

## Characteristics and performance of village animal health workers and veterinary assistants in northern Malawi

K Hüttner<sup>a</sup>, K Leidl<sup>b</sup>, F B D Jere<sup>b</sup> and D U Pfeiffer<sup>c</sup>

### ABSTRACT

Forty-two village animal health workers called keymen (KM) and 84 veterinary assistants (VA) involved in a Basic Animal Health Service (BAHS) Programme in northern Malawi were interviewed during 1998. The general characteristics and perceptions of both groups were analysed using uni- and multivariate techniques. Detailed sales and treatment patterns of six KM and 12 VA were evaluated for the period September 1996 to August 1997. Results indicated an overall job-satisfaction for 82 % of KM and 83 % of VA. Estimated weekly involvement in livestock service delivery, particularly of KM, was 3.7 days on average. Total annual drug sales of KM and VA between 1996 and 1997 on average were equivalent to US\$ 124 and US\$ 218 respectively. Most livestock remedies were issued for treatment of calves, followed by adult cattle, chickens and small ruminants. The changes suggested by VA and KM in order to improve field performance focused on regular refresher training by the BAHS programme.

**Key words:** community-based livestock services, Malawi, village animal health workers.

Hüttner K, Leidl K, Jere F B D, Pfeiffer D U Characteristics and performance of village animal health workers and veterinary assistants in northern Malawi. *Journal of the South African Veterinary Association* (2000) 71(3): 160–165 (En.). EpiCentre, Massey University, Palmerston North, New Zealand.

### INTRODUCTION

Numerous primary animal health programmes have been initiated during the past 20 years in developing countries all over the world<sup>1–5,10,14,16</sup>. The involvement of trained farmers (village animal health workers, laymen, keymen, bare-foot-vets) is one of the key-elements in almost every programme in order to develop practicable approaches for livestock health service delivery in remote areas. Despite the significance of this group, only a few studies have been published that describe the characteristics and experiences of these people in detail<sup>11,15,17</sup>.

The Basic Animal Health Service (BAHS) Programme in northern Malawi was launched in the late 1980s by the Department of Veterinary Services, assisted by the German Agency for Technical Cooperation (GTZ), to provide a regional service to livestock owners. Self-help, demand-driven strategies and consequent cost-recovery are essential components of the programme's philosophy. All administrative matters are managed

through a farmers' association (Foundation for the Improvement of Animal Health, which is registered as a legal entity under the laws of Malawi. More details about the set-up of the BAHS scheme can be obtained from Leidl *et al.*<sup>13</sup>. At present the BAHS programme operates within an area of 27 000 km<sup>2</sup>. The focal point of the programme is part-privatisation of Government field veterinary services through establishing a Drug Revolving Fund (DRF), and deployment of trained farmers, appointed by their community, as village-keymen (KM). Figure 1 illustrates the DRF drug and money flow as part of extension pictorials produced by the BAHS programme. The trainees have to meet certain prerequisites before being accepted by both the respective village livestock group and the BAHS team. These criteria include literacy, experience with livestock keeping, age and reliability. After an initial 4-day training, KM are supplied with a kit (drug box), which allows them to treat village livestock and provide general advice on health and husbandry in their home area. Veterinary assistants (VA), who are Government employees, take part in the programme by handling a drug box that includes injectable drugs, which distinguishes it from the KM's box. In addition, VA provide backup and supervision to KM in

their area.

The BAHS programme currently offers a range of 40 different drugs and additional items such as sprayers, ropes, calculators and tubes. Most of the drugs are tailored to meet the needs of the traditional farming sector, with emphasis on disease prevention. Many of them have been re-packaged into smaller and thus affordable quantities. The greatest demand is for dewormer-drenches (for prevention of helminthiasis caused by *Toxocara* spp. and *Strongyloides* spp. in young stock), pour-on formulae against ecto-parasites (mainly to prevent East Coast fever in cattle), and long-acting oxytetracycline for curative purposes<sup>9</sup>.

The aim of the current study was to describe characteristics, perceptions and performance of KM and VA involved in the BAHS scheme. The identification of factors limiting the effectiveness of the field service and motivation of field workers was considered to be important information that was required to develop strategies for continued enhancement and adaptation of the programme to meet the needs of the target population. The study is part of a comprehensive impact assessment of the BAHS programme<sup>7</sup>.

