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Household dynamics in northern Malawi during the 1980s

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Abstract

As part of an epidemiological study of leprosy and tuberculosis, a total of 112 026 individuals belonging to 17 889 households in Karonga District, northern Malawi, were interviewed and examined in the early 1980s and followed up over five years. The mean and median household size (6.4 and 5 respectively in the first survey) were similar in the two surveys. Males headed 85 per cent of all households. The proportion of females who were household heads increased with age, from less than 10 per cent among females under 45 years of age to more than 30 per cent of those over age 60. The implications of household definition for studies of household change over time is discussed. More than 84 per cent of the households were considered to have maintained their identity over the five years, and an appreciable proportion did so despite changes in location (21 per cent) or headship (8 per cent), or even both (1 per cent). The rate at which individuals changed households was strongly dependent upon age, sex and membership status, being low (c. 20 per cent) for children under 5 years, very high for females 15–19 years of age (63 per cent) and males 20–24 years of age (50 per cent), then lower for older adults though increasing gradually with age for females over age 50. The probability of survival of a household over time was strongly correlated with household size. These analyses reveal the complexities of household dynamics, and provide a basis for detailed studies of leprosy, tuberculosis and HIV transmission and impact in this population.

Keywords

Demography, household, dynamics

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INTRODUCTION

Households provide a fundamental grouping in virtually all human societies. According to conventional definitions (United Nations 1973), a *household* reflects the living arrangements of persons, individually or in groups, for providing themselves with food, shelter and other essentials. It is a comprehensive term used in many studies and does not necessarily depend on familial relationships between the persons involved. Households change over time, as a consequence of births, deaths and movement, and their dynamics play a crucial role in determining social and demographic patterns, as well as population patterns of disease. Though there is a considerable literature on households in both developed and developing countries, much of it relates to cross-sectional studies looking at household size and composition, with very little work on changes over time.

This paper takes advantage of an unusual data set in order to analyse the structure and dynamics of households in a rural African population. The data were collected in the context of a large longitudinal study of leprosy and tuberculosis, carried out in Karonga District, northern Malawi, between 1979 and 1989, called the Lepra Evaluation Project (LEP). Because both leprosy and tuberculosis are known to cluster in families and households, considerable care was taken to follow up more than 100 000 people and 15 000 households over time, providing a unique insight into household dynamics.

Decennial censuses and national Demographic and Health Surveys (DHS), carried out in Malawi in 1987 and 1992 have provided basic data on household size and headship (National Statistical Office Malawi 1987, 1994). According to these sources, the average number of persons per household in Malawi was 4.3 during the 1987 census and 4.5 in the 1992 DHS, respectively. The northern region of Malawi had the highest number of persons per household (4.8), with Karonga District having the highest in Malawi (5.3). These household sizes are consistent with those reported in specialist surveys for several sub-Saharan African countries (Gregson, Garnett and Anderson 1994; Nakiyingi, Malamba, Kamali *et al.* 2001). New households in Malawi, like elsewhere, are formed mainly through marriage, with the wife being more likely than the husband to move location, and the husband assuming the headship, except in a few cultures which are matrilinear (as found in southern Malawi – see e.g. Mtika and Doctor 2002). Due to the polygamous nature of some societies, a man may be a head of more than one household. According to DHS data in 1987 and 1992, men headed 74 per cent of rural and 85 per cent

of urban households in Malawi respectively. Similar patterns are observed in households in different populations in sub-Saharan Africa (Foster, Makufa, Drew *et al.* 1997; Nakiyingi, Malamba, Kamali *et al.* 2001; Urassa, Ng'weshemi, Isingo *et al.* 1997; Zulu and Sibanda 2000). This paper analyses the dynamics of such households over time. The data relate to the pre-HIV era, and provide a background for a major series of demographic and epidemiological studies in this population (e.g. Chirwa, Floyd, Zaba *et al.* submitted; Crampin, Floyd, Glynn *et al.* 2002, 2003, 2004, Fine, Sterne, Ponnighaus *et al.* 1997).

