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The Mamprobi Survey—a screening survey for cardiovascular disease and risk factors in Africa: methodology and validity *

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The Mamprobi Survey is a cardiovascular disease prevalence sample survey in an African community in Ghana. This preliminary paper describes its methodology and validity. Response rate corrected for migration from the area was 73%. Subsequent sampling of non-respondents revealed only trivial reasons for non-attendance and only minor differences in health status, suggesting that estimates of disease prevalence by the survey were likely to be accurate.

In order to determine the prevalence of heart disease and cardiovascular "risk factors" in an indigenous African population, the World Health Organization established a cardiovascular diseases research team in Accra, Ghana in 1974. In conjunction with the University of Ghana Medical School, it conducted a community health survey in Mamprobi, a suburb of that city, in 1975–76. In addition to the establishment of accurate prevalence figures for cardiovascular disease, the survey located occult chest tuberculosis, hypertension, idiopathic cardiomegaly, and other conditions in the community. It also acted as a baseline survey for a subsequent follow-up study designed to determine the relationship of various physiological measures to the later development of cardiovascular disease. This paper describes the study methodology and its validity.

MATERIALS AND METHODS

The survey was launched in an urban community in a suburb of Accra, a large West African city. The area is representative of many types of West African urban life, with the entire social range represented. At one end of the area, fishermen and their families live in very simple wooden huts on the beach, while less than a mile away are the spacious bungalows of senior civil servants and professional people, many with servants' quarters. In between are the apartments and small houses of wage-earners. People from the major ethnic groups of the country have migrated to the area, although there is still a preponderance of Ga, the local people.

In order to obtain reliable data on the basic population, a census was undertaken by the team of the whole Mamprobi district shortly before the survey began. From this district, 10 enumeration areas out of 40 were chosen at random in order to

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provide a sample population of about 5000 persons aged between 15 and 64 years. The people in these areas were then approached personally over a 6-month period and asked to attend a centrally placed health centre, which had recently been built in the area by the Ghanaian Ministry of Health. Each afternoon, field workers called on about 30 households from the sample by referring to completed census forms and personally invited all the occupants of appropriate age to attend the survey about 2 days later. All those invited were given numbered identity cards and fields workers visiting the houses carried excuse-duty certificates to be given to employers the following day by those employees who needed them.

Methods used to encourage cooperation included public meetings, posters, loudspeaker vans, talking drums, church and social club announcements, and visits to local dignitaries to enlist their support. In addition, several prominent personalities spoke on television and there were radio announcements. Towards the end of the survey, free gifts and transport to the centre were offered as encouragements. If a person failed to attend after the first invitation he was visited up to four times. Finally, a sample of the hard core of non-respondents was visited and examined either in their home or at work. Apart from answering the standard questionnaire and having their blood pressure taken, these non-respondents were asked to give their reasons for not attending.

The actual examinations were carried out over a 9-month period from September 1975 to May 1976. When persons arrived at the health centre, basic personal data were recorded on a form which they then carried to the various investigation booths. The investigations consisted, in order, of: a urine test, height and weight measurements, a cardiovascular questionnaire, blood pressure and pulse rate measurements, a venous blood sample, finger prick packed cell volume (PCV), pulmonary function tests, Mantoux skin test, electrocardiogram, clinical auscultation, and chest X-ray. The whole procedure took between 1 and 1½ h and about 50 persons could be examined each day using about 16 field staff. Examinations were carried out on four mornings of each week, allowing one day for completion of paper work and for essential meetings and group briefings. Before the subjects left the health centre, their forms were checked for completeness and they were asked to return in 2 days for a reading of the Mantoux test and for any necessary repeat examinations. It proved possible to have the X-rays films processed and the forms checked within 24 h so that any further procedures needed could be arranged on the second visit.

The urine was tested using " Combistix " (Ames Co., England). Diastolic blood pressure was taken as phase IV (muffling) of the Korotkoff sounds and the pressure measured after at least 15 min of rest. Venous blood samples for biochemistry (non-fasting) and electrocardiograms were taken on people aged 35 years or more and PCV was estimated on all subjects, using blood taken by finger prick. The biochemical analyses performed on the sera were those for total and fractional protein, uric acid, and cholesterol. Red cells were examined for haemoglobin type and glucose-6-phosphate dehydrogenase deficiency. The London School of Hygiene cardiovascular questionnaire (*1*) was translated into the principal local languages. These translations were checked by having them back-translated by a Ghanaian. Socioeconomic status was scored on a 10-point scale based on material possessions by the method of Pole & Ikeme (*2*).