### MATERIALS AND METHODS

#### *Selection of VA and KM and data collection*

A total of 149 VA and KM were operating drug boxes from June 1998 in the study area, which covers about 60 % of the entire area of the BAHS operation. Of these, 42 KM and 84 VA with a minimum of 12 months' involvement in the BAHS programme were included in the study. The survey questionnaire used for structured interviews was pre-tested with 3 KM and 4 VA, and adjusted accordingly. Major sections included social and farm characteristics, BAHS workload, job satisfaction, difficulties experienced while performing BAHS duties, and self-perception. Three members of the BAHS team conducted the structured interviews between July and December 1998, each of which lasted about 30 minutes.

<sup>a</sup>EpiCentre, Massey University, Palmerston North, New Zealand.

<sup>b</sup>Basic Animal Health Service Project/GTZ, PO Box 611 Mzuzu, Malawi.

<sup>c</sup>Royal Veterinary College, London, United Kingdom.

\*Author for correspondence: e-mail: k.huttner@massey.ac.nz  
Received: November 1999. Accepted: July 2000.

For detailed analysis of drug sales and treatment patterns, 6 KM and 12 VA were evaluated. The selection was based on completeness of annual accounting and prescription form data entries for the period of September 1996 to August 1997. While these results are not representative of the entire study population, they suffice to provide a general indication of the performance of KM and VA.

**Data analysis**

Data were stored using Microsoft Access 97 (Microsoft Corporation, Redmond, USA). Global positioning system receivers were used to determine the precise locations of KM houses and VA stations within the study area. Maps were produced using the geographical information system software Arcview for Windows version 3.1 (ESRI Inc., Redlands, USA). Statistical analyses were performed using NCSS 2000 (NCSS Statistical Software, Kaysville, Utah, USA) and STATISTICA/W version 5.1 (StatSoft, Tulsa, Oklahoma, USA). Multiple correspondence analysis (MCA) was used to explore the data for relationships between categorical variables contained in simple 2-way or multi-way tables. The goal was to represent the entries in each table as distances between individual rows and/or columns in a low-dimensional graphical space. Another way of looking at MCA is to consider it as a method for decomposing the overall  $\chi^2$ -statistic (or inertia =  $\chi^2/\text{total } n$ ). What is important are the distances of the points in the 2-dimensional display. Row points that are close to each other indicate a pattern of relative frequencies across the columns. Adding supplementary column points to the design matrix (in our case the KM/VA status), permits the equivalent of a multiple regression for categorical variables to be performed. The summary statistics (total inertia) provides an indication of how well one can explain the KM/VA status as a function of the other variables in the design. The column points in the final coordinate system should provide an indication of the nature (e.g. direction) of the relationships between the columns in the design matrix and the supplementary column points, indicating BAHS user-status<sup>6</sup>.

**RESULTS**

**Locations of drug box holders**

The study area covers approximately 18 000 km<sup>2</sup> of which about 7000 km<sup>2</sup> are forest reserves, national parks or game reserves. The KMs houses and stations of VAs involved in the BAHS programme are shown in Fig. 2. The map illustrates