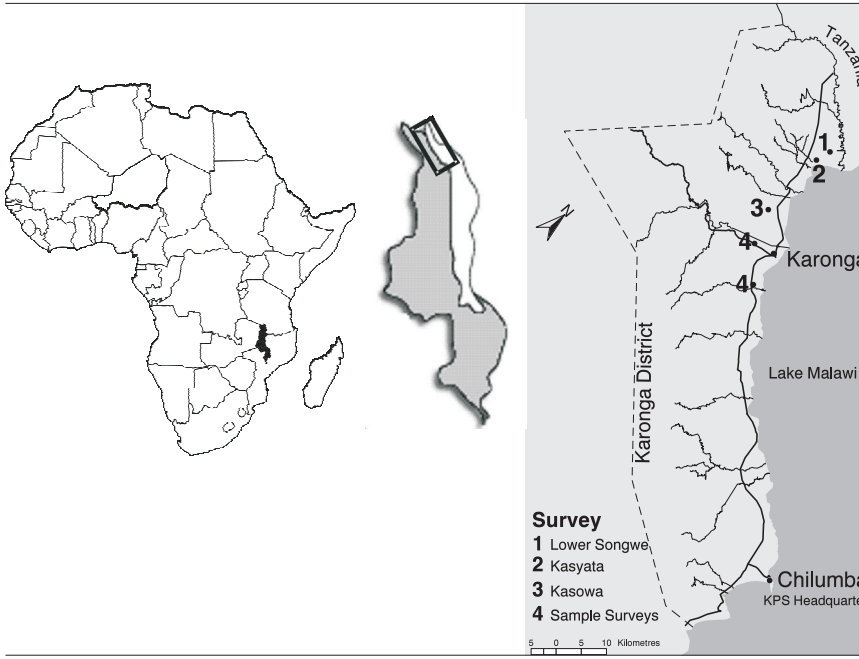
METHODS

The main data analysed here were collected during two linked population surveys, each of which covered more than 90 percent of the area of Karonga District, northern Malawi (Figure 1). Details of the fieldwork methods have been described elsewhere (Ponnighaus, Fine, Bliss *et al.* 1987). The first survey (called LEP-1) was carried out from 1979 to early 1985, and the second survey (LEP-2) from 1986 to 1989. The order in which villages were surveyed was similar in the two surveys. In addition to the two total population surveys, smaller surveys were carried out in five areas indicated in Figure 1. To achieve high coverage, all the surveys were carried out by systematic house-to-house visits by field teams.

For each individual, interviewers collected name, birth year, birth village, sex, mother's and father's names, names and ages of all siblings, and history of having been seen previously by the project. On this basis each individual was assigned a unique and permanent identification number (six digits plus an algebraically determined check digit). If people did not know their precise year of birth, this was estimated with reference to a local events calendar. Marital status was not recorded. The basic demography of the population has been described elsewhere (Chirwa, Floyd, Zaba *et al.* submitted).

Each individual was assigned initially to the household in which they resided when they were first identified. An effort was made in LEP-2 to trace all individuals identified in LEP-1. It has thus been possible to trace whether individuals died, changed status within their household, changed households within Karonga, or moved to areas outside the district, between the two surveys. Because of the duration of the LEP-1 and LEP-2 surveys, some individuals and households moved, and were seen two (or three) times, in different places, in the course of a survey. In the basic enumeration of population and

Figure 1 Map showing Karonga District, including location of project headquarters in Chilumba, and areas included in special surveys



households, and of individual movements between households, each individual and household is counted only once. However, descriptions of household size include all individuals who belonged to each household when it was first seen. Description of household changes between LEP-1 and LEP-2 relate to the first time the household was seen in each survey.

A *household* was defined as *a group of people living together and acknowledging one person as the head* (Ponnighaus, Fine, Bliss *et al.* 1987; Fine, Sterne, Ponnighaus *et al.* 1997). Information collected on households included location (recorded as grid coordinates on aerial photographs), identification of the head of household and information on household assets. Each household was assigned a unique (5 digit) "household number".

This definition of a household (equivalent to "nyumba" in Tumbuka, the predominant language of the area) was found to be appropriate in the Karonga cultural context, and posed little difficulty in defining a household group at any point of time. However, it raised problems in the follow-up study, in that it

was sometimes unclear whether a household was the "same", the second time it was seen, if the composition had changed or a new head had taken over. This is a problem for any household definition, though it has received little attention in the literature. Because of the number and complexity of different circumstances that could arise, rather than attempt to formulate a complete set of fixed rules, the decision as to whether a household was considered to be the "same" over time (and hence deserved to preserve its old number) was left to the judgement of the interviewers, and reviewed by the coding manager, using the following general guidelines.

An old household number was retained, if:

- the original (e.g. LEP-1) head remained as household head in the same location, or
- the original head had died but most of the members remained in the same location, the headship having been inherited by someone else (e.g. wife, child or parents), or
- the original head had left, but most of the members remained together in the same location, the headship having been assumed by, e.g., the divorced ex-wife, or
- the original household had been headed by a wife while the husband was away, but he had since returned home and assumed the headship, or
- the original household had just moved from one location to another with the head and most of the members still together.

It will be noted that there is flexibility in some of these criteria (e.g. the phrase "most of the members"), which meant that the decision as to whether a household preserved a previous number, or received a new one, was sometimes left to the judgement of the interviewers and coders. As the interviewer and data staff were from the local population, and as they underwent a standardised training experience and were rigorously supervised, their decisions on household status should have been well informed under local custom, and consistent. The implications of employing this flexible approach are described below.

Most households consisted of nuclear or extended families but they sometimes included distant relatives, visitors, renters and workers. The positions of individuals in a household were categorised as "head", "member" and "other" (which included visitor, employed worker, renter, and relative of employed worker or renter). A "member" could be a spouse, child, or (sometimes distant) relative of the head of household or of his or her spouse. Individuals who were

considered by the head to be normal residents of the household, but who were absent on the day of the survey, were followed up and interviewed later, and are included in the household analyses presented here.

A few individuals were found living under special circumstances which were unlike conventional households (e.g. inmates in the district prison, patients in traditional healer camps, or road work gangs). Though enumerated and followed up for demographic and epidemiological purposes, these individuals and "atypical households" were excluded from the analyses presented here.

The additional special surveys in five areas (Figure 1) allowed the enumeration of individuals who changed household more than once, either to a different household each time they moved ("forward move") or back to their previous, or original, household the second time they moved ("return move").

The data are held on a combination of Oracle and Foxpro databases, which allow generation of household histories and family trees, and extraction of files for analyses in STATA (Stata Corp., College Station, TX, USA).

