed' (Coimbatore and Villupuram districts) and 'under developed' (Thanjavur and Sivagangai districts) areas were selected randomly. From these districts 320 farmers (80 from each district) were chosen by adapting multistage random sampling technique. Information on socio-economic status of the selected farmers, livestock possession, accessibility of veterinary services, costs incurred, true maximum WTP for total annual health care services for sheep and goats, etc. were collected by personal interview through the structured and pilot-tested interview schedule.

The respondents were asked to characterize the status quo level of seven attributes of public livestock services and assess a transition from the status quo to the preferred state.

Table 1. Specification of explanatory variables for the Tobit regression models

Quality parameters stated to be improved	Levels of attributes	Scoring/measurement scale
Geographical proximity to public veterinary centre	Very far, far, average, close, very close	1, very far; 0 , otherwise 1, far; 0, otherwise 1, average distance; 0, otherwise
Waiting time before meeting the service provider	Very long, long, average, not long, not long at all	1, very long; 0, otherwise 1, long; 0, otherwise 1, average; 0, otherwise
Attitude of the public veterinary centre's staff	Good, fair, bad, very bad	1, very bad; 0, otherwise 1, bad; 0, otherwise
Being able to find the prescribed treatment/AI	All, some of them, None	1, none of them; 0, otherwise 1, some of them; 0, otherwise
Socio-economic parameters		
Sex of respondent	Male; female	1, male; 0, otherwise
Age of respondent	Continuous	In years
Educational level of respondent	Illiterate; primary; secondary; collegiate	0, illiterate; 1, primary; 2, secondary; 3, collegiate
Annual household income	Continuous	In ₹ '000
Livelihood share of livestock	Continuous	Proportion of income from livestock to total income
Milk price	Continuous	₹ per litre
Quantity of milk sold	Continuous	Litres per day
Possession of crossbred/graded buffaloes	Possessing; not-possessing	1, if possessing; 0, otherwise
Veterinary livestock unit	Continuous	Units
Purpose of visit to public veterinary centre	Treatment; AI	1, if treatment; 0,otherwise
No. of previous visits made during the last year	Continuous	Counts
Distance from the public veterinary centre	Continuous	Travel time in minutes

Geographical proximity, 'close' and 'very close' are combined and included in the constant; waiting time, 'not long' and 'not long at all' are included in the constant; attitude, 'good, ≤ and 'fair' are combined and included in the constant; drug availability, 'all' is included in the constant.

The attributes of public livestock services listed were, (i) geographical proximity, (ii) waiting time, (iii) attitude of staff, and (iv) drug availability. Contingent valuation (CV) approach was used to study whether the farmers would be willing to pay any extra user fee to receive a better quality service was enquired, followed by presenting a payment card, having anchors of ₹5, starting from ₹5 to ₹500, if their answer to the above question was positive.

Modelling

Tobit model was used to analyse the association between willingness to pay values for the stated quality improvements in the public livestock services and the respondents' demographic and socio-economic characteristics in the study area as described by Tobin (1958). This model was preferred over the OLS estimator which fails to account for qualitative differences between the limit observations (those with zero WTP) and the non-limit observations (those with WTP > 0), leading to erroneous estimation of marginal effects (Donaldson *et al.* 1998 and Mataria *et al.* 2004).

Cameron and Huppert (1989) suggested using interval regression for analyzing payment card interval WTP data. However, Tobit model was used here following Whitehead *et al.* (1995) and Johnson *et al.* (1998), since the data contained a high ratio of zero values and relatively narrow intervals, because the payment card used in this study portrayed a thinner interval between anchors to find the WTP value for quality improvements.

Following Mataria *et al.* (2004), 4 Tobit regression analyses, each followed by Ramsey's (1969) RESET test were carried out to explore the relationship between each of the partial WTP values and the corresponding quality attribute's status quo level, adjusting for farmers' socio-demographic and economic characteristics, besides variables concerning the location of the public veterinary centre. The marginal effects of (i) variations in the positive WTP values, and (ii) variations in the probability of stating a positive WTP values for respondents who declared that they were not willing to pay were estimated. The list of explanatory variables and their specifications are presented in Table 1.

RESULTS AND DISCUSSION

Results of the 4 Tobit regressions along with the marginal effects of the independent variables on the stated WTP values are presented in the section that follows.