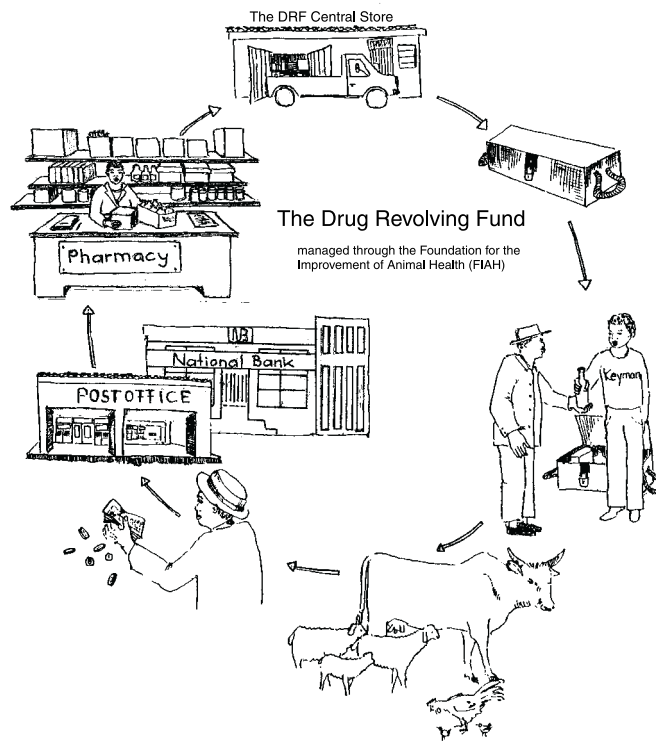


Fig. 1: The drug and money flow of the Drug Revolving Fund, the core piece of the BAHS programme (pictorial as part of BAHS extension material).

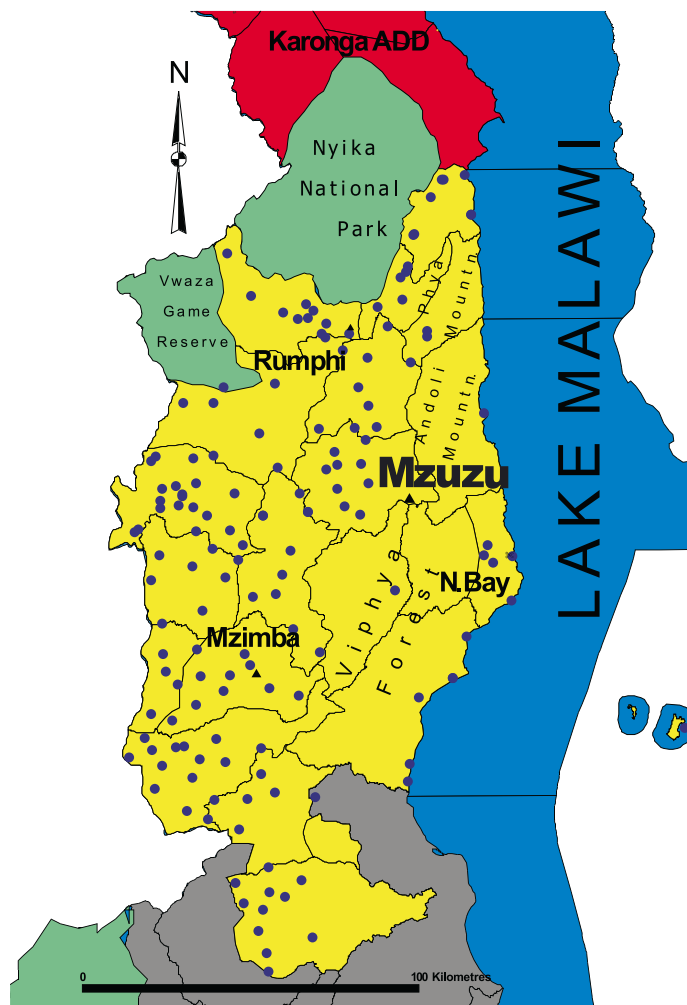


Fig. 2: Distribution of all drug boxes (●) within Mzuzu Agricultural Development Division as of August 1999 (n = 149).

Table 1: Comparison of VA and KM characteristics and work-related issues.

Factor	VA (% yes)	KM (% yes)	P-value
<b>Keeps livestock?</b>	86.9	100	0.014 ( $\chi^2$ 6.03; df 1)
<b>Location by zone</b>			0.107 ( $\chi^2$ 4.46; df 2)
Lakeshore	7.1	14.3	
Highlands	31.0	42.9	
Plains	61.9	42.9	
<b>Tribal background</b>			0.001 ( $\chi^2$ 15.94; df 3)
Ngoni	14.3	7.1	
Chewa	20.2	2.4	
Tumbuka	38.1	73.8	
Other	27.4	16.7	
<b>Has organised farmer livestock discussion meeting?</b>	98.8	88.1	0.007 ( $\chi^2$ 7.09; df 1)
<b>Farmer meeting was a success?</b>	72.6	61.9	0.220 ( $\chi^2$ 1.5; df 1)
<b>Livestock husbandry issues taken into account?</b>	95.2	88.1	0.14 ( $\chi^2$ 2.15; df 1)
<b>BAHS training was adequate?</b>	51.2	52.4	0.899 ( $\chi^2$ 0.016; df 1)
<b>What changes are needed?</b>			0.428 ( $\chi^2$ 2.77; df 3)
None	56.0	57.1	
Teach extension skills	1.2	4.8	
More demonstrations	20.2	11.9	
More refresher courses	22.6	26.2	