RESULTS

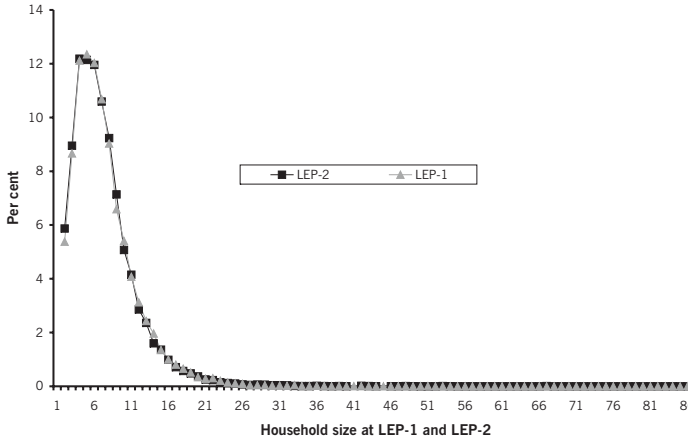
The results shown here include household size distributions in the two surveys, age and sex patterns of household headship, and changes in headship and membership of households over the period between the two surveys. The total numbers of individuals interviewed during LEP-1 and LEP-2 were 112 886 (52.6 per cent female, mean age 22.7) and 146 129 (51.7 per cent female, mean age 22.5), respectively. The age and sex patterns were similar to those observed in the 1987 National Census for Karonga District (National Statistical Office Malawi 1987; Chirwa, Floyd, Zaba *et al.* submitted).

Households

After excluding the "atypical households" (prison, healer camps etc), there were 17 889 households and 112 026 individuals recorded at least once in LEP-1, and 23 589 households and 145 204 individuals recorded at least once in LEP-2, respectively. Of these, 15 015 households were identified (i.e. assigned the same household number) in both surveys. The average interval between LEP-1 and LEP-2 visits to the same household was 5.3 years (SD 1.1 years): 80 per cent of the intervals were between 4 and 6 years.

Figure 2 shows the frequency distributions of household size during the two surveys, in terms of the number of current residents. The distributions were

Figure 2 Relative frequency distributions of household size in LEP-1 (1979–84) and LEP-2 (1986–89) surveys in Karonga District, northern Malawi.



virtually identical, with mean household size equal to 6.4 in LEP-1 and 6.3 in LEP-2, median equal to 5 in both surveys, 14 per cent and 13 per cent of households exceeded 10 individuals in LEP-1 and LEP-2 respectively, and 4 per cent of households exceeded 15 individuals in both surveys. The largest household in LEP-1 contained 50 individuals (in LEP-2 the largest contained 86).

Table 1 shows the distribution of LEP-1 households by size and membership status. Not all households were recorded as having a *resident* head, reflecting the fact that some men were heads of more than one household but were recorded as living in only one of them. Thus, for example, out of 962 households with a single actual resident in LEP-1, 27 (3 per cent) of the single residents considered themselves as members of two-person households but with a head who resided elsewhere. The majority (63 per cent) of the single person households consisted of a single male, and most of these individuals were over 40 years of age. The pattern was very similar in LEP-2.

Eighty-three per cent of all LEP-1 household heads were male. Figure 3 shows the percentage of males and females who were heads of households in LEP-1, by age. The proportion of males who were heads rose to 90 per cent by age 50. The proportion of females who were heads during LEP-1 increased slowly with age to approximately 30 per cent by age 60. This pattern was similar in LEP-2.

Table 1 Frequency distribution of the LEP-1 population by position and household size

Household size	*Row percentages*						*Total individuals*	*Total households*
	Position in household at LEP-1							
	Head		*Member*		*Others*			
	Per cent	*n*	*Per cent*	*n*	*Per cent*	*n*		
1	97.2	935	2.8*	27	0.0	0	962	962
2	48.6	1 507	50.6*	1 569	0.8	24	3 100	1 550
3–5	24.4	6 374	74.3	19 389	1.3	337	26 100	6 529
6–10	13.0	6 272	84.4	40 657	2.6	1 260	48 189	6 400
11+	6.7	2 402	88.0	31 364	5.3	1 886	35 652	2 448
Total	15.3	17 490	81.6	93 006	3.1	3 507	114 003**	17 889

*Some households were recorded as having no resident head, as polygamous head was resident in another household.

**This exceeds the total (112 026) seen at least once in "typical" households in LEP-1, as some individuals were found in more than one household during the course of the survey.

Figure 3 Percentage of males and females who were heads of household, by age at LEP-1, Karonga District, northern Malawi 1979–84