Geographical proximity

The farmers in LUD districts were willing to pay a mean sum of ₹6.16 to have a close proximity of the public veterinary centre, while LD districts' farmers were ready to pay ₹9.25. Overall, the respondents in the study area were willing to pay ₹8.12 for improving the geographical proximity attribute of the public veterinary centre (Table 2).

The probability that the respondents visiting from a 'very far' place to the public veterinary centre be willing to pay in order to have a 'very close' centre was 0.253 greater than that of a respondent living 'very close' or 'close' to the centre. Moreover, those living 'very far' from a centre were willing to pay an extra ₹13.01 at every coming visit to have a very close centre (Table 3). Farmers who perceived the distance separating them from the centre as 'far' had a higher probability of 0.473 than that of farmers perceiving the distance as 'very close' or 'close' to be willing to pay to have a 'very close' centre; and they were willing to pay ₹8.19 more at every visit for this purpose. The probability that a respondent's WTP value to have a 'very close' public veterinary centre be greater than zero, given that the farmer's perception of the distance to the centre was 'average', was 0.216 higher than that of a farmer perceiving the distance as 'very close' or 'close'. More over those living at an average distance from the centre were willing to pay ₹5.59 for every visit to the centre. The results indicated an absolute concordance between WTP results and distance perception in terms of the WTP values stated. Further, the farmers in LD districts had a higher probability of 0.082 than LUD districts' farmers to state a positive WTP value to have a very close public veterinary centre, and were willing to pay an extra ₹1.33 for this purpose, all things being equal. Results suggested that the respondents with higher quantity of daily milk sold, had a higher probability of 0.009 to state a positive WTP value to have a very close public veterinary centre, and were willing to pay an extra ₹0.15 on each visit for this purpose. Similarly, farmers possessing crossbred cattle and/or graded buffalo had a greater probability of 0.147 to state a positive WTP value to have a very close public veterinary centre, and were willing to pay an extra ₹1.94 for this rationale. Farmers those visited the centre for availing animal health services exhibited a higher probability of 0.134 than those visited for insemination to state a positive WTP value in order to have a very close public veterinary centre, and were willing to pay an extra ₹1.93 on every visit. Similar results were reported by Sanjay Kumar *et al.* (2011) in Maharashtra, and when the farmer's locality was away from the public veterinary centre, the WTP value increased significantly for home services. The above results explicitly revealed the importance that the farmers attached on this attribute, which in turn, suggests opening up new public veterinary centres at places where animal population is dense.

Waiting time

As could be seen from the Table 2, farmers of LD districts were willing to pay more (₹ 8.45) than the farmers of LUD districts (₹ 7.38) to reduce the waiting time before the case was being attended by the service provider in the public veterinary centre. On an average, the respondents in the study area were willing to pay ₹8.12 for minimising waiting time in public veterinary centres.

The probabilities that respondents who waited 'very long'

Table 2. Status quo level of attributes and their WTP values for improvement

Attributes	LUD districts	LD districts	Overall	't' value
Travel time (min)	35.19 (1.20)	34.02 (1.11)	34.41 (1.22)	0.96 ^{NS}
WTP	6.16 (0.58)	9.25 (0.42)	8.12 (0.37)	4.03**
Waiting time (min)	31.30 (0.32)	32.32 (1.13)	32.16 (0.59)	0.85 ^{NS}
WTP	7.38 (0.40)	8.45 (0.41)	8.12 (0.29)	2.56*
Drug availability score	1.5796 (0.08)	1.5806 (0.08)	1.5801 (0.0576)	0.01^{NS}
WTP	4.81 (0.61)	8.32 (0.75)	6.58 (0.49)	3.64**
Staff's attitude score	1.7875 (0.05)	1.8375 (0.05)	1.8125 (0.04)	0.72^{NS}
WTP	6.00 (0.48)	4.41 (0.48)	5.20 (0.34)	2.35*

Figures in parentheses indicate standard errors; ^{NS} Not significant (P>0.05); ** highly significant (P<0.01); * significant (P<0.05).

and 'long' time before being their cases attended to by the service provider be willing to pay to benefit from a waiting time perceived as not long at all, were 0.089 and 0.214, respectively, higher than that of a respondent who waited 'not long' or 'not long at all' (Table 3). Those waiting very long and long were willing to pay a comparable extra user fee of ₹15.76 and ₹6.46, respectively, on every visit so as to get benefited from a waiting time perceived as 'not long at all'. As shown in the geographical proximity attribute, the respondents with a higher quantity of milk sold had a higher probability of 0.005 to state a positive WTP value to have a waiting time as 'not long at all'. The results indicated that the increase in the veterinary livestock units owned would have a negative marginal probability for stating a positive WTP value to improve waiting time attribute. If the purpose of visit to public veterinary centre was availing animal health services, the farmers had a higher marginal probability of 0.074 to state a positive WTP value to benefit from minimised waiting time, and were willing to pay an extra ₹1.68 compared to those visited for availing bovine breeding services in the centre. The other factors relevant to district versatility and demography were not significantly influencing the results of the model fitted. It was observed that the waiting time attribute got worst, on occasions, because of uncertainty over timing of visit of service provider, which could be solved by improving man power and also through enforcing strict adherence towards service timings.