the extensive coverage of the BAHS programme throughout the study area (Mzuzu Agricultural Development Division).

#### General description of VA and KM

All KM and VA were male. The average age of VA and KM was 37.4 years (SD 8.7) and 42.6 (SD 10.1), respectively. VA estimated their weekly BAHS workload to be 4.1 days (SD 1.7), which is higher than the estimate provided by the KM (3.7 days, SD 1.8). On average, VA had received their drug box 2.8 years ago (SD 1.37) compared with 3.4 years for KM (SD 1.83). Table 1 is a summary of additional key characteristics of both groups. More KM than VA own livestock themselves. Relatively more VA than KM were based in the plains area. The population in the study area includes people from 14 different tribes, with most belonging to the Tumbuka. There is greater variation in the tribal origin of KM than of VA. The Tumbuka tribe appeared to be under-represented in the VA-group.

More than half of both groups were satisfied with the initial training they had received through the BAHS scheme. Forty-four percent of VA and 43 % of KM suggested some changes, with most of these groups requesting regular refresher courses and practical demonstrations. Almost every VA and 88 % of KM had organised livestock farmer meetings

in villages. Fewer KM than VA were satisfied with the outcome of the meeting(s) they conducted. Both groups were highly likely to include advice on livestock husbandry and management in addition to treatments as part of their field services.

#### Annual drug sales and treatment regime

Table 2 provides a summary of drug use, which reflects patterns across species summarised for the 12 VA and 6 KM drug box locations selected for a detailed survey. Most prescriptions were issued for treatment of calves, followed by adult cattle, chickens and small ruminants. A relatively small number of pig prescriptions were issued. The VA at Kachere appeared to be the most active person, followed by the KM in Mdolo, based on total number of visits. The average annual number of farm visits by the selected KM was 81.3 (SD 32.7) involving 42.2 (SD 23.6) farms, compared to 78.4 visits (SD 40.4) and 33.6 (SD 31.5) farms for VA. Comparing medians statistically did not show any significant differences between KM and VA.

Table 3 provides a summary of drug sales per selected drug box location. The calculation is restricted to the 4 drugs in greatest demand. There were no significant differences between drug sales by KM and VA. Since KM are not entitled to use injectables, a statistical comparison

was not performed for long-acting oxy-tetracycline (LA-OTC). The average drug sales turnover for VA of \*MK3271.5 (US\$ 218) is almost twice as high as that for KM with \*MK1859.3 (US\$ 124), which is significantly different.

#### Job satisfaction and self-perception

Eighty-two percent of KM and 83 % of VA stated that they enjoyed their job. When asked for reasons, 59 % of KM and 55 % of VA mentioned drug availability after years of ineffective field services. Twenty five percent of KM and 31 % of VA felt they had gained knowledge about livestock production. Almost half of all KM (47 %) and a third of VA (34 %) reported an increase in self-esteem. All the KM and 96 % of VA indicated that they were satisfied with the job because farmers showed their appreciation. Figure 3 provides a graphical summary of these findings based on multiple correspondence analysis. The model explains 44 % of inertia using 2 dimensions. The 1st dimension mainly relates to BAHS programme aspects, whereas the 2nd separates the study population according to their relationship with farmers. The overall job satisfaction is clearly reflected by the closeness of a range of column points to both, KM and VA. These are statements such as 'I like my job as a

\*1 US\$ = 15 MK (Malawi kwacha) in December 1996.

Table 2: Annual number of farm visits and total treatments by KM/VA per species between September 1996 and August 1997 (Kruskal-Wallis 1-way ANOVA to compare between KM and VA groups,  $P < .05$ ).