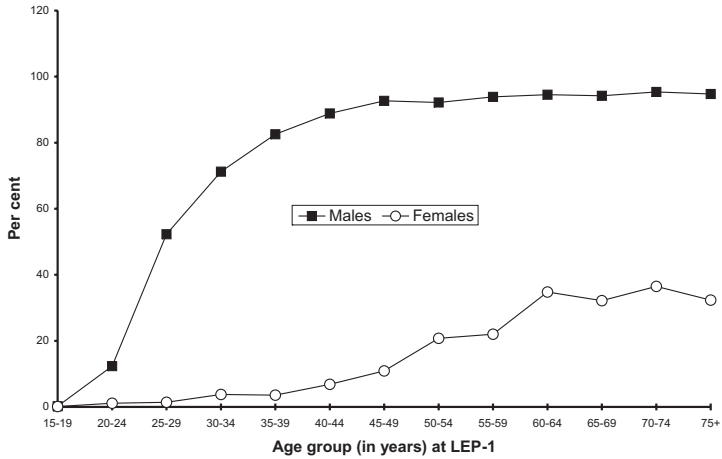


Table 2 shows the continuity of households by headship and location, between the two surveys, according to the rules employed for assigning the same or new household numbers. This analysis is restricted to 17 673 households identified in LEP-1 in areas included in both surveys (a small area in the western hills, containing 216 LEP-1 households [1 per cent of the total] was excluded from the LEP-2 survey). Of these 17 673 LEP-1 households, 14 834 (84 per cent) were identified and assigned the same household numbers in LEP-2. Of these 14 834 "surviving" households, 10 029 (67 per cent), had the same head and were within 500 metres of their location in LEP-1, whereas 3 421 (23 per cent) had the same head but had moved further away from their original household site. Approximately 10 per cent (1 384) of the surviving households had a different head in LEP-2. 1 071 (80 per cent) of the new heads had been recorded as members in LEP-1.

Of the 17 673 LEP-1 households located in areas also covered in LEP-2, 2 839 (16 per cent) were not identified in LEP-2. Not all of these households necessarily dissolved over the five years, as it is likely that some moved outside the survey area. In addition some of these disappearances reflect the view of the field and coding staff that households had changed in such a way that they no longer deserved to keep the same number. Only seven households (0.04 per cent) were found in the exact same place in LEP-2 as in LEP-1, and with the same head as a LEP-1 household, but with different household numbers.

Table 2 Continuity of households between LEP-1 and LEP-2 surveys, based upon 17 673 households surveyed in LEP-1, in areas covered fully in both surveys

	Same household number		*Different household number*		*Totals*
	Same location	*Different location*	*Same location*	*Different location*	
Same head in LEP-2	10 029	3 421	7	46	13 503
Different head in LEP-2	1 136	248	708*	(2 078)**	4 170
Totals	11 165	3 669	715	2 124	17 673

Note: The criterion for being in the *same location* is <500 metres distance for households retaining the same household number, and <30 metres (allowing for measurement error on maps) when making links between households with two different numbers.

*Very few of these households had any members in common. Thus most of the original 708 households had either dissolved or moved out of the study area.

**These 2 078 LEP-1 households either dissolved or moved out of the study area.

Figure 4 Proportion of households which "survived" (i.e. with same household number) over five years, as a function of their size in LEP-1

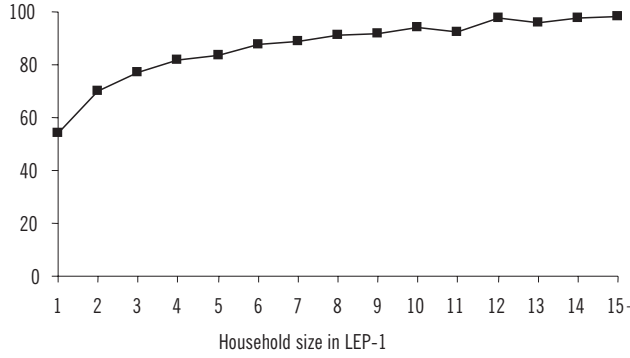


Figure 4 shows that the probability that a LEP-1 household was identified in LEP-2 was strongly correlated with household size.

Changes in heads of households

Of the 15 015 households which retained the same household number among the total surveyed in LEP-1 and LEP-2, a headship change was recorded in 1 390 (9.3 per cent) between the surveys. Table 3 presents a breakdown of these households by sex of initial and subsequent head. Among households which changed head, 1 000 (72 per cent) had a male head in LEP-1 but only 463 (33 per cent) had a male head in LEP-2. Headship was assumed by an individual of the opposite sex in 824 + 287 = 1 111 (80 per cent) of these households. Eighty-two per cent of households (824/1 000) originally headed by men were taken over by women, and 74 per cent (287/390) of those originally headed by women were taken over by men. The changes were due to death of the original head in 973 (70 per cent) of these households (831 males, 142 females), 97 per cent of whom were aged over 40 years. In another 160 (12 per cent), the original head was recorded as having left the household (119 males, 41 females). The LEP-2 status was unknown or missing for 258 (18 per cent) of the original heads who had been supplanted (51 males, 207 females). The different age distributions of male and female heads shown in Figure 3 reflect the fact that women frequently take over headship of households after being widowed.

Table 3 Cross-tabulation of previous and new heads for the 1390 households that changed heads between LEP-1 and LEP-2, by sex. (Row percentages)

		New head at LEP-2		
		Female	*Male*	*Total*
Head at LEP-1	Female	103 (26.4)	287 (73.6)	390 (28.1)
	Male	824 (82.4)	176 (17.6)	1 000 (71.9)
		927 (66.7)	463 (33.3)	1 390 (100.0)

Position changes in household between the surveys

Tables 4a and b summarise position changes by age (at LEP-1) and sex between the two surveys. The large majority of people remained in the same household and with the same membership status. This was particularly so for male heads (96 per cent), for male members under 20 (78 per cent), for older (over age 30) female heads (80 per cent) and for female members under 10 and over 30 (both at 77 per cent). An appreciable proportion of males over age 20 who were household members in LEP-1 became heads of new households (43 per cent) or, in the case of male members aged 30 and over, took over the headship of their existing household (17 per cent) in LEP-2. The majority of "Others" were recorded as members or heads of different households when seen in LEP-2 although 14 per cent of male and 16 per cent of female "others" were assimilated as full members of the original household.