Drug/Artificial insemination (AI) availability

The farmers were willing to pay an average of ₹6.58 (Table 2) as extra user fee on every visit so as to get all the medicines and breeding facilities in the public veterinary centre at all times. This WTP amount was significantly varied between LUD and LD districts as ₹4.81 and ₹8.32, respectively.

Tobit analysis results (Table 3) indicated that the farmers who were unable to get any prescribed drug/AI had higher probability of 0.597 ($P \leq 0.01$) to state a positive WTP to gain from getting all the medicines at the centre itself, and were also willing to pay an user fee of ₹12.72 compared to those who found 'all' medicines at the centre. Similarly, the visitors of the centres who found only some of the drugs prescribed were having a marginal probability of 0.0563 ($P \leq 0.01$) to state a positive WTP. They were also ready to pay an extra user fee of ₹7.77 for getting all the drugs always at the centre. The farmers in LD districts exhibited a higher probability of 0.175 ($P \leq 0.01$) for departing towards a positive WTP to get all the prescribed drugs at the centre itself and were willing to pay an user fee of ₹1.57 for this endeavour. Interestingly, all the milk related factors incorporated in the model, viz. milk price, quantity of daily milk sold and possession of crossbred cow and/or graded buffalo had exhibited higher probabilities of 0.099 ($P \leq 0.01$), 0.014 ($P \leq 0.05$) and 0.201 ($P \leq 0.05$), respectively, to state a positive WTP value for getting the prescribed drugs always at public veterinary centre. A rupee increase in milk price per litre would increase the WTP amount by ₹0.87, while a litre increase in the quantity daily milk sold would increase the WTP amount by ₹0.12 to get all the drugs in the centre itself. Similarly, farmers owning crossbred cows and/or graded buffaloes inclined to pay an user fee of ₹1.69 compared to those not owning, to find all the prescribed drugs at the centre itself.

Attitude of public veterinary centre's staff

In order to benefit from a better attitude exhibited by the staff of public veterinary centres, the farmers in LUD districts were willing to pay a mean sum of ₹6.00, while LD districts' farmers were ready to pay only ₹4.41 for this purpose. Overall, the respondents in the study area were willing to pay ₹5.20 for improving the attitude of public veterinary centres' staff (Table 2).

Results of the Tobit regression analysis suggested that the farmers who found the attitude of the personnel of the public veterinary centre as 'very bad' and 'bad' had higher probabilities of 0.702 ($P \leq 0.01$) and 0.734 ($P \leq 0.01$), respectively, to state a positive WTP value to be treated in a 'good' manner, in comparison with those who already found that they were treated 'good' in the centre (Table 3). Further, farmers who had been treated in a 'very bad' and 'bad' manner

Table 3. Factors influencing partial WTP values for improving quality attributes (Tobit regression)

