SELF-REPORTED AND INDEPENDENTLY ASSESSED MEASURES OF POPULATION HEALTH COMPARED: RESULTS FROM THE ACCRA WOMEN'S HEALTH SURVEY.

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INTRODUCTION

In every attempt to determine the health state of a population, the challenge is to select the most parsimonious set of measures that will capture the salient features of that population's health. Generally, it is assumed that so-called objective measures, physical examinations, performance tests and biological assays, are a more reliable guide to the health status of individuals and populations than descriptions based entirely on self-reported health. This may not be the case for conditions for which such observations and tests are more difficult. Mental illness/depression or pain, for example, are both difficult to measure objectively. An additional consideration in deciding the content of health surveys is whether or not we are concerned with the correct diagnosis of health or illness at the individual or the population level. Clearly, for the treatment of illness in individual patients, it is important that the self-reported and objectively assessed measures are consistent with each other at the level of the individual. On the other hand, if we are concerned more with public health interventions and their effect on population-level distributions, then overall patterns matter more than the consistency of measures at the level of the individual. The relationships between these different levels of health – individual and population – is important to establish empirically but we must accept that assessments of the validity and reliability of individual and population health measures will have to employ different criteria depending on the nature of the assessment undertaken.

In 2003, the PIs conducted a major health interview and examination survey amongst a representative sample of approximately 3200 women usually resident in Accra, Ghana that allows us to draw both individual and population-level comparisons. The women were selected by a two-stage cluster probability sample stratified by socio-economic status from the 2000 national population census. Older women were progressively over-sampled to provide a sufficient number of cases of older women for analysis. All of the women consented to being re-visited for a second interview and to a further medical examination in the future. Accurate address and identifying information with global positioning system co-ordinates have been maintained in confidential files in order to provide feedback to the women following their interviews and examinations

The primary objective of the 2003 survey was to quantify the burden of disease attributable to communicable and non-communicable illnesses. Linked with this general goal was the interest in identifying risk factors and exposure variables for the salient conditions identified in the study. [1] The specific objectives were: 1) to obtain information on the health of women beyond the

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reproductive ages and thus provide the first description of morbidity amongst the elderly, here defined as 50 years old and greater, in an African city; 2) to collect self-reported data on general health and specific health domains to allow comparison with similar data being collected internationally and in Ghana in 2003 by the World Health Survey supported by WHO [2]; 3) to evaluate the value of reference "anchoring vignettes" as a way of correcting for reporting bias in self-assessments of health status [3]; 4) to compare the self-reported morbidity data collected at home with the health assessments based on the physician's medical history and examinations and tests in the clinics; 5) to estimate the prevalence of disease from a comprehensive medical history and physical examination by combining reports on particular conditions with disease-specific constellations of symptoms, physical examination findings and the results of laboratory and radiographic testing; and 6) to create a baseline for a longer-term cohort study of women's health in Accra.

STRUCTURE OF THE STUDY

Household Health Survey (HHS)

A household information sheet was first completed to obtain basic personal, demographic and socio-economic information on the household. In general, the variables on the household roster were derived from the 2000 National Population Census to permit comparisons of the sample with the full census data. The Ghana Statistical Service provided a 10% public use sample of households for all enumeration areas (EAs) in Accra.

Following this, the eligible woman chosen in advance from the prior listing operation in each household was interviewed in private. The interview included a full history of marriages and pregnancies, and detailed information about self-reported general health and selected specific conditions. The HHS used the Short Form 36 (SF36)[4] to measure general morbidity and the World Health Survey (WHS) [5] questions to assess 11 health domains. The full maternity and marriage histories were modelled on the Demographic and Health Survey (DHS) for Ghana. The section on reproductive health was developed based on the experience with the reproductive health survey in The Gambia.[6] Questions on specific health conditions and risk factors were obtained from NHANES[7] and the WHO STEPS initiative to measure risk factors for non-communicable diseases. Thus, the survey instruments consisted largely of questions and modules previously validated and extensively tested.

The inclusion of "anchoring vignettes" in the interview schedule was intended to assist with two persistent problems in social survey research in general and health research in particular. [32] The first problem arises when the investigator and the respondent interpret the questions posed in different ways. The second arises from the need to ask about complex concepts and conditions that can only be identified by example. To deal with these problems, the concept of "anchoring vignettes" has been introduced into a number of social surveys including the World Health Survey. Essentially, each vignette consisted of a brief description of a hypothetical person with a health problem. Respondents are asked to rate the severity of these reference conditions. It is then possible to index the individual responses to the direct morbidity questions and correct for biases that may be associated with, for example, health state, social class, ethnic group or education. The Accra survey followed the WHS recommendations and used vignettes covering health domains including mobility, affect, pain, sleep, personal relationships, vision, energy, cognition, self-care, general health,

hearing and breathing. The vignettes chosen for the Accra study were those used in the Ghana 2003 WHS survey with the names all changed to female names common to a range of ethnic groups in Ghana. These four sets of vignettes were rotated systematically for each woman interviewed so that the full range of conditions could be assessed.

Comprehensive Medical and Laboratory Examination (CMLE)

After the HHS was completed, the women were invited to attend the out-patient clinic at Korle Bu Teaching Hospital at the University of Ghana, for the comprehensive medical and laboratory examination. A physician performed the comprehensive medical history and complete physical examination and performance tests. Blood was drawn for a complete blood count, electrophoresis for haemaoglobinopathies, fasting blood glucose, cholesterol and triglycerides and Pap smears were performed. Confidential HIV testing was offered with voluntary pre-test and post-test counselling by trained HIV health workers. An aliquot of blood was banked at the Noguchi Memorial Institute for Medical Research (NMIMR), with written informed consent, for future medical research. Medical advice and recommendations for treatment were provided by the examining physicians and referrals to specialists were made when necessary.

This study was approved by the Human Subjects Review Committee at the Harvard School of Public Health and the Noguchi Memorial Institute for Medical Research Institutional Review Board (FWA # 00001824), University of Ghana.

The study area.

The area chosen for this study was the administrative unit known as the Accra Metropolitan Area, the core urban area within a larger region known as Greater Accra. There is considerable variation in socio-economic status and ethnic composition within this area.[8] The female population totalled 839,310 in the 2000 Population and Housing Census of whom 38.2% were under age 18. Fertility was high - average parities for the 50-54 year olds was 4.3 children but current total fertility rates are below 3 children per woman. Some 16% of the children ever-borne alive to these women had died by the time of the census. This indicator of high childhood mortality is linked to the unsanitary living conditions. Only 42% of households had a piped indoor water supply, only 19% had exclusive use of a toilet and only 41% of these toilets were WCs or pit latrines. There is a wide diversity of living conditions in the metropolitan Accra population as well as several distinctive ethnic groups (Ga, Akan, Ewe in the main) that allow us to draw out differentials in health status and associated exposure variables and risk factors[9]

The sampling frame, design and size.