Movements between households

There were 87 151 individuals identified and recorded at both LEP-1 and LEP-2 of whom 53 per cent were female, excluding those in atypical households. Of these, 22 047 (25 per cent) had changed household between the surveys (29 per cent of the females and 21 per cent of the males).

Figure 5 shows age and sex differences in individual propensity to change household during the inter-survey interval. There were high rates of household change (20 per cent), but no apparent sex differences, among children under five years of age. There was a very active change of households among young adults aged 10–30 years – with more than 30 per cent changing households in most age groups. There is a higher and earlier age peak for females (over 60 per cent in the 15–19 year age group) compared to males (nearly 50 per cent in the 20–24 year age group). The figure also shows a relatively low rate of household change for persons over 40 years of age, under 10 per cent

Table 4a Frequency table for changes in position between LEP-1 and LEP-2 for surviving resident males, by age when first seen. Karonga District, northern Malawi 1979–89 (Row percentages)

			LEP-2 Household and position								
			Same Household				*New Household*				
		Age	*Head*	*Member*	*Others*	*Sub-total*	*Head*	*Member*	*Others*	*Sub-total*	*Total*
LEP–1 position	Head	0–9	–	–	–	–	–	–	–	–	–
		10–19	7 (77.8)	–	–	7	–	2 (22.2)	–	2	9
		20–29	1 332 (93.9)	3 (0.2)	0	1 335	10 (0.7)	53 (3.7)	21 (1.5)	84	1 419
		30–	10 097 (95.9)	1 (0.01)	0	10 098	227 (2.2)	131 (1.2)	77 (0.7)	435	10 533
		All	11 436	4	0	11 440	237	186	98	521	11 961
	Member	0–9	–	11 903 (79.8)	10 (0.1)	11 913	–	2 829 (19.0)	169 (1.1)	2 998	14 911
		10–19	15 (0.2)	7 037 (74.0)	13 (0.1)	7 065	626 (6.5)	1 719 (18.1)	107 (1.1)	2 452	9 517
		20–29	75 (2.5)	1 244 (41.1)	9 (0.3)	1 328	1 331 (44.0)	313 (10.4)	51 (1.7)	1 695	3 023
		30–	207 (16.9)	419 (34.2)	5 (0.4)	631	485 (39.7)	80 (6.5)	28 (2.3)	593	1 224
		All	297	20 603	37	20 937	2 442	4 941	355	7 738	28 675

Others	0–9	–	53 (20.2)	4 (1.5)	57	–	193 (73.4)	13 (4.9)	206	263				
	10–19	–	22 (20.6)	1 (0.9)	23	12 (11.2)	70 (65.4)	2 (1.9)	84	107				
	20–29	–	14 (8.9)	8 (5.1)	22	70 (44.6)	47 (29.9)	18 (11.5)	135	157				
	30–	2 (0.9)	12 (5.5)	21 (9.6)	35	117 (53.7)	29 (13.3)	37 (17.0)	183	218				
	All	2	101	34	137	199	339	70	608	745				
		11 735	20 708	71	32 514	2 878	5 466	523	8 867	41 381				
Total														

among males but higher rates for females, increasing from 12 per cent at age 50 to 26 per cent at over 75 years of age.

Movements by age and position in household

The propensity of individuals to change household depends on their position in the household (Table 4). Figure 6 breaks down the data in Figure 5, and shows that individuals identified as visitors, employed workers, renters, or families of employed workers or renters (i.e. "others") were far more likely to change households than members who, in turn, were more likely to move than heads. Over 80 per cent of individuals coded initially as "others" changed households between the two surveys.

The high proportion changing household among female members below age 25 (peaking at 62 per cent in the 15–19 age group) reflects the pattern seen in Figure 4. The peak age for males to change households was ten years older (25–29 age group). The proportions of female heads who changed households were higher than for male heads, across all ages. Less than 10 per cent of male heads aged over 20 years changed household compared to between 12 per cent and 45 per cent for female heads. We note a rapid decline in household change with age for female compared to male heads. There were too few heads at ages <20 (2 and 3 changed households respectively out of 9 and 6 male and female heads) for

Table 4b Frequency table for changes in position between LEP-1 and LEP-2 for surviving resident females, by age when first seen. Karonga District, northern Malawi 1979–89. (Row percentages)