Each person was given a form and asked to carry it during the survey. The investigations were listed on the form in the same sequence as they were actually carried out, so that findings could be directly entered for submission to the computer to minimize transcription errors. The data were entered on punched cards within a week and checked for completeness and logic by a special computer program. After being transferred to magnetic tape, they were analysed, using locally available computer facilities at the University. Computer analysis was performed with the help of programs written specially by one of us (D.P.).

RESULTS

While the detailed findings will be the subject of subsequent papers, it is the intention of this communication to determine the representativeness of the population and the validity of the findings.

Analysis of the census revealed the 10 enumeration areas selected to contain a total population of 10 735, of whom 5636 (52.5%) were aged 15–64 years; 172 (1.6%) were older than 64 years and 4927 (45.9%) were under 15 years of age. Of those aged 15–64 years, 3745 attended for examination, leaving an apparent number of 1891 (34%) who, although recorded in the census, did not attend. Towards the end of the survey, this hard-core group of non-respondents was randomly sampled by a stratified

Table 1. Response rates at various ages

Age group (years)	Total No. of people in census	Apparent response rate	Percentage of non respondents found to have left the area [a]	Corrected response rate
15–19	1187	56 %	23.9 %	62.4 %
20–24	1008	70 %	26.0 %	75.8 %
25–29	880	68 %	24.3 %	73.8 %
30–34	649	67 %	41.6 %	77.3 %
35–39	507	79 %	24.0 %	83.2 %
40–44	447	62 %	21.0 %	67.2 %
45–49	376	70 %	21.7 %	74.7 %
50–54	288	66 %	30.0 %	73.3 %
55–64	294	74 %	33.3 %	81.0 %
Total	5636	65.5 %	26.7 %	73.0 %

[a] Figures from a sample stratified by sex and enumeration area as well as age.

technique that reflected the age, sex, and enumeration areas of the non-respondents.

It was found that 26.7% of the sample (equivalent to 8.9% of the original population) had permanently left the area since the initial census 6 months before. It was therefore possible to revise the estimate of non-respondents, basing it on the actual number of persons remaining. The original number asked to attend (5636) was effectively reduced to 5131 and, as the number responding was 3745, a corrected response rate of 73% was obtained. The response rate was higher for women than for men. The educational level, average age, proportion of the two sexes, and proportion of ethnic groups in those who had left the area were not significantly different from these factors in those remaining.

When asked why they had not attended, the great majority of non-respondents could give no pressing reason and in only 10% was it clearly related to their health or the nature of the survey. Twice as many refused because they felt healthy as those who refused because of ill-health, but in both cases the numbers involved were small. The commonest excuse was temporary absence (28%), followed by " had not been asked " (23%) and " did not want to " (22%).

The response rate varied at different ages, being highest in the 35–39-year age group and lowest among 15–19-year-olds (Table 1). Apart from one enumeration area, persons with poor literacy levels (20–30%) had a low response rate (60–65%), whereas those with good literacy levels (50–70%) showed a high response rate (75–85%). The same relationship was observed between socioeconomic score and response (Fig. 1). The exceptional area was the one with the highest average socioeconomic status. In this " elite " area cooperation was particularly low. The resentment of intrusion into the

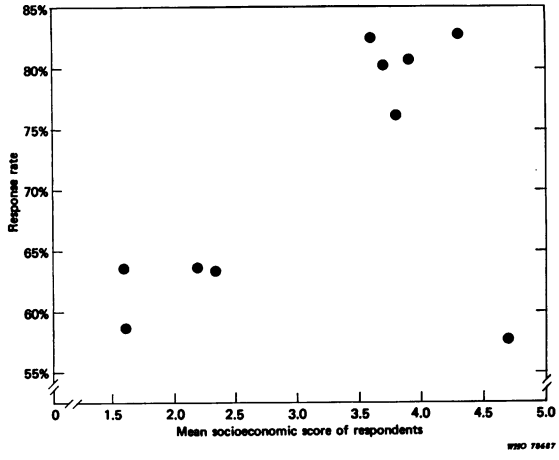

Fig. 1. The ten enumeration areas studied, showing the relationship between response rate and socioeconomic score. Apart from the most " elite " area, there is a clear positive correlation.