The 2000 Population and Housing Census provided a full enumeration of the population of Accra on census night, 26 March 2000. In the Accra metropolitan area, there are 1731 Enumeration Areas and each contains an average of 959 people. This census and accompanying maps were used to select a sample of women truly representative of women aged 18 and older usually resident in Accra. To increase the efficiency of the sample, the EAs were stratified by socio-economic status using the master sample constructed by Megill.[10] Household facility indicators and education were used to stratify all EAs in Accra into four categories. The four SES (socioeconomic educational status) categories contain roughly equal numbers of people since they were derived by dividing the SES

index into quartiles. To keep the design effect small, the "take" of women was restricted to an average of 18 women per EA.

Once the 200 sample EAs had been selected with probability proportional to population size, eligible women usually resident in Accra aged 18 and older were listed by name and address. Over 30,000 names and addresses were collected. From this frame, study women were selected with probabilities fixed according to the SES status of the EA and the age group of the women. Older women were progressively over-sampled to allow us to have at least 200 women in each of the resulting 16 cells (4 socio-economic categories, 4 age groups). Previous work on mortality, health and sanitation in Accra by Songsore et al [11] and Stephens et al [12] has demonstrated the marked contrast in the living conditions of households resident in different parts of the Accra metropolitan area.

The overall sample size of the 2003 WHSA was derived based on several considerations. First, the anticipated prevalence of certain important health states were estimated from other studies in Ghana and from community and reproductive health surveys elsewhere in West Africa.[13, 14] The true prevalence of the illnesses of this population were unknown until the 2003 WHSA data were collected. The general conclusion based on these considerations and the resources available was that the overall target size of the sample should be 3200 in total. It was decided to distribute this total equally amongst all 16 cells (4 socio-economic status categories and 4 age groups), thus yielding a sample of 200 women in each cell.

CHARACTERISTICS OF THE WOMEN

The size of the original cohort was 3200 women. The initial intent of the 2003 Women's Health Study of Accra was to include all of the women in the comprehensive medical examination. The clinical examinations and laboratory tests proved more costly than anticipated and as some anticipated additional funding was not forthcoming, 1328 women, with priority given to those 50 and over, were examined in the clinic. Final numbers are shown in Table 1. The numbers are sufficient in power to detect major illnesses in the population based on the results from the comprehensive medical examination, but may be insufficient to detect rare illnesses or low-level risk factors.

Figure 1: The age distribution of the sample shows the effect of over-sampling the elderly when compared with the 2000 national population census.
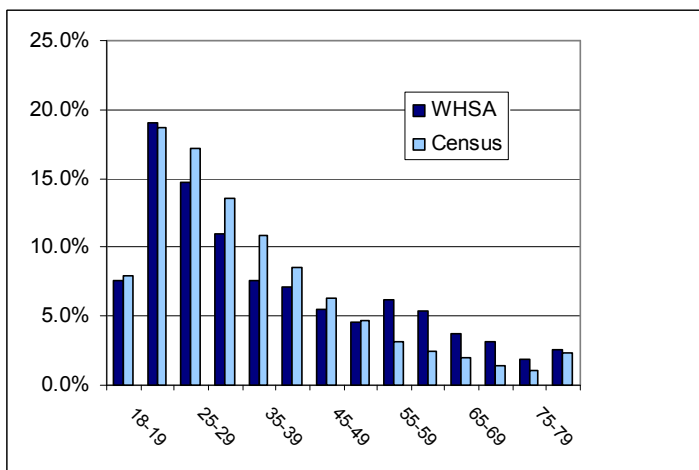
The sample can be readily weighted to provide estimates of the health for all women in the city taking into account the 2000 census age distribution. The results presented below are unweighted.

Living conditions. The most common type of dwelling was a compound with several rooms (62.5%), 52.5% of which were covered with a metal roof. 43.4% of the women rented the dwelling. The

main source of drinking water was a pipe inside for 52.8% and a pipe outside the dwelling for 44.5%. The most common type of toilet facility was a public toilet (35.3%), followed by an improved pit latrine (16.8%), and a bucket or pan (10.5%). The main source of cooking fuel was charcoal (64.8%) followed by gas (27.2%).

Education. Most of the women had received some level of formal education. Of the 76.6% reporting that they attended school, approximately 16% attended to the primary school level only, 54% attended middle school, 21% attended secondary school and 9% received an education higher than secondary schooling. Almost a quarter of the women reported that they were co-wives.

HEALTH ASCERTAINED FROM PHYSICAL EXAMINATION AND TESTS

We will begin with a brief overview of the results from the physicians' examinations, the physical measures and the laboratory tests since health professionals generally regard these are the reference standard for the capturing the health status of a population, in this case the women of Accra.

Physically, the women were quite short, 151.1 cm (S.D. 6.25 cm) weighing on average 63.6 kilos (S.D. 16.7 kg) with little variation by age. As Table 1 shows, however, a significant proportion, particularly amongst the older women, were obese or morbidly obese – 35% of the whole population.

Table 1. Physical measures by age from the clinical examination

Age groups	% BMI>30	% waist-hip ratio >0.8
18-24	11.0	34.4
25-34	29.1	48.4
35-44	40.0	72.5
45-54	44.7	72.6
55-64	43.0	76.7
65 & over	36.4	82.6
All	34.6	66.0
Total	1254	1258

In this study population, 65.9% of women met the criteria for a diagnosis of overweight and 6.1% as morbidly obese. Another index to measure risk for obesity related disease is the Waist Hip Ratio (WHR) that quantifies the relationship between measurements of waist and hips. Overall obesity, however, is still of greater risk than body fat storage locations or WHR. A WHR ≥1.0 is in the danger zone, with risks of heart disease and other ailments connected with being overweight. For men, a ratio of .90 or less is considered safe, and for women, .80 or less.[15] In our study population, 66.0% of all women had a WHR of > 0.8 and 4.3% had a WHR of 1.0 or greater. Evidence from epidemiological studies shows waist circumference to be a better marker of abdominal fat content

than WHR and that it is the most practical anthropometric measurement for assessing a patient's abdominal fat content before and during weight loss treatment.[16] The WHSA identified 50.7% of the women with an abdominal girth >88 cm.

Consequently, many of the other physical measures related to obesity were also elevated in this population. Hypertension, as defined by a systolic blood pressure of $\geq$ 140 mm Hg or diastolic blood pressure of $\geq$ 90 mm Hg, was identified in 48.8% and 46.2%, respectively, of all women examined. The range of systolic blood pressures ranged from 80 to 230 mm Hg. The range of diastolic blood pressures ranged from 50 to 150 mm Hg. Table 2 compares blood pressure results by age group.