			LEP-2 Household and position								
			Same Household				*New Household*				
		Age	*Head*	*Member*	*Others*	*Total*	*Head*	*Member*	*Others*	*Total*	*Total*
LEP-1 Position	Head	0–9	–	–	–	–	–	–	–		–
		10–19	–	3 (50.0)	–	3	–	2 (0.3)	1 (0.2)	3	6
		20–29	20 (23.5)	35 (41.2)	–	55	3 (3.5)	24 (28.3)	3 (3.5)	30	85
		30–	1 610 (80.0)	134 (6.7)	2 (0.1)	1 746	15 (0.7)	239 (11.9)	13 (0.6)	267	2 013
		All	1 630	172	2	1 804	18	265	17	300	2 104
	Member	0–9	–	11 045 (76.9)	16 (0.1)	11 061	–	3 112 (21.7)	190 (1.3)	3 302	14 363
		10–19	6 (0.1)	4 236 (47.0)	104 (1.1)	4 346	24 (0.3)	4 444 (49.3)	207 (2.3)	4 675	9 021
		20–29	42 (0.7)	4 165 (67.0)	20 (0.3)	4 227	55 (0.9)	1 805 (29.1)	123 (2.0)	1 983	6 210
		30–	831 (6.3)	10 151 (76.9)	8 (0.1)	10 990	467 (3.5)	1 621 (12.3)	120 (0.9)	2 208	13 198
		All	879	29 597	148	30 624	546	10 982	640	12 168	42 792

Others	0–9	–	59 (21.2)	3 (1.1)	62	–	201 (72.0)	16 (5.7)	217					279
	10–19	–	21 (11.2)	2 (1.1)	23	1 (0.5)	159 (84.6)	5 (2.6)	165					188
	20–29	–	30 (15.2)	8 (4.1)	38	4 (2.0)	141 (71.6)	14 (7.1)	159					197
	30–	1 (0.5)	30 (14.5)	5 (2.4)	36	30 (14.5)	132 (63.8)	9 (4.3)	171					207
	All	1	140	18	159	35	633	44	712					871
		2 510	29 909	168	32 587	599	11 880	701	13 180					45 767
Total														

reliable estimation, and thus they have been omitted from Figure 5. In contrast to males, the propensity for female heads to change household was similar to that for female members.

Further analysis of inter-household movements for the "other" categories (visitors, itinerants, employees, renters) showed that individuals identified initially as visitors had a slightly lower propensity to move (76 per cent) than did those identified initially as employees or renters (85 per cent).

Forward and return moves

A more detailed analysis of movements of individuals between households was possible for 3 902 individuals observed in three separate surveys. This gave an opportunity for measuring the proportions of individuals who made forward and return moves, by age and sex. Ninety-five percent of these individuals were first interviewed between 1979–81 during LEP-1, 91 per cent were included in the 1984 survey and 91 per cent were encountered again in 1988–89 during LEP-2. On average, these surveys were five years apart and span changes in households over a ten-year period. Movement patterns are shown by age when first seen and by sex in Figure 7.

Of these individuals, 2 657 (68 per cent) did not move, 881 (27.6 per cent) moved once, and 364 (9.4 per cent) moved twice (of whom 127 [35 per cent] moved back to their original household).

Figure 5 Percentage of individuals changing household between LEP-1 and LEP-2 surveys, by age in LEP-1 and sex: Karonga District, northern Malawi, 1979–89

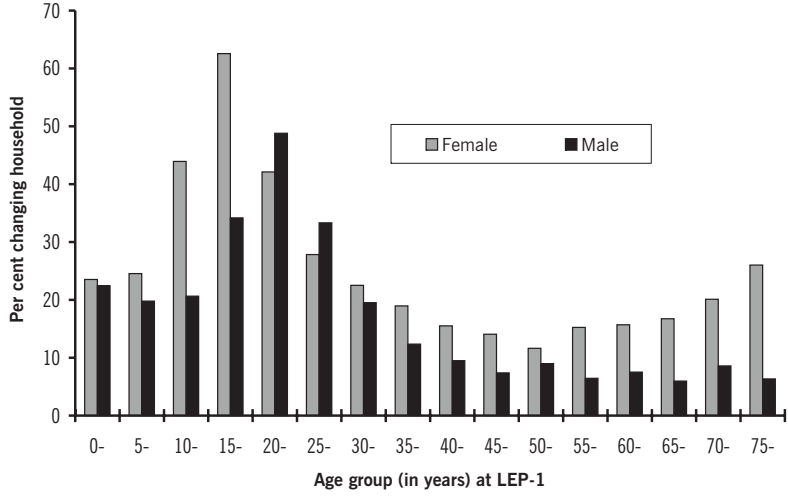
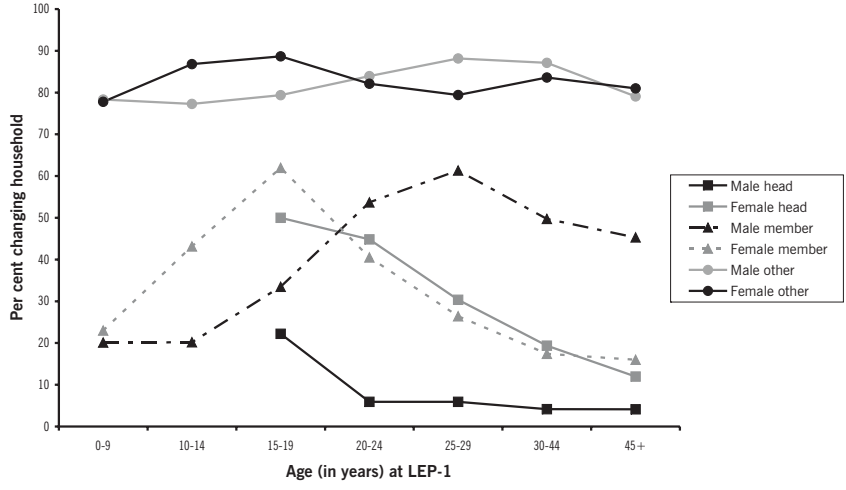


Figure 6 Percentage of individuals who changed household between LEP-1 and LEP-2 surveys, by age, sex and position in household at LEP-1: Karonga District, northern Malawi 1979–89



Among individuals who moved twice, women were more likely to make forward moves than men (161/226 = 71 per cent compared to 76/138 = 55 per cent, p=0.002).

