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COMPREHENSIVE CAN BE EFFECTIVE: THE INFLUENCE OF COVERAGE WITH A HEALTH CENTRE NETWORK ON THE HOSPITALISATION PATTERNS IN THE RURAL AREA OF KASONGO, ZAIRE

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Abstract—This study analyses routine data from Kasongo, Zaire in order to assess the influence of coverage with a network of health centres delivering primary care on hospitalisation patterns. Admission rates are 2.1 times higher for non-covered than for covered areas. For non-justified hospitalisations (false positives) distance decay is marked both in covered and non-covered areas, but at consistently lower levels in covered areas. For justified hospitalisations (true positives), hospitalisation rates are markedly lower in covered than in non-covered areas if one considers areas with reasonable (<40–50 km) access to the hospital. In more remote areas the relationship is inversed, and populations from non-covered areas do not use the hospital at all, whilst some people from covered areas do reach the hospital. Reduction of hospitalisation rates is for diseases for which standardised technical solutions of known efficacy are available at the health centres. Hospitalisation rates for the diseases usually targetted by selective PHC programmes are reduced by 86% in the covered areas as compared to the non-covered areas. Reduction in hospitalisation rates for those diseases accounts for 29% of the total coverage-related reduction.

INTRODUCTION

One of the places where an attempt is made at running comprehensive primary health care (CPHC) services under routine circumstances is the rural district of Kasongo, Zaire [1]. The health care system there is an integrated two-tier system consisting of a rural hospital and a network of health centres. The health centres (an average of one per 10,000 inhabitants) make up the first contact level, and are backed up by the 180 beds hospital, which serves as a referral level. The health centres are staffed by a team consisting of an auxiliary nurse with two to four post-primary years of medical training, a clerk and a medical aid. This team has full technical and managerial responsibility for the health care in its area: except for trypanosomiasis control no vertical programmes of any kind are conducted in the district. A medical team of four to five general practitioners has the overall responsibility for the entire system. The network of health centres has gradually been expanded, area per area, since 1971. The system has been developed along two axes: rationalisation and participation [2]. There has been an explicit commitment to provide integrated and comprehensive care, taking the communication with the population and the felt and expressed needs as starting points for planning and for defining the content of the system. The communication with the population was considered a way of increasing the community's self-reliance (participation), but also as a precondition for organising an effective and accessible system (rationalisation), within the context of the limited human and other resources. These limitations are important in Kasongo: one medical doctor for about 40,000 inhabitants, one auxiliary nurse (hospital and health centres) for 3600, a total health care budget of 3 US$ per inhabitant per year.

A health care system such as the one in Kasongo is much more difficult to evaluate than a categorical disease control programme. For the latter the issues are usually clear and obtaining an epidemiological measurement of its 'impact' is not as much a conceptual as a methodological problem. The complexity of a routine district health care system makes both the choice of relevant indicators and parameters and their measurement more hazardous, and process evaluation becomes relatively more relevant than a classical 'epidemiological' evaluation. It remains crucial, nevertheless, to test the adequacy of the model and the underlying comprehensive approach, not only in terms of feasibility but also in terms of usefulness.

This paper gives an example of how routine information can be used to contribute to such evaluations. Two issues are addressed. First it will be shown that coverage with the health centre's network in Kasongo reduces hospitalisation rates among the people in the rural area; secondly, it will be argued that in Kasongo this reduction is an indication of the adequateness of the health care system, and that such results would not have been obtained had the approach been limited to selective categorical disease control.

Considering such a reduction of hospitalisation rates as a test of the adequateness of the district health care system—and indirectly of the comprehensive approach to PHC: the Kasongo health care system is an attempt at implementing this approach in routine district health services [3]—has the following rationale. If the health centres network functions as intended, this should lead to preventing the occurrence or to ensuring early detection and treatment of a number of health problems. All other things remaining equal, and unless the health centre promotes unnecessary hospitalisation, this in turn should lead to a reduction of hospital admissions, as problems are either avoided or resolved at first contact level [4]. A

