

Research article

## Cross-sectional study of morbidity, morbidity-associated factors and cost of treatment in Ngaoundere, Cameroon, with implications for health policy in developing countries and development assistance policy

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### Abstract

**Background:** In a population-based epidemiological study in Ngaoundere, Cameroon, we studied cross-sectional child morbidity and the cost of necessary investigation and treatment.

**Methods:** Three teams of two to three health workers visited haphazardly selected households in all major housing quarters. We asked permission to enter for a health survey. Children with cough, fever or weight loss as well as sick adults were offered free-of-charge local hospital examination and treatment.

**Results:** From 177 households with 1777 persons, 51 (2.9%) persons were referred. Thirty-five of them had an undiagnosed disease threatening individual health and in many cases also public health. Seven were hospitalised, including three adults with tuberculosis. Malnutrition was diagnosed in nine small children. Four patients had AIDS, seven had malaria. Average total cost for ambulant patients was 15 USD, for hospitalised patients 110 USD.

In the households, almost half of the women 16–50 years of age had no schooling. Two per cent of women and nine per cent of men were daily smokers. Coughing children were more likely than non-coughing children to live in a household with at least one smoker (OR = 3.58, 95% CI 1.72 to 7.46), and they generally lived in more poor households (P = 0.018). Twelve of 16 children with weight loss were referred from households with a high poverty score.

**Conclusions:** Adult smoking and poverty affect children's health. The cost of hospitalisation or long-lasting therapy is beyond the means of most ordinary families. Diseases with severe consequences for public health, like tuberculosis, AIDS and malaria should have national programs with free, decentralised examination and treatment. Access to generic drugs is important. A major educational effort is needed to improve public health.

### Background

A number of major diseases afflict the health of Africans.

The under-five mortality rate for Africa south of Sahara was 169 per 1000 in 1996 [1]. In children, malaria, mea-

sles and meningitis have been joined by the increasing HIV problem. Common respiratory and gastrointestinal infections are frequent and often lead to serious disease. Persisting poverty and low level of scholarisation appear to contribute to the elevated morbidity and mortality. We did a simple population-based epidemiological study in December 2000 in the town of Ngaoundere, Cameroon, a multi-ethnic inland province centre situated on a large plain 1500 meters above sea level, with a rainy season from April to October and with a population estimated to be 250 000 inhabitants. Our questions were:

1. What kind of cross-sectional child morbidity exists in the families?
2. Do factors related to the household influence morbidity?
3. What is the cost of necessary investigation and treatment?

### Materials and methods

Three teams of two to three health workers visited haphazardly selected households in the eleven major housing quarters in Ngaoundere. In each quarter, the teams went in different directions and knocked on the door of every third or fourth concession, trying to include a broad cross-section of households from the very poor habitats to more well-to-do concessions with several houses, and covering all major ethnic groups. Questions had been agreed upon in advance by the team members. The composition of the teams varied to assure a uniform approach, but each team was led by a medical doctor (KH) or by one of two registered nurses. The other three visitors were auxiliary nurses.

In each household we explained in local language that we were doing a health survey and wanted to ask questions about the family, offering to look at children having one of three symptoms: a cough, a fever or having lost weight lately. We told that the survey was mainly aimed at children, but that we might also look at sick adults, especially those with a persistent cough. It was explained that if clinically indicated, a next-day examination and appropriate treatment would be offered with all expenses covered at the Protestant Hospital which is one of two general hospitals in Ngaoundere. Referrals were received by the author HH, who works as a paediatrician at the hospital.

We recorded the number of adults 16 years and above, and children, male and female. We recorded data about sleeping conditions, drinking water, toilet facilities and habits, smokers in the household and scholarisation of the women between 16 and 50 years of age. The presence or absence of stagnant water in or right outside the concession was observed, and we asked to inspect toilet facilities.

Electronic fever thermometers with disposable plastic tips and a meter band for arm circumference measurement were brought along for use when indicated. The parents' information about cough, fever or weight loss was noted whether or not the child was referred.