Table 2. Responses to the questionnaire

Symptom	Sex	Respondents	Non-respondents
Any chest pain	M	26.9 %	27.1 %
	F	25.7 %	27.0 %
Severe chest pain	M	12.7 %	16.7 %
	F	14.3 %	18.0 %
Shortness of breath [a]	M	14.7 %	3.1 %
	F	19.3 %	7.9 %
Total number of people involved	M	1635	96
	F	2110	89

[a] Difference statistically significant.

privacy of this group was even expressed by the release of dogs when field workers called.

The responses to the questionnaire with respect to chest pain were very similar for the non-respondents and for those who did attend: about 27% admitted to some pain and 17% to a severe episode. However, in the case of breathlessness, most of those interviewed in the home or at work denied shortness of breath whereas about a sixth of those attending at the health centre answered positively (Table 2).

The blood pressures of the non-respondents were consistently higher than those of the persons who did attend (Fig. 2) although, because the sample was small, the differences did not always reach statistical significance in every age group. In general, systolic pressures were 1.1–1.3 kPa (8–10 mmHg) and diastolic pressures 0.7–0.8 kPa (6–7 mmHg) higher in the non-respondents.

The socioeconomic score, as calculated for the respondents from their material possessions, was compared to two measures of socioeconomic level for the entire sample frame taken from the census:

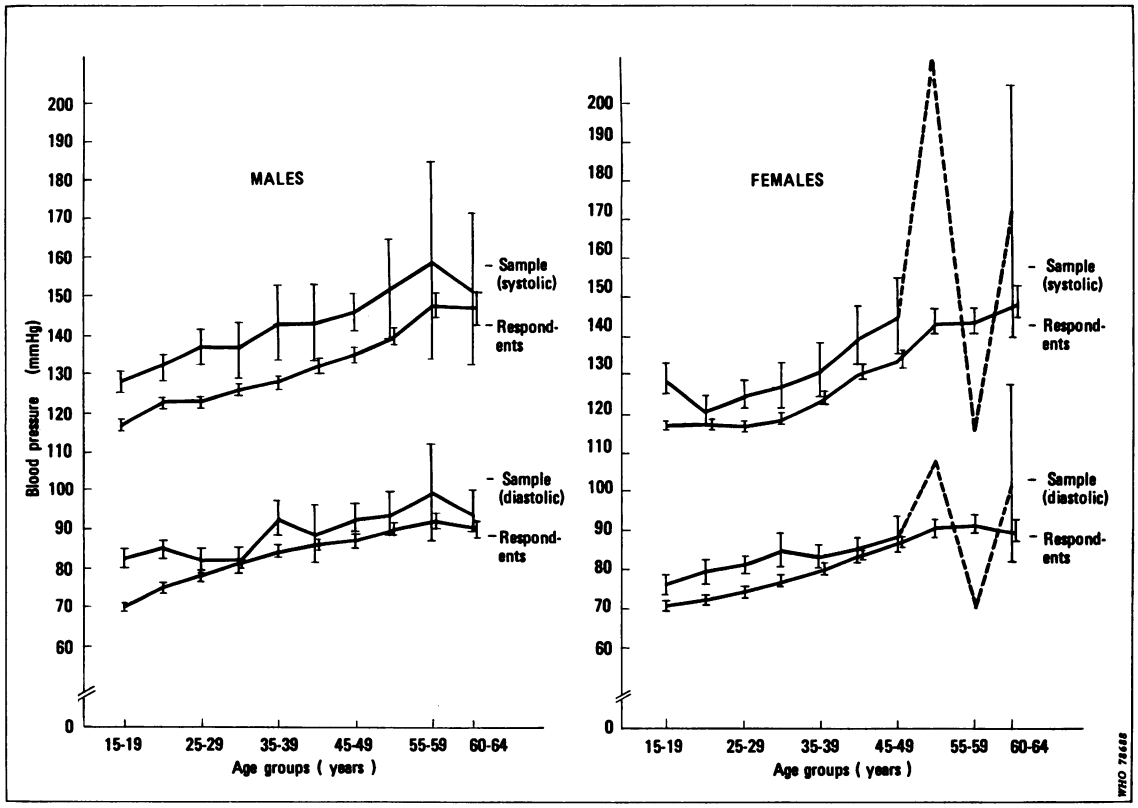

Fig. 2. Comparison of average blood pressures (in mmHg) of respondents and non-respondents; the latter were consistently higher in most age groups. Vertical lines are standard errors; dotted lines refer to very small groups. (1 mmHg = 0·133 kPa).