Table 2. Blood pressure levels from the clinic examinations.

Age groups	Upright systolic over 140mmHg	Upright diastolic over 90mmHg
18-24	5.2	7.2
25-34	8.2	10.3
35-44	34.4	35.2
45-54	64.3	62.4
55-64	81.7	75.0
65 & over	83.9	74.0
All	48.8	46.2
N	1292	1289

The results of the lipid panel measurements revealed that the serum total cholesterol (TC) was elevated in 25% of all women evaluated (Table 3). High Density Lipoprotein, cholesterol (HDL), the lipoprotein which confers a protective cardiac benefit, was elevated in only 66/998 (6.6%) of all women tested in this study. In fact, most of the women in the WHSA (590/998, 59.1%) had a lower than normal HDL level. When the TC was elevated, only 26/250 (10.4%) had an elevated HDL, while 116/250 (46.4%) had a lower than normal HDL and 108/250 (31.6%) had a normal range HDL value (p<0.01).

The TC to HDL ratio was calculated for 983 women. The mean value was 5.12 SD $\pm$ 6.0 (range 0.13 to 74.09). Overall, 441 (44.9%) had an optimal ratio less than 3.5:1; 294 (29.9%) had a ratio between 3.5:1 and 4.9:1; and 248 (25.2%) had an abnormal ratio $\geq$ 5.0:1. There was a significant correlation with TC/HDL ratio and obesity measured by BMI, WHR and WC (p<0.01).

Low Density Lipoprotein, cholesterol (LDL), the unfavourable lipoprotein, was elevated in 149/998 (14.9%) of all women studied. While there was no significant association with LDL and obesity, there was a trend for higher LDL levels in the obese. LDL was increased above the normal test range in fewer underweight women than any other weight category. 6/80 (7.5%) of underweight women (BMI < 18.5) compared to 41/277 (14.8%) normal weight women, 45/260 (17.3%) over

weight women and 50/341 (14.7%) of obese women (BMI ≥ 30.0) had an increased in LDL-cholesterol.

Fasting serum triglycerides were elevated in 53/998 (5.3%) of the population studied. Most of the women had a low to normal result (891/998).

Table 3. Cholesterol and fasting blood sugar levels

Age groups	Fasting blood sugars above 6.5	Elevated cholesterol
18-24	0.0	11.1
25-34	2.2	17.9
35-44	6.7	21.0
45-54	9.3	24.2
55-64	15.2	33.8
65 & over	13.7	31.4
All	8.4	25.0
N	1256	989

The complete blood count was performed by an automated analyzer. Results are available for 970 women. Anaemia, as defined by a haemoglobin less than 12 g/dl was identified in 254 (26.3%) of all women tested. Only 3.5% of the women tested had a haemoglobin level < 10g/dl. Of those diagnosed with a haemoglobin less than 12 g/dl, 41.6% had MCV RBC micro indices suggestive of microcytic anaemia and none had an index suggestive of a macrocytic anaemia. An assessment of haemoglobin type was available for 582 women. Sickle cell anaemia (SS) was identified in 1 of 1049 (0.1%) women evaluated. The most common haemoglobin types were normal (AA) identified in 72.8%, AC variant in 9.8% and sickle cell trait (AS) in 15.5% and other (1.8%).

Visual acuity was measured by the Rosenbaum Pocket Vision Screener. Few women who stated that they wore glasses brought them for their clinical examination, so most of the readings are uncorrected. When glasses were available, the visual acuity was performed with and without the glasses. These data represent uncorrected visual acuity. A normal exam 20/20 was recorded for 8.4% of all women examined. 41.0% of examined women had a visual acuity of 20/40 or better and 59.0% had a visual acuity of 20/60 or worse.

A pelvic examination was recorded for 1206 (90.7%) women. The slides for the Pap smears were read by the pathologists at Korle Bu Teaching Hospital. The Pap smear was judged to be satisfactory for 66.7% of the smears and inadequate for assessment for 2.4% of all Pap smears submitted to pathology. Most (89.9%) of the specimens were read as no dyskaryosis, a normal result. Only 1% (n=8) of the smears were read as having mild, moderate or severe dysplasia. There were no cases of cervical cancer identified based on the Pap smear results for any age group.

Statistical analysis was performed using the goodness of fit chi-square test to determine if the observed results were significantly different from the expected results. The analysis was performed by recoding the original reports into the Bethesda classification.[17] There is a statistically significant difference ($p \leq 0.001$) in the observed results and the expected results of the Pap smear readings. The external examination was determined to be abnormal in 11.5% of the women with prolapse of the bladder, prolapse of the uterus, genital lesions and evidence of circumcision being the most common reported abnormalities. The internal examination was reported to be abnormal in 37.2% of the women. Of the 1206 women who had consented to the internal pelvic examination, 583 women were age 50 years or older (48.3%). There were a total of 13 (1.0%) cervical lesions that were suspicious for malignancy on the clinical examination, 8 (61.5%) in the group of women age 50 and greater. Bloody cervical discharge was identified in 25 of the 583 women (4.3%) age 50 years and older compared to 22 of 623 women (3.1%) aged less than 50 years (p= NS).

HIV testing was performed using the Determine HIV 1/2 Rapid Test (Abbott Laboratories, Abbott Park, Il.). All positive and indeterminate tests were repeated using the InstantScreen Rapid HIV 1/2 Assay (Morwell Diagnostics GmbH, Zurich, Switzerland). A total of 1307/1328 (98.4%) women consented to HIV testing. 35 (2.8%) of these women tested positive by a rapid test and by a confirmatory test with the peak prevalence of 4.8% in the 25-34 age group. [18]

This battery of examination data coupled with information from physical and biological tests amounts to a wealth of information on this population's health. The general impression is one of a population in reasonably good health with the exception of the impressive combination of elevated risk factors for cardio-vascular disease – obesity, diabetes, high cholesterol levels and high blood pressure. Levels of anaemia are low, however, and HIV prevalence is also low with few signs of widespread cell changes in the cervix. Morbidity rises steeply with age, however, and we see evidence of many untreated conditions including uncorrected vision problems and severe dental decay. The picture of these women's health is of course very much affected by the selection of tests and assessments used in the clinic. As we will see below, fevers, probably many malarial, were very common in this population but we did not analyze blood slides for parasites during this examination. For practical and cost reason, we omitted all assays based on stools or urine and so we have little information on infection with intestinal parasites and the like.

The interesting question is thus whether these conditions that we tested for would be picked up by less expensive or intrusive methods including self-reported morbidity or medical histories. Another angle on the same question is whether the home interview and the medical history brought to light conditions not identified by the examining physicians or the laboratory tests.