### Statistics

Pearson's chi square analysed relationships between variables. Correlation was performed with Pearson's analysis for continuous data and Kendall's tau for ordinal data. Logistic regression analysed factors possibly influencing coughing and weight loss in children. A household poverty index of 0–3 points was constructed after discussion among the team members about local criteria of poverty. Each of three factors contributed one point if predefined criteria possibly connected with poverty were fulfilled: At least half of the women in the household having no schooling, at least four persons in the most crowded bedroom, nothing but a hole and water for toilet use.

### Results

#### *The household, and people in the household*

1777 persons, 898 adults and 879 children were recorded in 177 households visited (table 1). 51 persons (2,9%) were referred and received a medical journal booklet at the end of the home visit, 13 adults (1,4%) and 38 (4,3%) children. 27 were males, 24 females. The reason for referral was noted in the booklet, to be presented at the hospital the next day. From two to seven persons were referred from each of the 11 central and suburban housing areas.

There were on average 10 persons in each household, five adults and five children. Almost half of the women 16–50 years of age had no schooling. Two per cent of women and nine per cent of men were daily smokers. A majority of the households (table 2) had tap water. Mosquito nets and water closets were very uncommon. Median number of sleeping rooms in one household was 3, and median for the maximum number of persons sleeping in one room was 4. Most households appeared clean and well kept, but stagnant water was found in or adjacent to about one third of the households.

Number of children in a household was inversely correlated to schooling level for women ( $P = 0.032$ ) and correlated positively with the maximum number of persons sleeping in one bedroom ( $P < 0.001$ , Pearson). The more children, the higher poverty index ( $P = 0.003$ , Kendall's tau). Relatively more children than adults were living in poor households ( $P = 0.019$ ). More young children than older children were coughing ( $P < 0.001$ ). Fifteen of 34 coughing children lived in a household with at least one smoker. Logistic regression analysis showed that coughing children were about three and a half times more likely than non-coughing children to live in a household with at

**Table 1: Number and characteristics of persons in the households**

	Women	Men	Girls	Boys	All persons
Number	476	422	431	448	1777
Number per household:					
-mean	2.7	2.4	2.4	2.5	10.0
-median	2.0	2.0	2.0	2.0	9.0
-range	0–19	0–8	0–8	0–10	2–41
Age (years)					
-mean	33.1	32.8	7.3	7.2	20.0
-median	28	30	7	7	15
-range	16–97	16–82	0–15	0–15	0–97
Age group (years)					
<1			31	36	67
1–4			110	111	221
5–9			131	150	281
10–15 <sup>1</sup>			159	151	310
16–19	90	82			172
20–29	160	114			274
30–39	84	90			174
40–49	45	65			110
50–59	37	34			71
60–69	20	19			39
70+	24	7			31
No information	16	11			27
Schooling, number of women 16–50 years of age (n = 396) <sup>2</sup> :					
9+ years	49 (13%)				
5–8 years	110 (29%)				
1–4 years	42 (11%)				
No schooling	180 (47%)				
No information	15				
Poverty index					
0–1 (low)	236	228	198	215	877
2–3 (high)	240	194	233	233	900
Number of smokers <sup>3</sup>	9 (2%)	35 (9 %)			
Children living with smoking person <sup>4</sup>			81 (19.1%)	91 (20.4%)	
Symptoms <sup>5</sup> /referred:					
-fever	2	2	12/11	5/5	
-weight loss	2	8	7/7	9/9	
-coughing	3	9	16/7	18/8	
-other	1		4/3	12/6	
Referrals	3	10	21	17	51

<sup>1</sup> 15 instead of 14 years of age because of cut-off children-adults <sup>2</sup> Percentage calculated on the basis of the 381 women with information about schooling <sup>3</sup> Information lacking for 32 adults; 20 women and 12 men <sup>4</sup> Information lacking for 7 children; 6 girls and 1 boy <sup>5</sup> Several symptoms possible in each person. In adults, symptoms noted only for referred persons

**Table 2: Household data (n = 177) <sup>1</sup>**

Number of households with:	
Mosquito net(s)	12
Tap water/well/both	103/54/15
WC/Hole in ground	7/168
Toilet paper/water only	77/91
Hand wash with soap: yes/no/no information	62/75/40
Stagnant water	60
1-6 smokers/no smokers	35/141
At least 1 woman 16-50 years of age with:	
9+ years of schooling	37
5-8 years of schooling	58
1-4 years of schooling	21
No woman 16-50 years of age has been to school	56

