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A PRACTICAL, SIMPLE, COMPUTER-AIDED APPROACH TO VILLAGE LEVEL RANDOM SELECTION OF ANIMALS

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Les enquêtes à grande échelle, telles que celles requises pour évaluer l'efficacité des programmes de vaccination, dépendent d'habitude d'un plan d'échantillonnage à 2 degrés. Dans les pays en voie de développement, cela implique typiquement la selection des villages au premier niveau et des animaux à un second niveau. La validité des résultats de l'enquête dépend du caractère réellement aléatoire de l'échantillon à chacun de ces niveaux. A l'échelle de l'animal, cela pose un défi considérable. Un protocole simple pour l'échantillonnage aléatoire des animaux intra-village, adapté aux systèmes de production rencontrés dans la plupart des pays du Sud-Est asiatique, a été développé. Une réunion des éleveurs est organisée pour recueillir les données sur la population animale du village. Un programme simple fonctionnant sur un micro-ordinateur portable réalise la selection aléatoire des animaux. Une méthode manuelle alternative utilisant la table des nombres aléatoires a aussi été utilisée. Une méthode pour l'identification ultérieure des animaux échantillonnés sur le terrain, en l'absence de tout système d'identification individuelle permanent est présenté. L'approche communément utilisée d'échantillonnage raisonné à l'échelle des villages risque d'introduire un biais significatif dans les résultats de l'enquête. L'expérience, à la fois en Thaïlande et au Laos, a montré qu'un réel échantillonnage aléatoire des animaux à l'échelle du village peut être assuré et que la méthode présentée peut être rapidement maîtrisée par le personnel de terrain local.

INTRODUCTION

Information about the health of a country's livestock population is essential for rational decision making by government veterinary authorities. Priority setting for the optimal targeting of resources, disease control and eradication program formulation and implementation, and international reporting and trade requirements are just some examples of how this information is used. In the past, most government veterinary services have depended largely on passive reporting systems to collect information about livestock diseases. More recently, it has been realised that much information gathered in this way fails to represent the true situation. An alternative approach to the collection of animal health information, active surveillance, has developed, and been widely adopted.

Active surveillance involves the use of properly structured, targeted surveys to gather information which will allow reliable, unbiased estimates of the disease situation to be made. These surveys examine a sample of the population and extrapolate the results to the population of interest. This extrapolation is only valid if the sample truly represents the population from which it was drawn. Similarly, statistical measures of the reliability of survey results can only be calculated if the survey is properly structured. The key to both these problems is the use of random sampling.

Surveys of large populations usually use a two- or more stage sampling approach. Two-stage sampling overcomes the problem of developing a reliable sampling frame which includes every animal in the population. It also means that field procedures are much simpler and less expensive. In the first stage, animals are grouped into convenient units for which a sampling frame is available, such as a herd or village. In the second, individual animals are selected from groups selected in the first stage.

In developing countries, the most practical unit for first-stage selection is often the village. Random sampling of individual animals at the village level is probably one of the most difficult aspects of conducting active surveillance in developing countries. Failure to select a truly random sample is very likely to introduce bias, and undermines all the effort taken to select the villages properly. Currently, most sampling at the village level is based on convenience sampling, often guided by village authorities, and sampling the animals of cooperative or nearby livestock owners. Those most willing to have their animals bled during a survey are also those most likely to have their animals vaccinated. This is clearly a biassed group.

In an attempt to formalise and simplify the task, other strategies have been used, such as a village walk in a randomly chosen direction, as used by the WHO's Enhanced Program for Immunisation to sample children (Lemeshow and Robinson, 1985). This was developed to avoid the need to develop a complete sampling frame, and to make field work more manageable. Simulation studies have been used to show that this technique is often a reasonable approximation to random sampling (Harris and Lemeshow, 1991), but performs poorly in the presence of distinct clustering. In the animal context, a high degree of clustering would be expected, as animals are kept as small family herds, all under the same managements system. Turner, Magnani and Shuaib (1996) propose a variation using village mapping which in effect introduces another level of selection and may be difficult to implement.

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The method described here represents an effort to achieve true random sampling of animals in the village context. In order to achieve this, a sampling frame is first developed, and animals chosen randomly from it. The approach to the creation of the sampling frame and random selection of animals has been developed to allow it to be carried out as quickly, simply and practically as possible. A simple computer program automates the task, but, in the absence of a computer, a simple manual procedure can also be used.