HEALTH CONDITIONS REPORTED IN THE HOME INTERVIEW.
The home interview began with some very general questions on self-reported health. Excellent or very good health was self-reported by 45.5% of all women during the HHS, while 34.8% self-reported good health, 17.9% fair health and 1.8% poor health. In comparison to their health one year ago, 30.8% reported that their health was much or somewhat better, 46.3% the same, 20.8% somewhat worse and 1.9% much worse. 45.5% of the women reported that they felt that they were as healthy as anyone they know, while only 3.1% felt that they seem to become ill easier than other people. Only 1.0% of all women felt that their health was most likely to worsen.

The pronounced age gradient in self-reported health status seen in the examination and laboratory data is borne out by the data in Figure 2. By age 60, the majority of women felt that their health was only "fair" or "poor" and compared to a year ago, a majority rated their health as "somewhat worse" or "worse". Using the SF36 General Health Index for which the US median is 72, we find that above age 60, over half are rated below 70.

Figure 2. Self-reported health states.
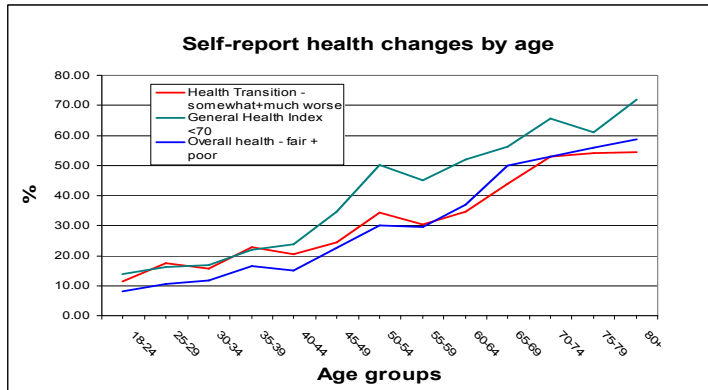
As a crude measure of the seriousness of these conditions, for the 12 months preceding the HHS, 53.7% reported that they took measures to improve their health. The most common steps were to increase physical activity (32.6%), to take vitamins (24.1%), receive medical treatment for illness (18.2%) and change diet or eating habits (15.9%). Of those who stated that there were barriers to health improvement measures (24.3%), the most common barriers included cost (31.1%), lack of will power or self-discipline (29%) and lack of time (21.2%). 85.1% of the women reported that their health was no financial drain for them while only 2.1% reported that they spent all of the monthly income or spent savings or borrowed money for health related reasons.

Figure 3: SF-36 scores from the household health interview.
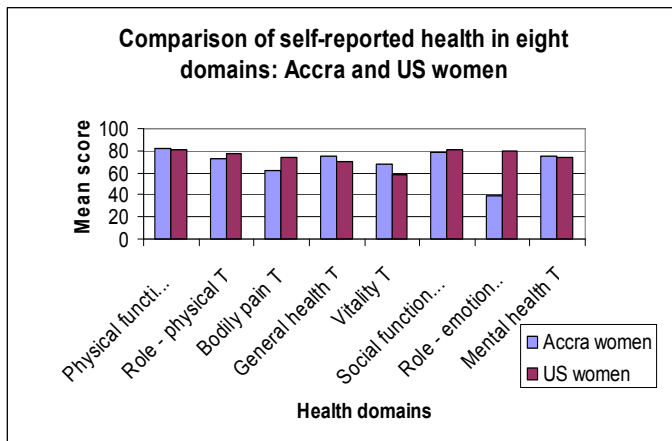
This optimistic view of their health is reflected in the comparison of the Short Form 36 mean scores on eight health domains from the WHSA and a sample drawn from the US general population (Figure 3).[19] Note that the Accra results have not been standardized by age for the comparison with the US data for this preliminary presentation. Apart from the lower scores on the Role-emotional scale (unable to work as much or as carefully, accomplished less due to poor health), the Accra women's self-reported health compares favourably with those in the US, especially with reference to the measure of vitality (more full of pep and energy and less tired and worn out than their US counterparts). These data present a *prima facie* case for an analysis of the cut point shift and their determinants in the Accra population[20].

Fertility has been declining steadily for some time in Accra and seems to be particularly low in Accra. The cumulated period-cohort parities show that just before 2003, the total fertility rate had dropped to 2.4 births per woman, including women of all educational categories. This decline can be seen across all cohorts.

In terms of reproductive health history, 11.7% of the women age ≤ 54 years old interviewed were currently pregnant. 2028 (82.1%) reported being pregnant at least once for even a short period of time and 34.4% of the women were post-menopausal. 2796 women (89%) of the women answered the questions related to birth control. 35.2% report ever using some form of birth control, with the most frequently used forms included oral contraceptives (26.7%), male condom (24.9%), and hormone injections (20.5%).

Most of the women have never smoked (98.5%) and 1.1% are current smokers. 42.2% of women reported that they consumed alcohol, with most of the women who consume alcohol report drinking one or two drinks at weekends. Most of the women (65%) were gainfully employed, 11.5% were students, and the rest were retired, unemployed unable to work or unemployed able to work.

In the self-reported home interviews, therefore, we learn more about aggregates of individual conditions rather than specific signs or symptoms but it may be that this is the way the symptom complexes are perceived by the individuals concerned. The link between physical and mental health emerges more clearly. In addition, we learn about risk factors and courses of action taken to alleviate morbidity and its consequences. Age strongly affects levels of morbidity amongst all social classes and we see both the effects on communicable and non-communicable disease on the women's health. Overall, the impression of a population in reasonably good health as judged by the laboratory data is confirmed.

HEALTH CONDITIONS REPORTED IN THE MEDICAL HISTORY

The medical history differs from the home interview in that it was taken by physicians in a hospital out-patient clinic prior to the full physical examination. Of the 1328 women examined, 618 (46.5%) of whom were aged 50 and over, 59.2% of women ever had been hospitalized, mostly for delivery (30.2%), gynaecologic problems (17.7%), abdominal pain (8.5%) or malaria (4.1%). In all, 90.5% had ever been to an out-patient facility for fever (25.2%), a routine exam (9.4%), whole body pain (7.1%), abdominal pain (6.8%), gynaecologic problem (6.0%) or hypertension (5.1%). Almost all (98%) used the public health facilities for their health care.

The most common conditions reported for the past 12 months were: malaria (48.6%), hypertension (23.0%), arthritis or joint pain (12.0%), diabetes (4.1%), asthma (3.1%), and anaemia (3.0%).

Table 4 depicts the most common symptoms of the previous 4 weeks experienced by at least 20% of the women. Fever was the most common symptom that prompted the women to seek medical care (43.0%).

Table 4. Common symptoms reported in the 4 weeks before interview.