Explanatory variables	Geo-proximity	A	B	Waiting time	A	B	Drug availability	A	B	Staff's attitude	A	B
Distance from the public veterinary centre: very far	15.676** (1.689)	0.253**	13.015**	-	-	-	-	-	-	-	-	-
Distance from the public veterinary centre: Far	12.787** (1.411)	0.473**	8.187**	-	-	-	-	-	-	-	-	-
Distance from the public veterinary centre: average	7.776** (1.542)	0.216**	5.591**	-	-	-	-	-	-	-	-	-
Current waiting time: very long	-	-	-	16.671**(2.469)	0.089**	15.768**	-	-	-	-	-	-
Current waiting time: long	-	-	-	8.294**(1.202)	0.214**	6.460**	-	-	-	-	-	-
Current waiting time: average	-	-	-	5.728**(1.165)	0.170**	4.286**	-	-	-	-	-	-
Drug availability in centre: No drug/AI	-	-	-	-	-	-	22.352** (2.126)	0.597**	12.724**	-	-	-
Drug availability in centre: Some drug/AI	-	-	-	-	-	-	16.912** (1.652)	0.563**	7.774**	-	-	-
Attitude of public veterinary centre staff: Very bad	-	-	-	-	-	-	-	-	-	18.078** (1.165)	0.702**	11.765**
Attitude of public veterinary centre staff: Bad	-	-	-	-	-	-	-	-	-	18.232** (1.148)	0.734**	11.524**
District versatility	2.109** (0.796)	0.082**	1.328**	0.604 (0.628)	0.017	0.453	4.528** (1.462)	0.175**	1.565**	–0.913 (0.857)	–0.066	–0.360
Sex of respondent	1.726 (1.229)	0.073	1.040	0.824 (0.932)	0.026	0.606	0.944 (2.252)	0.037	0.320	–2.501* (1.230)	–0.174*	-1.083
Age of respondent	0.061 (0.048)	0.002	0.039	–0.016 (0.036)	–0.001	–0.012	–0.084 (0.088)	–0.003	–0.029	0.134** (0.050)	0.010**	0.053**
Educational level of respondent	0.509 (0.710)	0.020	0.321	–0.933 (0.564)	–0.027	–0.700	-1.759 (1.346)	–0.069	–0.607	1.930** (0.722)	0.140**	0.761**
Milk price (₹/litre)	0.377 (0.533)	0.015	0.237	0.142 (0.415)	0.004	0.107	0.087 (0.051)	0.003	0.030	–0.012 (0.560)	–0.001	–0.005
Quantity of milk sold (litre per day)	0.240* (0.095)	0.009*	0.151*	0.175* (0.080)	0.005*	0.131*	2.528** (0.913)	0.099**	0.871*	–0.021 (0.106)	–0.002	–0.008
Possession of crossbred cows/graded buffaloes	3.317** (1.192)	0.147*	1.944**	0.698 (0.929)	0.021	0.516	0.353** (0.172)	0.014*	0.122*	0.063 (1.257)	0.005	0.025
Veterinary livestock units owned	–0.054 (0.222)	–0.002	–0.034	–0.492** (0.178)	–0.014**	0.369**	5.346* (2.234)	0.201*	1.694*	–0.121 (0.244)	–0.009	–0.048
Annual household income (in ₹'000)	–0.001 (0.001)	–0.000	–0.001	–0.001 (0.001)	–0.001	–0.001	–0.727 (0.460)	–0.028	–0.251	–0.001 (0.001)	–0.001	–0.001
Livelihood share of livestock	–2.531 (2.380)	–0.098	–1.594	0.535 (1.815)	0.015	0.401	–0.008 (0.015)	–0.001	–0.003	-1.410 (2.392)	–0.102	–0.556
Purpose of visit to public veterinary centre	3.194** (0.869)	0.134**	1.931**	2.309** (0.684)	0.074**	1.681**	5.547 (5.079)	0.216	1.914	0.565 (0.911)	0.041	0.221
No. of visits made during the last year	0.170 (0.145)	0.007	0.107	–0.087 (0.112)	–0.003	–0.066	1.844 (1.598)	0.072	0.625	0.558** (0.148)	0.041**	0.220**
Constant	–19.210** (5.086)			-1.343 (4.048)			–0.477 (0.269)			-13.436* (5.456)		
Sigma (Σ)	6.236 (0.299)			5.087 (0.233)			–33.140** (8.984)			5.444 (0.339)		
No. of observations	320			320			10.198 (0.649)			320		
No. of censored observations	83			57			320			172		
LR c^2 (15)	197.24			110.34			172			385.66		
Prob > c^2	0.000			0.000			209.140			0.000		
Pseudo R^2	0.107			0.060			0.000			0.278		
Log likelihood	–826.301			–859.585			0.141			–501.514		
RESET (probability > F)	0.178			0.110			–636.208			0.092		

A, Marginal effects for the probability being uncensored; B, marginal effects for E (WTP | 0 < WTP).Figures in parentheses indicate standard errors;* Significant (P≤0.05); ** highly significant (P≤0.01).

were willing to pay an extra user fee of ₹11.77 and ₹11.52, respectively to benefit from a good attitude of the centre's staff. It is imperative to note that the females had a higher probability (0.174) than males to state a positive WTP value, so as to benefit from a better attitude of staff. Similarly, as age of the respondent increases, the marginal probability of stating a positive WTP for attitude improvement would increase by 0.010 ($P \leq 0.01$) and they were willing to pay an extra user fee of ₹0.05 ($P \leq 0.01$). As expected, improvements in the educational level of respondents increased the probability of stating a positive value by 0.140 ($P \leq 0.01$) and also increased their WTP amount by ₹0.76 ($P \leq 0.01$). The regular visitor to public veterinary centre, which was measured in terms of number of visits to the centre in the last one year, had a probability of 0.041 to state a positive WTP value and was willing to pay an additional user fee of ₹0.22 on every visit so as to gain from the better attitude of staff.