Location	Total number of farms	Number of visits	Number animals (number of farms involved)				
			Calves (<12 months)	Adult cattle	Sheep/goats	Chickens	Pigs
<b>KM-locations</b>							
Kavululanga	57	80	35 (25)	36 (27)	1 (1)	861 (29)	1 (1)
Madede	14	90	65 (6)	26 (4)	48 (1)	1584 (5)	3 (1)
Matete	23	41	57 (22)	46 (18)	2 (1)	171 (9)	1 (1)
Mdolo	75	132	91 (36)	55 (21)	99 (33)	732 (19)	18 (8)
Visenthe	55	94	49 (27)	44 (29)	15 (2)	472 (21)	23 (8)
Yakuwata	31	51	23 (14)	34 (16)	2 (2)	1455 (8)	0
KM averages of species (SD)	42.2 (23.6)	81.3 (32.7)	53.3 (23.8)	40.2 (10.2)	27.8 (39.2)	879.2 (550.9)	7.7 (10.1)
<b>VA-locations</b>							
Chitanga	28	78	35 (9)	56 (9)	42 (7)	630 (8)	78 (8)
Chitimba	17	47	28 (11)	17 (8)	31 (3)	480 (17)	6 (1)
Jata	44	66	111 (40)	57 (28)	6 (3)	219 (10)	14 (1)
Kachere	114	187	167 (62)	116 (18)	30 (4)	3909 (68)	1 (1)
Kampupu	63	97	71 (23)	54 (32)	19 (6)	185 (9)	6 (1)
Kapopo	26	39	55 (14)	37 (13)	0	98 (7)	1 (1)
Katumbi	38	58	45 (17)	45 (11)	4 (1)	2115 (13)	32 (10)
Luzi	41	70	72 (29)	44 (14)	8 (3)	288 (12)	23 (7)
Magido	17	68	238 (13)	10 (5)	3 (1)	261 (8)	0
Mzikubola	9	72	44 (5)	15 (3)	54 (3)	937 (4)	5 (1)
Ng'onga	27	44	38 (15)	24 (14)	36 (7)	41 (2)	4 (1)
Vibangalala	39	115	200 (45)	69 (36)	32 (5)	1280 (21)	7 (2)
VA averages of species (SD)	33.6 (31.5)	78.4 (40.4)	92 (71.3)	45.3 (29.2)	22.1 (17.8)	870.3 (1130.3)	14.8 (22.1)
<i>P</i> -value		0.57	0.37	0.74	0.64	0.45	0.35

KM/VA, 'I feel supported by the BAHS team', 'Farmers do show their appreciation for my efforts' and 'I enjoy talking to farmers on BAHS issues'. Negative feedback from farmers or not feeling sup-

ported, were unlikely outcomes for both groups.

One issue was perceived very differently by KM and VA. VA experience difficulties significantly more frequently

when dealing with livestock farmers (73%), as compared with KM (43%) ( $P = 0.001$ ). When asked to specify those difficulties, the following was disclosed: 40% of the 126 interviewees mentioned a

Table 3: Sales of most wanted BAHS drugs per selected location between September 1996 and August 1997 (using Kruskal-Wallis 1-way ANOVA to indicate statistically significant differences between KM and VA,  $P < 0.05$ ).

Location	Dewormer 1	Dewormer 2	Pour-on (sum in cc)	LA-OTC (sum in ml)	Total in MK*
<b>KM-locations</b>					
KM Kavululanga	34	32	51	0	1619.80
KM Madede	40	33	262	0	1978.10
KM Matete	31	39	815	0	1828.00
KM Mdolo	47	61	525	0	2638.70
KM Visenthe	29	67	124	0	2176.40
KM Yakuwata	11	25	161	0	915.00
KM averages (SD)	32.0 (12.2)	42.8 (17.1)	323 (292.0)	0	1859.33 (578.3)
<b>VA-locations</b>					
VA Chitanga	42	43	183	150	3234.20
VA Chitimba	22	1	292	99	1986.20
VA Jata	48	37	331	363	3874.30
VA Kachere	97	54	1731	296	5679.50
VA Kampupu	12	35	1242	353	4079.95
VA Kapopo	15	23	72	236	2214.50
VA Katumbi	33	19	185	121	2883.60
VA Luzi	29	15	637	312	2865.98
VA Magido	57	26	287	398	3072.10
VA Mzikubola	17	34	253	267	2468.00
VA Ng'onga	11	7	383	336	2,221.50
VA Vibangalala	63	80	102	470	4677.70
VA averages (SD)	37.2 (25.8)	31.2 (21.5)	474.8 (505.5)	283.4 (114.2)	3271.46 (1114.6)
<i>P</i> -value	0.85	0.26	0.45	—	0.003