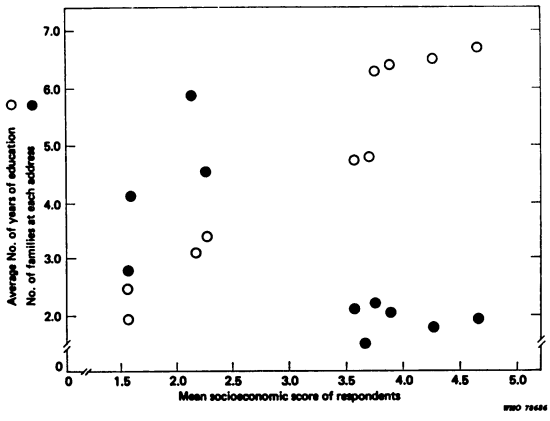

Fig. 3. The ten enumeration areas studied, showing the relationship between socioeconomic scores of respondents: (*a*) average number of years of education and (*b*) number of families at each address, both taken from the census. The relationship is a strong one.

the average number of years of education and the number of families at each address (Fig. 3). The clear relation between the different measures confirmed that the survey findings on respondents reflected the situation in the community as a whole.

DISCUSSION

In countries where almost the entire population is literate and ample technical resources exist, the main problems involved in planning and implementing sample surveys have been solved. This is not so in many developing countries, where the handicaps include the absence of a complete and convenient frame or list of people for sample selection, difficulties of travel and communication, and the problem of devising questionnaires and interview techniques that respondents will accept and can understand (*3*). These problems are made worse by the high degree of movement among urban residents and their low educational level.

The difficulty of performing community health surveys in developing countries is particularly unfortunate in view of the fact that these countries need reliable data on the amount and relative importance of various diseases. In planning the Mamprobi survey, we attempted to develop a methodology that would overcome a number of these handicaps while at the same time obtaining thoroughly accurate and trustworthy data on chronic disease as it exists in the community.

First, we kept to a well-circumscribed field of operation: we took one suburb of a city, kept the investigations performed to a bare minimum, and concentrated on the productive age groups likely to suffer the highest toll from chronic disease. The search for risk factors for ischaemic heart disease was confined to those aged 35–64 years. Other studies carried out in Ghana on schoolchildren (*4*) and rural people (*5*) were thus complemented.

Second, the technique of choosing 10 clusters (enumeration areas) from within the whole Mamprobi district was used to ensure a well-stratified selection of socioeconomic and cultural groups while reducing travelling time and other logistic problems to a minimum. Since the clusters corresponded to those used in the census, it was possible to match the survey and census data on the sampling frame and, since the clusters formed well demarcated communities, publicity and recruitment could be more efficiently handled than if the whole district had been canvassed.

Third, the new health centre was used as a focal point of the survey. It was prestigious and had the confidence of the people, therefore serving to establish the *bona fides* of the survey team. Health propaganda from the Ghanaian Ministry of Health associated with the establishment of the centre also served to publicize our survey. The Ministry was, of course, happy that the survey in turn helped to introduce more people to the centre, thus accelerating its acceptance as a local source of health care.

Finally, the basic data were all collected and verified by the team and not abstracted from existing records of unknown veracity. The census performed immediately before the survey was personally supervised by the survey team. In preparation for the census, the streets and dwellings were all mapped and renumbered with the help of the Accra City Council, who were persuaded to cover the survey area to fit in with our timetable. The survey techniques themselves were tested on students and hospital staff before they were considered reliable. The questionnaire was translated from the London School of Hygiene protocol into the local languages of Ga, Twi, and Ewe, and then back into English by different linguists to verify its accuracy. Senior team members periodically checked the survey themselves to ensure that no unexpected departures from the established techniques were developing. Field staff responsible for measurements were trained by the team personally and frequently checked.

As a research endeavour of this magnitude was

new to most of the staff, active quality control mechanisms were considered to be essential, especially in the early stages of the survey. The tendency to cheat a little and perhaps replace missing information with guesses had to be prevented.