Using A, B and C to refer to successive separate households, individuals were described as remaining in the same household throughout (AAA), moving only between the first and second survey (ABB), only between the second and third surveys (AAB), moving and then returning (ABA) or moving twice to different households (ABC). Figure 7 shows that the age distribution (when first seen) of those who made AAB moves was on average 5 years younger than those who made ABB moves, reflecting that movement is a function of age. The proportion of individuals who made forward moves (ABC), between the three surveys, peaks in the 15–19 year age group (about 30 per cent of all females and 15 per cent of all males) and steadily decreases with age thereafter to less than 4 per cent in those aged over 45. The percentages are small for return moves (ABA): under 4 per cent in most age groups, with a maximum of 6 per cent (9/151) for females aged 15–19 when first seen.

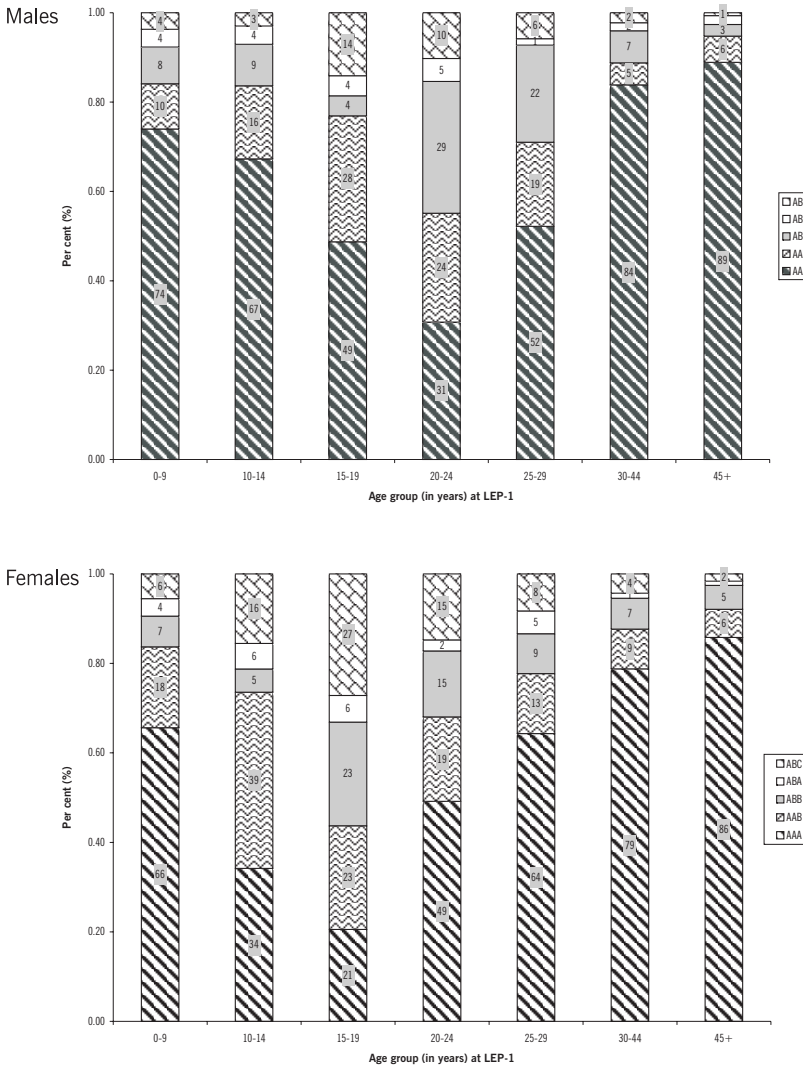
DISCUSSION

The analyses presented here provide an unusual insight into the structure and dynamics of households in a rural sub-Saharan African population during the 1980s. They provide important baseline information for analyses of demographic and epidemiological issues in this and similar populations (Chirwa, Floyd, Zaba *et al.* submitted; Fine, Sterne, Ponnighaus *et al.* 1997; Crampin, Floyd, Glynn *et al.* 2002, 2003), and for a demographic surveillance study which has recently been set up in this Karonga population.

These LEP data indicate larger household sizes than were recorded in the national census – e.g. mean household size of 6.4 in both surveys, in contrast to 5.3 as recorded in the 1987 census (National Statistical Office of Malawi 1987, 1994). This reflects the fact that the census was a rapid survey attempting to identify *de facto* residence at that precise time. The LEP surveys, however, were carried out on a *de jure* basis, and included individuals who were considered by the informants to be residents of that household, but who were physically absent at the time of the interview but who were followed up and interviewed later.

Despite the absence of explicit marital status information, the patrilineal nature of northern Malawian society is evident in these data. It is normal in this

Figure 7 Distribution of movement patterns between three surveys (LEP-1, SS/Ls/Ks/Kw and LEP-2) by age when first seen in LEP-1 and sex. A, B, C refer to (separate) households at the successive surveys in Karonga District, northern Malawi, 1979–89.