METHOD

Creation of a sampling frame: The creation of an accurate sampling frame is most effectively achieved during a village meeting. Meetings of village livestock owners are an ideal means to gather information on a range of issues at the village level. This technique may often be very useful in providing other information of interest while carrying out surveys. As many livestock owners in the village as possible are encouraged to attend. Practical aspects of the timing of this meeting and how it can be convened must be considered in the cultural context. At the start of the meeting, each livestock owner present is asked their name, and the number of animals of each relevant species that they own. A simple list is compiled on paper with numbered lines, as shown in table I. After the details of all those present have been added to the list, villagers are asked to list those livestock owners not present, and the number of animals owned by each. Experience in Thailand and Laos has shown that a group meeting of this type, especially if attended by most livestock owners, is usually able to generate a virtually complete sampling frame and is able to provide much more reliable data on the village livestock numbers than asking a few key informants or consulting official village statistics.

Table I
Example of data collection form for village animal sampling frame construction, to be completed during a village group interview

	Name	Cattle	Buffalo	Total
1	Pornchai	12	4	16
2	Surapong	2	3	5
3	Sanchai	-	4	4

Selection of random sample of animals: Although the list created does not individually identify all animals, if done carefully, all animals in the village will appear on the list. Sample selection can be done either using a computer program, or manually. When the list is complete, the number of animals owned by each villager are entered into a simple computer program, optimised for rapid data entry. Names are not entered, as villagers are identified by the number of the line on which their name appears on the written list. Only the total number of animals owned by each livestock owner is entered. In this way, data entry for a village of 100 livestock owners can be easily achieved in 2 or 3 minutes. After the data has been entered, the program converts the list of owners and animal numbers into a list of animals, each with an owner identification number (line number). The program randomly selects the required number of animals from this list. The result is a sample of individual animals, identified by their owner (line number). Individual animals are distinguished from those owned by same owner by a sequential number, as shown in the example of the program's output below.

Total number of animals in village: 39
Number of animals selected: 10 (25.64%)

Owner Number	Animals to select
1	4 13
2	4
4	2 3 5 6
5	2 3
6	1

The selected livestock owners can be identified by their line number on the written list, and invited to submit their animals for sampling. For each owner, the individual animals to be sampled are also derived from the list. This step requires that the animals of each selected owner be ordered in some way. With small numbers (the usual the case) or tethered animals, this may be achieved by simply counting the animals from a distance, and assigning each animal a sequential number. The animal or animals which are assigned numbers corresponding to those on the list are selected for blood collection. For instance in the example given above, owner 1 has 16 animals, and numbers 4 and 13 were selected by the computer. When visiting the area where these animals are kept, they are counted. Blood is collected from the fourth animal and the thirteenth animal to be counted. To avoid any bias, one member of the survey team should be responsible for counting the animals (assigning sequential numbers) and another should be responsible for the random selection list produced by the computer. The person assigning numbers should not know in advance which numbers have been chosen by the computer. The use of a notebook computer and the random sampling program means that random selection of animals can be done in a matter of minutes. In many developing countries, survey teams will not be able to carry computers into the field. In the absence of a computer, the same system can be used, although random selection will take slightly longer. The data collection form is altered by the addition of a final column for the cumulative total. When the total number of animals for each owner has been recorded, the cumulative total of

animals is calculated for each owner. The last figure in the column represents the total number of animals in the village. Random number tables are used in the normal way to select the required number of random numbers, between 1 and the total number of animals in the village. An example of a form for manual selection is given in table II.

Table II
Sample frame data collection form for manual random sampling

No.	Name.	Cattle	Buffalo	Total	Cum. Total
1	Pornchai	12	4	16	16
2	Surapong	2	3	5	21
3	Sanchai	-	4	4	25
4	Wisitura	8	-	8	33
5	Prajit	4	-	4	37
6	Dilok	-	2	2	39

In this example, let us suppose that 3 animals were to be selected. Random number tables, used to select three numbers between one and 39 may provide, for example, 5, 18 and 26. The fifth animal in the village is owned by owner number 1, the 18th by owner number 2, and the 26th by owner number 4. When owner number 2's animals are visited, there are a total of 5 animals, that are assigned numbers from 1 to 5. The animal required can be calculated by deleting the previous owner's cumulative total (16) from the random number (18). Thus the second animal belonging to owner 2 is required. In the same way, the 5th animal belonging to owner 1, and the first animal belonging to owner 4 would be chosen.
If all the animals belonging to a particular owner are not kept in the same place, numbers, or groups of numbers, can be assigned to the different groups of animals without actually visiting them. Only the group or groups containing the selected numbers need be visited. Within each group visited, sequential numbers are assigned in the same way.

DISCUSSION

The approach described here simply follows traditional sampling practice: construct a sampling frame, then sample from it with random numbers. However operational techniques such as the use of village meetings for gathering the required information, and a simple computer program requiring minimal data entry for data management and selection make the task of selecting a random sample at the village level somewhat more feasible.
Even with the aid of a computer, this sampling technique requires more time and effort than a convenience sample or a random walk, but the sample produced has the distinct advantage of being a true random sample. The much greater value of data from a true random sample, due to our ability to confidently make valid inferences from it, should usually outweigh the increased effort to collect the data.

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