Symptom	% experiencing symptom	% seeking medical care
Pain, anywhere	44.9	30.3
Headaches	38.1	23.8
Worry	36.0	0.8
Blurry vision	31.8	18.5
Joint pains	30.0	23.5
Abdominal pain	26.5	15.8
Fever	22.3	43.0
Numbness, anywhere	22.1	18.3
Dysmenorrhoea	22.0	19.4
Pins and needle sensation	21.7	17.9
Fatigue	21.5	22.3
Chronic back pain	21.5	23.7

Screening measures for breast and cervical cancer. Only 11.9% of women reported that a clinical breast examination had *ever* been performed for them while 34.9% of the women performed a self-breast examination at least monthly. 1.5% had a mammogram, most reported that the test was normal, and 4.2% of the women had a breast biopsy, either as a fine needle aspiration or as an open biopsy. Five of the 1328 women reported a prior diagnosis of breast cancer; three were less than 40 years old at the time of diagnosis. Approximately 35% of the women reported *ever* having a pelvic examination. By the evaluation of the dates of the last pelvic examination provided by the women, most were for obstetrical reasons. Only 1.9% of the women reported having a Papanicoulau (Pap) smear performed and 80% of those reported that the test was normal. No woman in the study stated that she was ever diagnosed with cervical cancer, ovarian cancer or uterine cancer.

The mean age of first sexual intercourse was 18.9 years $\pm$ 3.1 years old and 95.7% of the women reported to have ever had sex. The mean age of the first full term delivery was 21.3 $\pm$ 5.0 years. The average number of lifetime sexual partners for the entire cohort of sexually active women was 2.6 $\pm$ 2.3 and the average number of children was 5.9 $\pm$ 3.5. For the entire cohort, 38.4% had a known miscarriage, 11.0% reported at least one stillbirth, and 43.5% reported having an induced abortion. There was a general trend in increasing use of abortions with younger age, particularly in the 18 to 25 year olds. At the time of the examination, 45.6% were pre-menopausal, 47.8% (no menses for 12 months and not pregnant) were post-menopausal. 5.5% were peri-menopausal and 1.2% were unsure of their menopause status. Oral contraceptives were ever used even for a short duration by 22.7% of the women. There was no significant difference for ever use of oral contraceptives when analyzed for age greater than or less than 50 years. Of the women aged 18 to 25 years, 79.1% were sexually active and 84.1% of those young women had never used oral contraceptives, 69.1% experienced unprotected sexual intercourse the last time they had sex and 61.1% had undergone an induced abortion. Hormone replacement therapy (HRT) was ever used in 13.7% of post-menopausal women. Post-menopausal women who were age less than 50 years old were significantly more likely (p $\leq$ 0.01) to have ever used HRT than post-menopausal women over age 50 years.

A family history of the illnesses of their parents and any brother (same mother, same father) and any sister (same mother, same father) was obtained. Hypertension was the most common illness, being diagnosed in the fathers (10.9%), mothers (17.9%), sisters (9.4%) and brothers (4.9%). A history of

stroke was reported in fathers (5.1%), mothers (5.4%), sisters (1.7%) and brothers (1.2%). A history of diabetes was reported in fathers (2.9%), mothers (3.4%), sisters (2.3%) and brothers (3.0%).

At the conclusion of the history, the physicians were asked to score the woman's responses. The physicians judged that 97.5% of the women's answers to the questions were reliable, not reliable in 0.8% and uncertain in 1.6% of all women seen for medical examination.

NEW CASES IDENTIFIED: DIABETES, HYPERTENSION, CATARACTS and OBESITY.

Turning to the comparisons of the data on health status from the three different sources, we can see how each measure produced different numbers of cases on a sample of more easily identified conditions. Table 5 reflects the comparisons of data from the women who completed both the HHS and the CMLE (n=1328). A total of 812 new cases of diabetes, hypertension, cataracts and obesity were identified in the WHSA and 58.0% of the new cases were in women age ≥ 50 years.

Table 5. Number of cases identified by different instruments.

Condition	Household survey	Medical history or reported symptoms	Labs or exam	New cases	New Cases for women age ≥ 50 years old
Diabetes	48	54	68	57	14
Hypertension	314	304	632	328	225
Obesity	44	n/a	445	401	209
Cataracts	20	17	63	26	23
Total	426	375	1208	812	471 (58.0%)

ASSOCIATIONS WITH AGE ≥ 50 YEARS OLD.

Correlations were performed using Pearson Correlation and Spearman with SPSS data analysis software. Women age 50 years and older were significantly more likely than younger women to have an elevated fasting blood sugar (17.3% vs. 4.3%, p<0.01), elevated fasting serum cholesterol (32.6% vs. 18.8%, p<0.01), and an elevated LDL (17.85 vs. 10.3%, p<0.01), respectively. There was no difference in HDL levels. There was no correlation with age ≥ 50 years and results from the Pap smear, serum triglycerides or HIV status.

Age ≥50 years was significantly (p<0.01) associated with increased systolic and diastolic blood pressure, decreased visual acuity and body mass index (BMI) (p=0.04). Age ≥50 years was significantly associated with a past history of hypertension, arthritic joint pains, glaucoma, stroke, cataracts and diabetes (p<0.01), asthma and pancreatitis (p=0.03), hypercholesterolemia and blindness (p=0.01). Age ≥ 50 years did not correlate with myocardial infarction, thyroid disease, cancer, depression or malaria. Older women were more likely to wear glasses (p<0.01) but no more likely than younger women to have had a blood transfusion, surgery, hospital admission or a visit to the out-patient clinic.

There was no correlation with menopause status (defined as no menses for at least 12 months and not pregnant) and hot flushes, night sweats, mood swings, depression, slow thinking or irritability. Menopause status was significantly associated with fatigue (p=0.01) and pain, blurry vision and difficulty walking (p<0.01).

From the questions on the extensive review of systems, older women were significantly more likely to suffer from fever, chills, difficulty walking, toothache, blurry vision, chest pain with exertion, palpitations, shortness of breath with exertion, incontinence of urine, increased urinary frequency and urine production, loss of energy, wheezing and pain at any location (p<0.01) in comparison to younger women. While acute back pain was not reported to be a significant problem for women of any age, it was reported more frequently in the younger women. Older age was significantly associated with many other musculo-skeletal problems such as chronic back pain, symptoms of osteo-arthritis, muscle pains, muscle cramps and joint swelling (p<0.010). Numbness, pins and needle sensations and loss of memory were significantly more common in the older women (p<0.01).

In comparison to women under age 50 years, older women reported significantly more faintness (p=0.03), constipation (p=0.01), chest tightness (p=0.04), unquenchable thirst (p=0.03) and drinking more fluid than usual (p=0.01), and sought medical consultation for a breast related problem (p=0.03). They also are significantly more likely to take medications prescribed from a physician or herbalist (p<0.01) and just as likely as the younger women to take medications prescribed from a pharmacist.