An absolute concordance on the levels of attributes and the variations in the stated positive WTP values for quality improvements was noticed. Tobit regression analyses on the improvements of all above attributes indicated that the farmers who were at disadvantaged levels of each attribute were willing to pay more compared to those at an advantaged level. The study suggested that, as most of the livestock keepers were willing to pay for high-quality animal health care and bovine breeding services, there is a need to improve the quality of public livestock services, in terms of geographical proximity, waiting time, drug availability and attitude of staff. The farmers are willing to pay for the reduced travel distance, which would in turn reduce transportation stress and also cost. Therefore, the number of veterinary institutions delivering livestock services should be increased, besides ensuring their presence amidst rural habitations, so that the services can be charged nominally. Public veterinary centres should be improved by equipping with necessary infrastructure and imparting latest technical know-how to the service providers, so that early recovery from illness can be ensured for which partial cost recovery measures from the users can be imposed as the farmers are willing to pay. Although the public veterinary centres continue to be the single major animal health care and bovine breeding service providers, the efficiency and the effectiveness with which they deliver the services appear to have been lesser than expected, with the need for huge financial resources required on the part of the government to create and sustain necessary clinical and breeding infrastructure and the enormous drain on government to support manpower. Demand for public services is likely to dwindle unless the quality of public veterinary services is improved.

ACKNOWLEDGEMENTS

The authors are thankful to Dr Awad Mataria, Institute of Community and Public Health, Birzeit University, Palestine, for all his help and support in completing this analysis.

REFERENCES

Ahuja V and Sen A. 2006. Willingness to pay for veterinary services: evidence from poor areas in rural india. PPLPI: A Living from livestock. *Research Report.* RR Nr. 06–03; *March 2006.* Retrieved from: http://www.fao.org/ag/againfo/programmes/en/pplpi/docarc/rep–0603_willingness-to-pay.pdf

Cameron T A and Huppert D D. 1989. OLS versus M L estimation of non-market resource values with payment card interval data. *Journal of Environmental Economics and Management* **17**: 230–46.

Donaldson C, Jones A M, Mapp T J and Olson J A. 1998. Limited dependent variables in willingness to pay studies: Applications in health care. *Applied Economics* **30** (5): 667–77.

GOI. 1996. National livestock policy perspective: *Report of the steering group*. Ministry of Agriculture, Government of India, New Delhi.

Johnson K B, Brown J G and Whitehead C J. 1998. Estimation of the value of public goods generated by improved sport stadiums and arenas using the contingent valuation method. *A paper presented at the annual meeting of the Western Economic Association in Lake Tahoe, Nevada,* June 28–July 2, 1998.

Kleeman G. 1999. Responses of the livestock services delivery and its management to the Asian economic crisis. *Proceedings of the Workshop on the Implications of the Asian Economic Crisis for the Livestock Industry.* Bangkok on 6–9 July 1999, FAO, UN.

Leonard D K. 1993. Structural reform of the veterinary profession in Africa and the new institutional economics. *Development and Change* **24**: 227–67.

Mataria A, Donaldson C, Luchini S and Moatti J P. 2004. A stated preference approach to assessing health care-quality improvements in Palestine: From theoretical validity to policy implications. *Journal of Health Economics* **23**: 1285–1311.

Ramsey J B. 1969. Tests for specification errors in classical linear least squares regression analysis. *Journal of the Royal Statistical Society* Series B **31**: 350–71.

Sanjay K, Mirajkar P P, Singh Y P and Singh R. 2011. Analysis of willingness to pay for veterinary services of the livestock owners of sangli district of Maharashtra. *Agricultural Economics Research Review* **24** (1): 149–53.

Tobin J. 1958. Estimation of relationships for limited dependent variables. *Econometrica* **26**: 24–36.

Whitehead J C, Hoban T J and Clifford W B. 1995. Measurement issues with interested, continuous/interval contingent valuation data. *Journal of Environmental Management* **43**: 129–39; 151–70.