\*1 US\$ = 15 MK (Malawi kwacha) in December 1996.

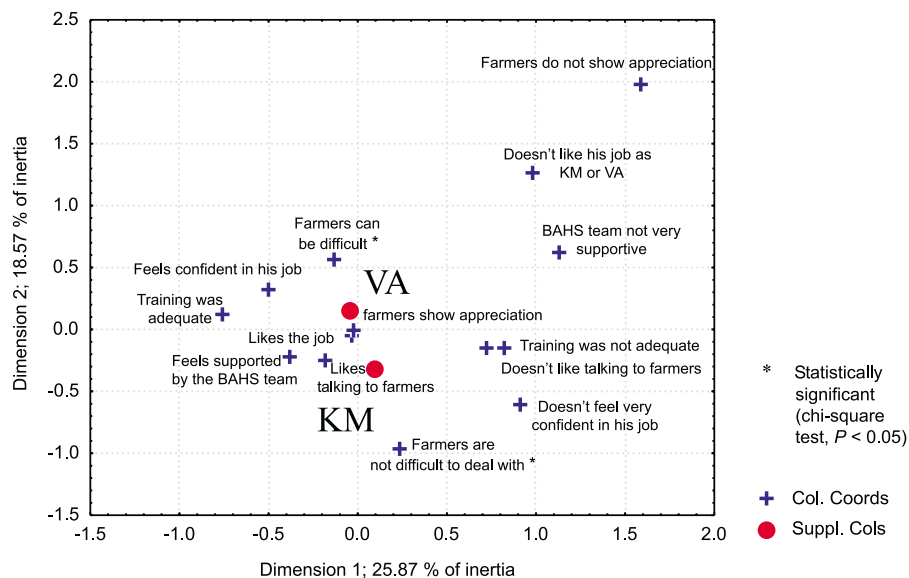


Fig. 3: Results of multiple correspondence analysis of job satisfaction and self-perception. The indicators of job satisfaction and self-perception are displayed as column coordinates (Col. Coords) while the KM/VA-status is added as supplementary column points (Suppl. Cols). Chi-square analysis results for cross-tabulated data are included.

misunderstanding of the BAHs concept by farmers, namely the principle of prevention rather than cure, issues of self-help, lack of cooperation by the village livestock group and treatments on a cash rather than a loan basis. Thirty percent of all VA and KM stated that there are communication problems (getting farmers together, inability to explain certain technical issues, cultural/tribal barriers,) and 17 % said that farmers had problems in accepting the current drug and treatment prices.

## DISCUSSION

The fact that the communities tended to select comparatively older farmers as KM is part of a culture of respecting elders in their communities. Meemark<sup>15</sup> reported the average age of keymen in northeast Thailand to be 39 years, almost identical to the situation in Malawi. The BAHs programme team advises against selection of KM of an advanced age (e.g., 4 KM are older than 60 years) because of the physical demands of service delivery.

An estimated BAHs weekly workload of 3.7 days for KM as compared to 4.2 for VA is remarkably high, considering the additional commitments of KM as farmers themselves. Although KM as well as VA are provided with a bicycle as part of the initial drug-box delivery, it is known that distances and absence of roads can result in every farm visit becoming a tiresome and time-consuming job. Woods<sup>18</sup> found proximity to the clientele to be a crucial determinant of the quality and frequency of livestock services for the performance of veterinary technicians in Zimbabwe. Apart from farm visits, activi-

ties of KM and VA include bookkeeping, group-meetings and cash accounting and transfer, which involves hand-over of cash to the treasurer of the village livestock group, but also stock-taking whenever requested by either the BAHs team or the village group. For a basic animal health project in northeast Thailand, KM bookkeeping was limited to filling in forms for drugs received/drugs sold<sup>15</sup>, whereas it is much more demanding in the case of the BAHs programme in Malawi. The differences in KM/VA locations according to ecological zones (Table 1), including distances to their BAHs clientele have been evaluated recently<sup>8</sup>.