Age ≥50 years was not statistically associated with headaches, cataracts, loss of vision (blindness), SOB when lying flat, productive cough, chronic cough, abdominal pain, prolapse of rectum or bladder or uterus, bloody sputum, incontinence of stool, painful urination, haematuria, diminished libido, change in eating habits or weight, dizziness, anxiety, sadness, loneliness, confusion, suicidal thoughts, irritability, mood swings, stress at home, joy and happiness, having a mammogram, breast biopsy, clinical breast examination, previous Pap smear for cervical cancer screening, or experience verbal or physical abuse by a spouse, friend or relative.

Younger women were significantly more likely to have experienced nausea (p<0.01), blood in stools (p=0.01), stress at work as well as pleasure at work (p<0.01), breast pain (p=0.04), performed a self breast examination at least monthly (p=0.005), at least one induced abortion (p<0.01), reported pelvic pain and foul smelling vaginal discharge (p<0.01), or to use a condom (p<0.01) in comparison to women age 50 years and greater.

The physical examination identified significantly more abnormalities of the skin, teeth, heart, external pelvic examination, and internal pelvic examination (p<0.01) in women age 50 and greater in comparison to the younger women. The older women were just as likely to remember five objects on the memory test as the younger women (p=NS).

Women under 50 years of age were significantly more likely to be diagnosed with anaemia (29.9% vs. 22.3%, p=0.01) than older women. There was no correlation with anaemia and chronic illnesses, a history of hospitalization, surgery, blood transfusions or malaria. There was no correlation with

menopause status, number of deliveries, age at first or last birth or abnormal uterine bleeding. There also was no correlation with symptoms or conditions that may suggest anaemia including fatigue, shortness of breath with exertion or at rest, chest pain with exertion or at rest, bloody diarrhoea, or parasites in the stool. The one woman with a confirmed case of sickle cell anaemia had a haemoglobin level less than 12 g/dl. There was a correlation with anaemia and current pregnant status - 66.7% of the women who were currently pregnant were identified to be anaemic (p<0.01) compared to 24.4% in that age group who were not pregnant.

Thirty-five women were diagnosed as HIV positive. Their ages ranged from 19 to 72 years. Twenty-four were under age 50, 11 were age 50 or older. In comparison to all women in this study (n=1328), a positive HIV test significantly correlated with lifetime number of partners (p=0.03), bloody sputum (p<0.01) and diagnosis of tuberculosis (p<0.01). HIV did not correlate with age at first intercourse, age at first birth, age at last birth, use of oral contraceptives, previous hospitalizations, blood transfusions, previous surgery, and symptoms such as weight loss, wasting, fatigue, bloody diarrhoea, non-bloody diarrhoea, abdominal pain, pelvic pain, foul smelling vaginal discharge, sexually transmitted diseases or depression or suicidal thoughts.

The dietary history revealed 33.8% of the women consume fruit 0 to 1 times per week and 13.4% consume vegetables 0 to 1 times per week. Palm oil is used as the primary cooking oil for 57.5% of the women and 95.8% prepare their meals at home. There was a significant correlation with obesity and infrequent consumption of vegetables (days/week) (p=0.015). There was no correlation with a diet that has a limited amount of vegetables or fruit or type of cooking oil with hypertension, hypercholesterolemia or hyperglycaemia. There was a significant correlation with obesity and owning a refrigerator and/or a television (p<0.01).

COMPARING THE INDIVIDUAL RESULTS FROM THE HOUSEHOLD HEALTH SURVEY AND THE COMPREHENSIVE MEDICAL EXAMINATION.

Hypertension. During the HHS, 314 women (24.0%) reported a previous diagnosis of hypertension compared to 304 (23.0%) women at the CMLE. This is a significant positive correlation between the HHS and the CMLE reporting (p<0.01). Hypertension, as an objective finding, was identified in 47.8% of all women see in the clinic. There was a significant positive correlation between self-reported hypertension and blood pressure measurement.

Diabetes. A significant correlation in reporting a previous diagnosis of diabetes was identified in this study. During the HHS, 48 women (3.7%) reported having been diagnosed with diabetes compared to 54(4.1%) from the CMLE (p<0.01). Of those women who know that they had been diagnosed with diabetes, 37.0% (p<0.01) had an elevated fasting blood glucose level on the morning of the examination.

Arthritis or joint pain. There was a positive correlation in reporting between the HHS and the CMLE (p<0.01) for arthritic symptoms and joint pain. No measured assessment was made for arthritic joints during the clinical examination.

Chronic Back Pain. More women reported chronic back pain during the HHS (42.0%) compared to reporting during the CMLE (21.5%). This difference in reporting is significant (p=0.14).

Obesity. The women were asked if they were obese during the HHS. Of the 1311 that responded, 44 (3.4%) stated that they were obese. At the CMLE, weight and height measurements

were taken and BMI calculated. There was a significant underreporting (p=0.04) of self-reported obesity from the HHS in comparison to the BMI calculated from the clinical data.

Depression There was a significant underreporting of depression during the CMLE compared to the HHS (p=0.029). Only 8 (<1%) of the women stated that they had been depressed during the CMLE as compared to 26 (2%) of the women during the HHS. None of these 26 women reported depression at the CMLE.

Asthma There was a significant positive correlation (p<0.01) between HHS and CMLE for a self reported diagnosis of asthma. The number of women with an abnormal pulmonary examination was higher than the reported number of women with asthma, but the clinical examination did not differentiate between pulmonary wheezing secondary to asthma vs. other chronic lung diseases such as emphysema.

Cataracts. There was a positive correlation between self reported cataracts between the HHS and the CMLE history reporting. (p<0.01). However, there was no correlation between the physical examination findings of the eyes and a history of cataracts.

DISCUSSION

This comparison of morbidity data from three different sources, home interview, medical history/examination and performance/laboratory tests, is rarely possible in high morbidity countries. The women of Accra are clearly in the midst of an important health transition. The results of the 2003 Women's Health Study of Accra are consistent with reports that chronic illnesses such as diabetes and hypertension present a serious health problem to the developing world populations.[21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31] Although heart disease has not been considered a major problem in African populations until recently, cerebral vascular disease (CVD) was identified in 2001 as the cause of death in 11% of autopsies performed at Korle Bu Teaching Hospital. [32] Hypertension was the dominant risk factor for both hemorrhagic strokes and a major factor in infarctions. The relative risk of death secondary to a stroke was significantly higher for women in comparison to men. This may account for the high prevalence of hypertension but few women were found with a history or evidence of a cerebral vascular accident or CVD in the WHSA.