<sup>1</sup> Missing data for a few households for each item

**Table 3: Children who cough in relation to age, passive smoking and a poverty index. Logistic regression. CI=Confidence interval.**

Independent variable	Coefficient	P-value	Odds Ratio (95% CI)
Age	0.179	<0.001	
Passive smoking	1.278	0.001	3.58 (1.72 to 7.46)
Poverty (categorical 0-3)		0.018	

least one smoker, and that they generally lived in more poor households (Table 3). Twelve of 16 children with weight loss were referred from households with a high poverty score of 2 or 3, but this tendency was not significant in the adjusted model. Mainly the younger children had weight loss ( $P = 0.036$  adjusted for poverty and passive smoking), but weight loss was not recorded before the age of one year.

Sex and housing quarter were included in the first regression models, but showed no relationship to coughing children or to children with weight loss. There was no correlation between poverty score and smoking. Five housing quarters had an even distribution of the poverty score, while three housing quarters tended to have higher and three to have lower scores. The three housing areas with a majority of high poverty scores were relatively new residence areas with many newcomers from villages in the region. These three areas had relatively few smokers.

### The patients

Four of the 51 patients did not show up; two sisters 6 and 1 year olds with coughing and fever, a 35 year old man and a 70 year old woman with coughing and weight loss.

The most frequent clinical signs on general examination in the hospital were reduced general condition and pathologic lung sounds. Other findings included abdominal signs, oedema, adenopathy, skin ulcers, neurological and orthopaedic pathology. Nine children had only minor findings.

Thick drop examination was performed in 41 cases and was positive in seven. Sputum examination was performed for ten adults and was positive in three. Tuberculin tests were done for three referred children and for several non-vaccinated children in families with sick adults. All were negative, and BCG vaccination was then offered. HIV serology was taken for seven patients where AIDS was clinically suspected. The test was positive for three adults and one motherless, ill-appearing one-year old boy. Haemoglobin was measured in 40 patients and showed anaemic values in four children and four adults. High sedimentation rates and neutrophilia in blood counts gave diagnostic information in a few cases. Twelve x-rays of chest were performed, pathologic findings were made in two children and eight adults. In nine of these cases pulmonary shadows were massive, uni- or bilaterally.

Thirty-five patients had serious or potentially serious disease (table 4; see Additional file 1). Seven were hospitalised, including the three adults with tuberculosis. Malnutrition was diagnosed in nine children, eight of them 1-3 years old. Twelve of the 18 children younger than five years of age had weight measurements which deviated from "the road to health", i.e. their weight was below the 3 percentile for girls on the WHO growth chart [2]. Seven of them had upper arm circumference 13 cm or less.

A six year old boy with a protruding tumour in his abdomen died after four weeks of cytostatic treatment for assumed lymphoma. Another six year old boy had advanced osteomyelitis in tibia, with several open wounds to the bone, the biggest measuring  $7 \times 4$  cm (fig 1). Bacterial culture showed *Proteus*, resistant to most relevant drugs. A third generation cephalosporine was given intravenously and surgical débridement was performed. After about a year the wound has healed, and the boy limps around with a crutch.

Some sick people were not referred by the visiting team. Two adult men were on Tb-treatment, and two adults with a chronic cough had recently had a negative hospital examination for Tb. One man was depressed after his wife died in a car accident four months previously, the team had a long talk with him. Scabies medication was prescribed on the spot, and in one case penicillin was prescribed for a wound in the foot.



**Figure 1**  
Osteomyelitis in a six year-old boy

Two reported but non-referred patients should have been referred; a ten year old boy with inguinal/scrotal hernia since infancy, and a girl 9 years old with a history of 1–2 epileptic fits per year and slight affection of movements of right arm, mentally sane.

### Cost

Total cost for diagnosis and treatment was noted for 45 of the 51 patients and was approximately 1300 USD. For the seven hospitalised patients, individual expenses varied from 30 to 175 USD, with an average of about 110 USD. Cost range for outpatients was 5 to 25 USD, on average about 15 USD.