The majority of both groups enjoy their role in livestock service delivery. Almost all of the VA and 88 % of KM organized meetings to promote the programme, and about 2/3 of both groups thought that they had performed this task successfully. The BAHs training, however, was not perceived to be adequate by the KM and VA. Their first suggestion was regular refresher courses, followed by more applied demonstrations and sessions on development of extension skills as shown in Table 1. It should be noted that the BAHs programme conducted regular refresher courses until 1997, and then committed VA and their supervisors to play an active part in KM training and supervision. This has apparently not worked well. One of the reasons is certainly due to changes (reduction) in the number of staff involved with the BAHs team.

Jones<sup>11</sup> referred to an initial 2-week training for village animal health workers in southern Sudan, followed by a refresher

course after another 6-12 months. Apart from the initial training of 4 days mentioned earlier, the BAHs team places much emphasis on ongoing supervision of KM, in particular by veterinary field staff. The regular BAHs drug delivery tours provide an additional opportunity for supervision and discussion, as does the annual stock-taking event attended by each livestock group.

In terms of service delivery, cattle as the economically most valued animals receive most of the attention. Pigs receive the least input in terms of drugs. This is not surprising, because efforts by BAHs to promote enhanced pig production in villages so far have been rather modest. It is noticeable that KM as lay practitioners on average visited more farms more often than VA. There are, however, no significant differences between KM and VA with regard to average visit numbers, drug sales or treatments performed. KM apparently spent more visits on fewer animals when compared with VA, while VA at the same time sold more drugs. The latter figure is increased by sales of antibiotics and other relatively expensive injectables through VA. Although VA on average had almost twice the turnover of KM, the large data variation and small sample size makes it difficult to obtain a clear picture of the situation. The fact that the number of VA and KM included in this calculation is not representative of all drug-box holders may be relevant in this context.

Seventy-three percent of VA and 43 % of KM said that they sometimes had problems when dealing with farmers. VA and KM attributed this to inability to attract sufficient farmers on one hand and poor understanding of the BAHs concept by farmers on the other. Government field staff in general have a reputation of passivity and inefficiency, which is inherited from a history of pure state services<sup>12</sup>. It is also possible that tribal issues influence farmers' interest in the scheme. This is supported by the fact that almost 2/3 of VA do not belong to the Tumbuka, who predominate in the study area (Table 1). This factor should be taken into consideration during future phases of the BAHs programme, but remains to be further investigated.

When interpreting the responses that VA and KM provided in this survey, a tendency to give positive rather than negative information in relation to the programme must be taken into account, as VA and KM themselves receive a financial benefit from BAHs. Subjectivity and potential response bias do not invalidate the conclusions of the analysis, which provides an important summary of

VA/KM perceptions in relation to BAHS.

As illustrated in Fig. 3, the overall job satisfaction of VA and KM involved in the BAHS programme is the most striking pattern that emerged from this study. It resulted to a significant extent from the encouraging response they received from their clientele. The feeling of support by the BAHS team and enjoyment from talking to farmers was common in both groups. This was closely related to personal perceptions such as increased self-esteem and positive learning experiences. It is clear that for community-based livestock programmes to be successful in the short-term and sustainable in the long term, village animal workers must receive a perceived benefit from the programme, which need not necessarily be measurable on purely economic grounds.

#### ACKNOWLEDGEMENTS

Conducting this study was not just a component of a BAHS impact assessment, it was also part of the BAHS team approach, and thus provided much enjoyment for all parties involved. We wish to thank all keymen and veterinary assistants as well as their supervisors involved in this study for their cooperation.