Diabetes appears to be an important emerging disease and public health problem in African cities. [33, 34, 35,] There are no data available to date on the mortality, morbidity or disability associated with diabetes. Amoah et al reported on the prevalence of Type II diabetes in a community based study of Greater Accra. [36] In their study, 4733 Ghanaians aged 25 years and older were randomly selected from three community sites. Contrary to a previous study that found only a 0.2% prevalence of diabetes in Ghana, they found the crude prevalence rate to be 6.3%. The prevalence increased with increasing age with 13.4% of those 64 years and older diagnosed with diabetes. Diabetes was more common in males than females (7.7% vs. 5.5%, p<.05). Worsening glycaemic status was associated with increases in age, body index, and systolic and diastolic blood pressure.   These results are consistent with the findings from the 2003 WHSA.

There are also serious concerns that important health issues such as mental illness and depression may be neglected in developing countries.[37, 38] In the WHSA, women were more likely to report depression in the HHS than the CMLE. In future re-visits to the women, we will address mental health in more detail in the home interview.

The prevalence of HIV/AIDS is low in Ghana in comparison to other African countries. While the 2002 reported prevalence rate remains low (3.0% in the general population, 2.7% amongst women in the Women's Health of Accra Study of 2003), it is still a significant public health concern. HIV sero-prevalence has increased in commercial sex workers from 2% in 1986, 40% in 1990, 73% in 1997 and as high as 82% in 1999 in some areas. [39] These calculations are based in the previously published estimates for 1997 and 1999 and recent trends in HIV/AIDS surveillance in various populations. The current estimates do not claim to be an exact count of infections. These estimates are constantly being revised as countries improve their surveillance rates.

Data on the incidence and prevalence of cervical cancers in the developing world are incomplete and fragmentary. [40] There are many indications that cancers of the cervix represent problems of a public health dimension, but no data regarding the incidence of precursor lesions amenable to early interventions. Unfortunately, the risk factors for cervical cancer are widely prevalent in these countries. Even the simplest technique of a Pap smear is used infrequently in these medically under-served populations. [41, 42]

In assessing the results from the physical examination, the one area that must be addressed in the next study is the low number of funduscopic examinations performed. Few physicians had an ophthalmoscope and/or an otoscope and few knew how to perform a proper examination. The other most frequently skipped examination included the rectal examination, short-term memory and the reflexes, although supplies and reflex hammers were available to all study physicians. There were no tests based on stools or urine which narrowed the search for other biological markers of illness.

This study and other like it have the potential to provide some of the most reliable community-based information on health in Africa. It has drawn attention to the very wide disparities in health from one area to another; to the importance of induced abortion in the rapid fertility transition in the city; to persistent problems of fever and malaria in adults; and to the large burden of disease attributed to the risk factors for coronary heart disease including obesity, hypertension, little exercise, high levels of cholesterol and diabetes. The study has also shown that there are stark disparities in health within the city. The variation in all the population-level measures of well being such as child mortality, access to safe water and sanitation, security of employment and education is very much wider than in rural areas. These inequities within a confined geographical area are troubling to many. Secondly, the fertility transition is well advanced in cities but the systematic use of modern contraception remains at modest levels so induced abortion is a salient feature of the new urban fertility regimes. Thirdly, improved adult survival means that there are more people over age 55 than ever before. Obesity and hypertension as well as other risk factors for non-communicable disease are prominent amongst the older population. It seems too that these new conditions are related to social class now with the poor most affected by these conditions as in western countries.

Since many demographic surveys now include a substantial health component, the reliability of common questions on illness is important to establish. More comparative work using studies with standard protocols and multiple measures of the different dimensions health status is now necessary. The contribution of the "anchoring vignettes", questions on a range of conditions used to standardize responses, appears to have been useful as a means of adjusting for the well-known problem of cut-point shifts in severity assessments by age and socio-economic status.

CONCLUSIONS

We have shown that it is feasible to add a clinical component with a comprehensive medical examination and supporting laboratory tests to a community-based health survey. The study was conducted in a dense urban environment with access to good medical and laboratory facilities which made the movement of people and samples from one point to another easier than in a more extensive rural. Nonetheless, women had to travel up to 15 km to reach Korle Bu clinic, a journey that might take an hour in heavy traffic.

The women had on average only a moderate level of education but clearly understood the purposes of the study, the written consent agreements and the larger purposes of the study. Participation rates were very high. The lengthy questionnaires did not seem to be too burdensome and the women grasped some abstract concepts (such as the hypothetical conditions described in the anchoring vignettes) very readily.

The medical examinations and laboratory work added about $80 per woman to the costs of the study including the costs of the time of the examining physicians' time, the haematology and cytology. Other professional time and transport and survey support costs are excluded from this figure. The extra logistical problems of arranging for clinic appointments for women interviewed at home were considerable, however, and the institutional review boards' concern with human subjects issues did lengthen the process between study design and start of field work. Nonetheless, the high participation rate by the women and the seriousness with which the medical data have been received in comparison to self-report data alone (e.g. the DHS data) indicates the important policy implications of adding examination studies with biological markers to household surveys.

Two general recommendations emerge from this study. First, there is a need for wide empirical testing of survey instruments as well as testing and examination protocols to ensure that different studies are comparable. A common data bank of questionnaires with links to sources for obtaining economical and portable testing kits would serve many purposes. Secondly, similar studies would be more feasible and less costly if the initial focus was on collecting biological data in urban areas where the logistical challenges to such studies are simpler than in remote rural areas without clinics, physicians and laboratory facilities. The exception may be in some of the largely rural longitudinal study sites supported by the INDEPTH project.[43]

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REFERENCES

[1] The full protocol for this study – "Women's health in Accra: a comprehensive study", Principal Investigators: Allan G. Hill, Harvard School of Public Health &Ghana School of Public Health; John K. Anarfi, Institute for Statistical, Social and Economic Research, University of Ghana; Rudolph Darko, Dept. of Surgery, Ghana Medical School; and Dr. Rosemary B. Duda, Harvard Medical School and Harvard School of Public Health – is available on request.

[2] The Ghana component of the World Health Survey, directed by Professor R. Biritwum, was in the field in early 2003.

[3] Murray CJL, Tandon A, Salomon JA, Mathers CD, Sadana R. New approaches to enhance cross-population comparability of survey results. In Murray CJL, Salomon JA, Mathers CD, Lopez AD, eds. *Summary Measures of Population Health: Concepts, Ethics, Measurement and Applications.* Geneva: World Health Organization, 2002.

[4] Ware JE, Sherbourne CD, Ware JE Jr. The MOS 36 item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care* 30(6):473-483, 1992.

[5] WHO World Health Survey (WHS) Home Page is: www.who.int/whs/.