Note: Percentages refer to all individuals seen in the surveys: AAA indicates individual remained in same household throughout; ABA indicates individual changed and then returned to original household, etc.

population for a woman on marriage to leave her parental home to join her husband (Mtika and Doctor 2002). Though approximately 85 per cent of all household heads in Karonga were males, women often assumed headship if the male heads died or left the household. Thus, female heads were, on average, older than male heads. That household headship is more transient for females than for males in this society is evident in Figure 6.

Studies in rural sub-Saharan Africa have shown that single person households are unstable and likely to be absorbed into other households (Foster, Makufa, Drew *et al.* 1997; Nakiyingi, Malamba, Kamali *et al.* 2001; Urassa, Ng'weshemi, Isingo *et al.* 1997; Zulu and Sibanda 2000). This was observed in Karonga, as only 4.2 per cent (40/947) of the single person LEP-1 households remained as distinct entities at LEP-2. The likelihood of survival of a household over time is correlated directly with its size.

The most unusual aspect of these analyses relates to the problem of defining households as they change over time. According to the strictest definition, a particular household would be a particular group of people living together in a particular place, with particular relationships to each other; but this would imply a constantly changing household identity as in fact people constantly enter and leave households through birth, death or movement. Another approach to household definition could emphasise the head, and consider that all people who acknowledge a particular individual as "head" to be members of the same household, regardless of where they actually live, and that the household was no longer the same if that head died or left. The definition used here is less rigid than either of these, accepting that a group of people living together may be recognised by themselves and by their community as a particular household and that it may still be considered the same household after changes of membership or even headship. After much discussion with local people, it was decided that this more flexible definition was most fitting to the perception of a household within the context of this population in northern Malawi. Thus the decision as to whether a household seen in LEP-2 could be considered as the "same" as a household seen in LEP-1 was left to the household members themselves, guided by interviewers, prompted by the set of rules described in the methods section. As shown in Table 2, an appreciable proportion of households were considered to maintain their identity over time despite changes of location (21 per cent) or headship (8 per cent), or even both (1 per cent). A very small proportion (7/17 673 = 0.04 per cent) of households were assigned different numbers, despite remaining in the same place and with

the same head over the five years, though according to the rule they should have preserved the same number. These may reflect errors, or strong feeling on the part of staff that the households were different enough to deserve a change in number (in two of the households only the head remained the same). Given their small number, they have trivial effect upon the overall patterns reported here.

The patterns of change in household headships and membership status were strongly dependent upon age, sex and initial membership status. Most individuals remained in the same household over the five years between the two surveys. This was particularly true for male heads and older female heads. Young female heads (under 30 years) generally became members of the same or another household over time. For male household members (i.e. non heads), the probability of becoming head of a household in 5 years increased with age, being 40 per cent for males over age 30.

Approximately a quarter (26 per cent) of the individuals seen in both LEP-1 and LEP-2 were found to have changed households over the five-year inter-survey interval. More than 20 per cent of children under 10 years of age in LEP-1 were found in a different household in LEP-2. Household change (including return or forward moves) in children is likely to be dependent largely on movements of adults. Children may move with their mothers, but it is also common for them to be sent away to live with other close relatives, in particular with grandparents. With the recent increase in orphanhood as a consequence of AIDS-related death of parents, the rate of household change of children has increased (Floyd, Crampin, Glynn *et al.* submitted).

The highest rates of household change were in adolescents and young adults peaking at over 60 per cent among girls aged 15–19 and 50 per cent among males 20–24. Active household change in young adults is attributable primarily to marriage and the search for employment opportunities. The earlier age peak in household change for young women, compared to men, is a reflection of a younger age at marriage in females in this society.

Adults over age 30 changed household relatively infrequently, in particular the males, the majority of whom had become household heads by that age. The higher rates of household change for older women compared to older men are likely to reflect separation and widowhood, custom dictating that women, not men, leave the marital home if the marriage comes to an end. Thus, older women are likely to leave and join one of their children's households, or go back to their original parental household. The exact contribution of

widowhood or separation could not be investigated in these data because marital status was not recorded explicitly.

The propensity of an individual to change household depends on his or her position in the household. "Members" of households included children, spouses and other relatives, the majority of whom were dependents aged under 15 years. Not surprisingly, visitors and renters were a highly mobile group compared to heads and members of households.

In addition to providing a unique demographic perspective in themselves, these data and analyses provide a "background" for detailed epidemiological studies of leprosy (e.g. Fine, Sterne, Ponnighaus *et al.* 1997), tuberculosis (e.g. Crampin, Glynn, Floyd *et al.* 2004) and HIV/AIDS (e.g. Crampin, Floyd, Glynn *et al.* 2003) within this population. For each of these diseases, clinical onset typically occurs several years after infection. Transmission of infection within households is an important feature of each of them; but the fact that infected individuals may change their household between contracting the infection and disease onset, or that the source of infection in a household may either die or move away from a household after infecting another resident, makes it difficult to recognise the source and circumstances under which particular clinical cases became infected. Furthermore, HIV is associated with household disruption, due to high mortality of infected young adults. Knowledge of the patterns of household structure and change described here, in the initial stages of the HIV epidemic, will enhance our ability to trace the patterns and impact of these important infections, as well as the overall demographic changes, in this community.

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