#### REFERENCES

1. Abdel-Messieh F 1996 Basic animal health services in the Kingdom of Lesotho. In Zimmermann W, Pfeiffer D U and Zessin K H (eds) *Primary animal health activities in southern Africa. Proceedings of an International Seminar, Mzuzu, Malawi, 26 February – 8 March 1996*. German Foundation for International Development, Feldafing, Germany: 324–331
2. Akabwai D M O 1992 Paravet training among Turkana pastoralists of Kenya. In Daniels P W, Holden S, Lewin E and Dadi S (eds) *Livestock services for smallholder: a critical evaluation of the delivery of animal health and production services to the small-scale farmers in the developing world. International Seminar Proceedings, Yogyakarta, Indonesia, 15–21 November 1992*: 232–234
3. Arambulo P V, Aleta I R, Vallenias A 1986 Community participation in veterinary public health and animal health in the Caribbean – results of a preliminary survey. *International Journal of Zoonoses* 13, 162–173
4. Baptist R, Rajasmina A, Rakotoarimanana D, Rasambainarivo J H 1994 Private vets for the rural areas of Madagascar. *The Kenya Veterinarian* 18: 510–512
5. Grandin B, Thampy R, Young J 1991 *Village animal healthcare: a community-based approach to livestock development in Kenya*. Intermediate Technology Publications, London
6. Greenacre M 1992 Correspondence analysis in medical research. *Statistical methods in medical research* 1: 97–117
7. Hüttner K, Leidl K, Jere F B D, Pfeiffer D U 1998 Target group orientation of a basic animal health service program – first results of an impact assessment in northern Malawi. In *Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), Harare, Zimbabwe, 14–18 September 1998*: 296–309
8. Hüttner K, Pfeiffer D U, Leidl K, Jere F B D, Kasambara, D (in press) Farm and personal characteristics of the clientele of a community-based animal health service programme in northern Malawi. *Tropical Animal Health and Production*
9. Jere F B D 1997 Basic animal health service in Northern Malawi. In Zimmermann W, Pfeiffer D U, Zessin K H (eds) *Primary animal health activities in southern Africa. Proceedings of an International Seminar, Mzuzu, Malawi, 26 February – 8 March 1996*. German Foundation for International Development, Feldafing, Germany: 211–234
10. Johnson P J, Chahuares C 1990 Training Anyamara veterinary technicians in the southern Peruvian Andes. *Convergence* 23: 14–22
11. Jones B A, Deemer B, Leyland T J, Mogga W, Sterm E 1998 Community-based animal health services in Southern Sudan – the experience and future. In *Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), Harare, Zimbabwe, 14–18 September 1998*: 107–133
12. Lechner H L G, Böhm A 1990 Assessment of the veterinary field service of Mzuzu A.D.D. in 1988/89 and recommendations for an improvement of efficiency. Mzuzu, Malawi, 162 pp.
13. Leidl K, Jere F, Wanda G, Hüttner K, Stange M 1995 Establishment of a basic animal health service program in northern Malawi – dimensions of activities through field work prior to implementation. *Proceedings of the 8th International Conference of Institutions of Tropical Veterinary Medicine, Berlin, Germany, 25–29 September 1995*: 113
14. Loehr K F 1989 The basic animal health service in north-east Thailand – the principle of the service. In *Proceedings of an International Seminar on Animal Health and Production Services for Village Livestock, Khon Kaen, Thailand, 2–9 August 1989*: 37–39
15. Meemark N 1988 The development and evaluation of a village-based parasite control program for swamp buffalo and cattle in northeast Thailand. Thesis, Massey University, Palmerston North, New Zealand.
16. Moktan D, Mitchelhill B K, Joshi Y R 1990 *Village animal health workers in the Koshi Hills, Dhankuta District, Koshi Zone, Nepal*. PCA Working Paper No. 4
17. Sulistiyo U, Wahyuni D, Leksmono C S 1998 Village animal health workers in Minahasa District, North Sulawesi, Indonesia. In *Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), Harare, Zimbabwe, 14–18 September 1998*: 340–349
18. Woods P S A, Leonard D, Nielen M, Brand A 1998 The importance of proximity, transport and gender as factors affecting the efficiency of veterinary service delivery in Zimbabwe. In *Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), Harare, Zimbabwe, 14–18 September 1998*: 238–242