[6] Walraven G, Scherf C, West B, et al. The burden of reproductive-organ disease in rural women in The Gambia, West Africa. *Lancet*, 357:1161-1167, 2001.

[7] National Health and Nutrition Examination Survey (NHAMES). National Center for Health Statistics. www.cdc.gov/nchs/nhanes.htm.

[8] McGranahan, G and J Songsore (1996) Wealth, health and the urban household: weighing environmental burdens in Accra, Jakarta and Sao Paulo. Chapter 8 in: *Urban health research in developing countries.* Oxford: CAB International.

[9] Songsore J and G Goldstein (1995) Health and environment analysis for decision-making: field study in Accra, Ghana. *World Health Statistics Quarterly* 48(2): 108-117.

[10] MeGill, D (2002) Recommendations For Designing Master Sample For Ghana Intercensal Household Survey Program. Ghana Statistical Service and US Bureau of the Census.

[11] Songsore, J and G McGranahan (1998) The political economy of household environmental management: gender, environment and epidemiology in the Greater Accra Metropolitan Area. World Development 26(3): 3395-412.

[12] Stephens, C, I Timaeus, M Ackerman et al (1994) Environment and health in developing countries: an analysis of intra-urban differentials using existing data. London School of Hygiene and Tropical Medicine.

[13] Van der Sande, MAB (2000) Cardio-vascular disease in The Gambia: epidemiological studies. Catholic University of Nijmegen.

[14] van der Sande, Marianne. Ceesay, Sana M.. Milligan, Paul J.M.. Nyan, Ousman A.,. Banya, Winston A.S. Prentice, Andrew. McAdam, Keith P.W.J.. Walraven, Gijs E.L. MD, PhD, MPH. Obesity and Undernutrition and Cardiovascular Risk Factors in Rural and Urban Gambian Communities. American Journal of Public Health.91(10):1641-1644, October 2001.

[15] NHLBI: Obesity education initiative electronic textbook – appendices. www.nhlbi.nih.gov/guidelines/obesity/e_txtbk/appndx/apndx8.htm.

[16] NHLBI: Clinical guidelines on the identification, evaluation, and treatment of overweight and obese adults in adults – Executive Summary. www.nhlbi.nih.gov/guidelines/obesity/sum_rec.htm.

[17] National Cancer Institute Workshop. The 1988 Bethesda System for reporting cervical/vaginal cytological diagnoses. *JAMA* 262:931-934, 1989.

[18] Duda RB, Darko R, Adenu RA, Seffa J, Anarfi J, Hill AG. The prevalence of HIV in women in Accra: Results from the WHSA. Submitted, *AIDS*, 2004.

[19] Ware, JE. SF-36 Health Survey. Manual and Interpretation Guide. New England Medical Center, Boston, MA. 1993.

[20] Tandon, A, CJL Murray, JS Salomon and G King. 2003. Statistical models for enhancing cross-population comparability. Chapter 55 in: Health systems performance assessment. Edited by CJL Murray and DB Evans. WHO, Geneva.

[21] Amoah AGB, Owusu S, Acheampong JW, et al. A national diabetes care and education programme: the Ghana model. *Diabetes Research and Clinical Practice* 49:149-157, 2000.

[22] van der Sande, MAB et al Nationwide prevalence study of hypertension and related non-communicable disease in The Gambia. *Tropical Medicine and International Health*; 2:1039-48, 1997.

[23] van der Sande, MAB et al. Blood pressure patterns and cardiovascular risk factors in rural and urban Gambian communities. *Journal of Human Hypertension*; 14:489-96, 2000.

[24] Anim JT. Pattern of atherosclerosis in a Ghanaian adult population: an autopsy study. *Afr J Med Sci* 16(4):203-213, 1987.

[25] Cooper R, Rotimi C, Ataman S, et al. The prevalence of hypertension in seven populations of West African origin. *Am J Public Health* 87(2):160-168, 1997.

[26] Cappuccio FP, Plange-Rhule J, Phillips RO, Eastwood JB. Prevention of hypertension and stroke in Africa. *Lancet* 356:677-678, 2000.

[27] Burdon J. Figure of $1800 per life saved seems optimistic. *BMJ* 317:76.

[28] Anim JT. Pattern of atherosclerosis in a Ghanaian adult population: an autopsy study. *Afr J Med Sci* 16(4): 203-213, 1987.

[29] Anim JT. Cerebral macroaneurysms in a Ghanaian adult population: An autopsy study. *Atherosclerosis* 54:37-42, 1985.

[30] Amoah AG and Kallen C. Aetiology of heart failure as seen from a National Cardiac Referral Centre in Africa. *Cardiology* 93:11-18, 2000.

[31] Pobee JO. Community-based high blood pressure programs in sub-Saharan Africa. *Ethn Dis* 3:S38-45, 1993.

[32] Wiredu EK, Nyame PK. Stroke-related mortality at Korle Bu Teaching Hospital, Accra, Ghana. *East Afr Med J* 78:180-184, 2001.

[33] WHO Study Group, Diabetes Mellitus, World Health Organization, Geneva, Switzerland, *Tech. Rep. Ser.* 727, 2985.

[34] King H and Rewers MG. Diabetes in adults is now a third world problem. *Bulletin of the World Health Organization* 69:643-648, 1991.

[35] Amoah AGB, Owusu S, Saunders JT, et al. Facilities and resources for diabetes care at regional health facilities in southern Ghana. *Diabetes Research and Clinical Practice* 42:123-130,1998.

[36] Amoah AGB, Owusu S, Adjei S. Diabetes in Ghana: a community based prevalence study in greater Accra. *Diabetes Res Clin Prac* 56: 197-205, 2002.

[37] Cooper R, Rotimi C, Ataman S, et al. The prevalence of hypertension in seven populations of west African origin. *Am J Public Health* 87(2):160-168, 1997.

[38] Cooper R, Rotimi C, Ataman S, et al. The prevalence of hypertension in seven populations of west African origin. *Am J Public Health* 87(2):160-168, 1997.

[39] Ghana Epidemiologic Fact Sheet on HIV/AIDS and sexually transmitted infections. UNAIDS/WHO 2000 Update. www.aids.africa.com

[40] Lunt R. Worldwide early detection of cervical cancer. *Obstet Gynecol* 63:708-713, 1984.

[41] Chirenje ZM, Rusakaniko S, Kirumbi L, et al. Situation analysis for cervical cancer diagnosis and treatment in east, central and southern African countries. *Bull World Health Organ* 79:127-132, 2001.

[42] Fonn S, Bloch B, Mabina M, et al. Prevalence of pre-cancerous lesions and cervical cancer in South Africa – a multicentre study. *S Afr Med J* 92:148-156, 2002.

[43] See the list of sites co-ordinated by the INDEPTH project (www.indepth.org).