### Discussion

By visiting 177 random households in a Cameroonian town, we traced and treated 35 people with undiagnosed disease threatening individual health and in many cases also public health. The importance of tuberculosis and malnutrition is demonstrated, as well as malaria and cases of HIV infection. We showed that poverty affects children's health. An encouraging sign is that smoking is little prevalent, but we found a relationship between coughing in children and smoking in the household. Lack of therapy for congenital orthopaedic and neurological disease was demonstrated. Cripples observed in the streets indicate that this is a general phenomenon, resulting in far more disability than necessary.

Lack of population registers and city plans makes formal randomisation of households impossible, and we cannot claim that our study is representative for the town of Ngaoundere. Nevertheless, we think that our approach was sufficiently scattered and haphazard to give a good impression of health problems. Sex and age distribution is as expected. The relatively low number of young adults probably reflect that young men leave their homes and are geographically mobile for a good decade before marrying, with implications for their sexual life and HIV prevention possibilities. The low number of old persons corresponds with life expectation figures.

The data are partly based on observations, partly on answers to questions. In most cases several members of the household were present and helped each other with the answers. It happened that someone told she or he did not smoke, but admitted it when laughingly corrected by other people present. The low number of smokers is in accordance with our observation that we rarely see people smoking in Ngaoundere, even in bars. We had no impression that any woman tried to exaggerate her schooling.

### Different diseases, different requirements

In Africa, common illnesses seen in Western countries are modified in incidence and disease manifestations by poverty and illiteracy. Some more special diseases are serious, long-lasting and often difficult and expensive to cure. On average, each of our hospitalised patients cost seven times more than one patient treated without hospitalisation. For less serious disease, much could be done in terms of both prevention and cure. Prices for laboratory tests and

medication at this hospital are modest and mostly cover expenses. The consultation with a nurse costs 0.7 USD, plus 1.4 USD more if the patient is subsequently seen by a doctor. If the doctor is seen directly the price is 4 USD. Hospitalisation costs 3.5 USD regardless of length of stay. Investigations and therapeutic procedures as well as more long-lasting and expensive medication add to hospital bills. Few families have an income exceeding 150 USD per month. An ox could be sold for 200 USD and a merchant at the market may earn 300–350 USD per month, but a nurse would earn 120 USD, a salaried secretary about 70 USD. A maid or a woman selling her self-cultivated vegetables at the market often must do with 20–30 USD a month. Thus, many people live with less than the World Bank global reference lines for poverty set at 1 USD and 2 USD per day in 1993 purchasing power parity [3]. Many people can afford an outpatient illness episode, but a hospitalisation is beyond their means for most people.

Three of the hospitalised patients had sputum positive tuberculosis. Cameroon does not have a system of free treatment for tuberculosis, which is the case for some other African countries with organised national Tb programmes. Minimum cost for a Tuberculosis cure in Ngaoundere is 100 USD. While infectious disease was the cause of death in 1.2% of deaths in the Western world in 1996, this percentage was 43% in developing countries [4]. The AIDS-sick, motherless infant is represented in our sample. For serious diseases with great implications for public health it is difficult for an African country to act alone. Special programs and foreign aid is needed, but the responsibility for taking initiatives, organising and administering should clearly be national and local.

A serious but curable disease like malaria requires competent local personnel. Malaria was less prevalent than expected in our study, but seriously ill and deeply anaemic children with malaria are seen every week in the hospital. A high level of clinical suspicion must be maintained. We believe our findings show the advisability of extensive and decentralised use of combined clinical and laboratory diagnostics when malaria is suspected. Campaigns and sewage measures to eliminate stagnant water may reduce the malaria incidence during the dry season.