The degree of movement of the population was a surprise, 26.7 of the non-respondents having left the area by the end of a 6-month period. The actual migration rate could have been greater than this, as people may have left the area after having been examined. Therefore, the actual attendance rate is more accurately set at 73%. While not outstanding by comparison with European and American experience, it probably represents the best that can be expected from a developing country. Males and those in the youngest age range were the least cooperative; employment was probably an important factor in this. Cooperation was generally least from those areas with lower levels of education and the highest illiteracy rates, which is likely to be a measure of their sympathy with scientific medical thinking as well as the more obvious factor of their understanding the publicity. The cost of attending the survey, in terms of transport and time away from work, may also have been a factor. However, it is also of interest that the most " elite " area showed the lowest level of cooperation, as has been noted in other situations (*6*).

Our main fear was that there would be a difference in both objective and subjective health between those who attended and those who did not. If the sick were to attend and the non-respondents were all healthy, then estimates of incidence could be up to 25% too high. Another possibility was that the sick would not attend, in which case the amount of disease in the community could be seriously underestimated. The importance of sampling the absentees was therefore clear to us. It was not of course possible to repeat the entire survey procedure in the home or at work, but it proved possible to administer the questionnaire and to take a blood pressure reading on all subjects.

Complaints of chest pain on exertion or a severe attack of central chest pain were made with equal frequency by respondents and non-respondents, but complaints of breathlessness on exertion were not. This would indicate that the conclusions drawn from the question on breathlessness might overestimate its frequency in the community as a whole. The blood pressure readings taken at home or at work were higher than those taken at the survey site. This does not necessarily reflect a greater frequency of hypertension but may be due to the conditions under which the readings were taken. The unexpected arrival of field workers at the door is clearly a different situation from a planned visit to the survey site, where blood pressure measurements came late in the list of investigations performed. However, it does mean that, if anything, the estimates of hypertension in the community were on the low side rather than the reverse; this is significant in view of the high prevalence of hypertension.

Our main concern was that the respondents should be fair representatives of their communities. The close relationship between their socioeconomic status and similar indices from the census reassured us that this was the case.

CONCLUSION

The importance of precise data on chronic disease in the community when planning preventive and control measures is without question. In the Mamprobi Survey we have attempted to overcome the difficulties encountered by community health surveys in developing countries. Our experience should open the way to further studies in other types of community and in other developing countries. The analysis of non-respondents suggests that, although the response rate was only 73%, the findings in respondents represent a valid measure of the prevalence of disease and possible risk factors in the community.

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RÉSUMÉ

ENQUÊTE DE MAMPROBI: DESCRIPTION ET ÉVALUATION MÉTHODOLOGIQUES D'UNE ENQUÊTE DE DÉPISTAGE SUR LES MALADIES CARDIO-VASCULAIRES ET LES FACTEURS DE RISQUE EN AFRIQUE

L'enquête de Mamprobi — faubourg d'Accra (Ghana) — a été entreprise pour déterminer la prévalence des maladies cardio-vasculaires et les facteurs de risque dans une communauté urbaine d'Afrique occidentale. Sur une population totale de 5636 personnes âgées de 15 à 64 ans, 3745 (soit 66%) ont subi un examen approfondi qui a permis de noter les symptômes présentés, certaines caractéristiques physiques et biochimiques, et les anomalies décelées par la radiographie ou l'électrocardiogramme. Une enquête au hasard portant sur la fraction de population qui s'est soustraite à l'examen (soit 34%) a montré que 8,9% du total des personnes convoquées pour cet examen avaient quitté la région, ce qui donne un taux corrigé de réponse de 73%. Les membres du groupe réfractaire interrogés n'ont invoqué que des motifs d'importance secondaire, et on a constaté que le taux de réponse était en rapport avec le sexe, l'âge et le niveau d'instruction. Les réponses fournies par eux au questionnaire étaient analogues à celles obtenues lors de l'enquête principale, mais leur pression artérielle s'est révélée légèrement plus élevée que celle observée dans le groupe initial. Le succès de l'enquête peut être attribué au fait que le terrain d'expérience était limité et bien défini, ainsi qu'à la technique d'échantillonnage par grappe géographique qui a été appliquée, à la disponibilité d'un centre de santé où ont pu se dérouler les examens, enfin au rassemblement de données originales présentant une précision et une actualité que n'auraient pas eues les données consignées dans des dossiers existants plus ou moins fiables. Après l'examen complémentaire effectué sur un échantillon de réfractaires, il a paru raisonnable de conclure que les résultats de l'ensemble de l'enquête seraient représentatifs de nombreuses communautés urbaines africaines. Ces résultats feront l'objet de communications ultérieures.

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