#### **Prevention possibilities: poverty and smoking**

African children, after weaning, on average follow a slacker growth curve than European children. The borderline towards malnutrition, anaemia and an increased vulnerability in relation to disease is not clear, but it is telling that the great majority of our referred children were low on the percentile curve. The tendency for sick children in our study to come from poor families supports the banal truth that preventing poverty is an effective way to improve health in a population. Poverty measures are commonly

based on income or consumption. For an average citizen, Cameroon is just below the World Bank limit of 2 USD a day with 600 USD in Gross National Product per capita in 1999 [5]. In Cameroon in 1996, the consumption poverty line with regards to a minimum diet and other basic necessities, was estimated at F CFA 148 000, or a little less than 200 USD [6]. However, the World Bank Report [3] emphasises the need to study non-income dimensions of poverty as well. Our criteria education, shelter and access to sanitation are among the most important criteria suggested. Lacking a universal validated poverty measure, we believe our index discriminated well between rich and poor in the local setting and could do so in other localities as well. We did not include access to safe water because almost everybody in Ngaoundere has got such access, but it probably should be included as a criterion in communities where this is a problem.

It is important to emphasise what is good or promising in a community. Smoking is in many regions a much less widespread habit than in Europe, although national official smoking prevalence among adults in Cameroon was 35.7% in 1994 [7]. It is encouraging that poverty showed no relationship with smoking and seems to be little prevalent among village people who recently moved to town. Smoking, although cheap by western standards, is sufficiently expensive to require a certain level of income. However, this state of affairs could turn out to be fragile if economic conditions improve. The statistical association between coughing children and living in a household with at least one smoker is important because in vulnerable children common infectious diseases more easily develop into serious disease. The connection between passive smoking and coughing is in accordance with studies from Hong Kong [8,9]. Knowing what smoking means in terms of wasted health and expenses for a country, anti-smoking measures deserve high priority, even if not usually considered an urgent third world health problem.

#### **Three conditions for improved health care: organisation of health care, generic drugs, education**

Simple examinations are often the most important for diagnosis. In the present study, a good clinical examination and access to a few basic x-ray and laboratory examinations was crucial and sufficient in many cases. The cost gap between hospitalised and ambulant patients suggests that a better distribution of tasks between primary and secondary care could make health care more efficient. A national program for tuberculosis with free examination and treatment is urgently needed. A national hiv/aids program including antiretroviral therapy is in the process of being established with drug prices negotiated down to 30 USD per month, still a high price in relation to income even if it increases hope for many people. Co-operation,

supervision and a system for necessary transport are pre-conditions for health care on all levels.

Secondly, cheap and efficient drugs must be available, a goal which necessitates co-operation between international institutions and an ethics-considering pharmaceutical industry. Such considerations are important not only for HIV drugs; trade agreements must include obligations to make good generic drugs available. Globalisation must imply an effort to improve conditions globally. The most expensive treatment in our study was the osteomyelitis treatment in a six years old boy. The drug used was made in India, and the original brand drug costs about four times as much in a European pharmacy. The price of his antibiotic treatment, approximately 110 USD, is beyond the means of most families in light of the income examples given.

The third requirement is a large effort to increase education on all levels, and a fair geographic distribution of health personnel. Our study showed a frightening high level of illiteracy among mothers. This is unacceptable, both for the country and for the international community. Basic schooling allows improved understanding about child care and increases the possibility to rise from the most extreme poverty. The relationship we found between low female education and many children supports the assumption that education also promotes family planning. Higher education is equally important. Large numbers of physicians, nurses, physiotherapists and other groups of key personnel are needed. Practice periods should take place in rural communities to increase interest in future work in peripheral areas.

### Conclusions

Poverty is so important that its negative effect on health can be demonstrated in a small study like ours. Adult smoking affects children's health, even in a population where relatively few smoke. Most people can afford to pay for a simple consultation and outpatient treatment, but few people can afford hospitalisation or long-lasting or frequent medical therapy. Diseases with severe consequences for public health, like tuberculosis, AIDS and malaria should have national programs with free, decentralised examination and treatment. Access to generic drugs is essential. A major educational effort is needed to improve public health.

### Competing interests

None declared

### Author's contributions

Author 1 KH conceived the study, trained and participated in the visiting teams, assisted in the hospital evaluation of

patients, performed statistical analysis and drafted the manuscript.

Author 2 HH contributed to the design, performed all the clinical examinations in hospital as well as therapeutic follow-up of the patients, and collaborated on the editing of the manuscript.

Both authors read and approved the final manuscript

### Additional material

#### Additional file 1

. Characteristics and diagnosis/therapy/cost for 35 patients referred during population survey 1.

Click here for file

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