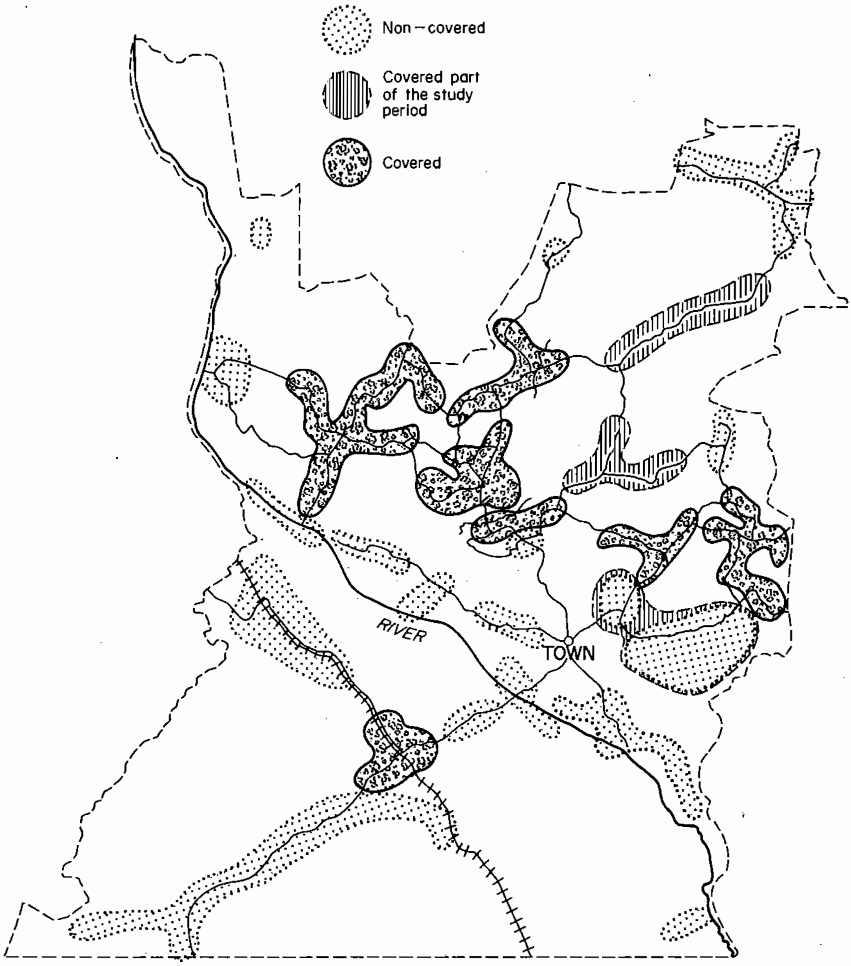

Fig. 1. Map of the Kasongo area with the different geographical units used in the spatial analysis of hospital admissions. The areas in between are uninhabited.

reduction of admission rates is then to be considered as an indication that the frequency or gravity of a number of health problems diminishes, or that there is an increased capacity of effectively dealing with them at first contact level, in a less expensive [5], alienating and iatrogenic setting than the hospital.

MATERIALS AND METHODS

The present analysis is based on routine data recorded on patients from the rural areas admitted to the hospital during one whole year. At that moment the coverage of the rural area with the health centre network was still incomplete, about 60% of the rural population was living in covered areas.

The urban and immediate periurban area—with an estimated population of about 35,000 inhabitants—is not included in this analysis because too many factors—physical accessibility, epidemiological and socio-cultural features—could affect utilisation patterns in a different way than in the rural areas. This would obscure the relation of hospitalisation rate differentials and coverage.

The rural area has been divided up into 27 geographical units (Fig. 1). All these were at 15 km or more from the hospital. Seven geographical units, with 74,809 inhabitants, were covered by a health centre that was already functioning for some time at the beginning of the one year study period. Sixteen areas, with 46,393 inhabitants, remained without health centre coverage throughout the one year study period. For four areas health centre coverage started during the one-year observation period. These four areas totalled 15,155 inhabitant-years before they were covered. The creation of three health centres regrouped these four areas into three covered areas totalling 15,201 inhabitant-years after the health centres were opened. The rural area thus totals 90,010 inhabitant-years in 10 covered and 61,548 inhabitant-years in 20 non-covered geographical units.

The population-weighted mean distance from the hospital is of 59 km for covered and of 77 km for non-covered areas. The geographical origin of each hospitalised patient was routinely recorded by the ward nurse. This makes it possible to calculate area-specific admission rates: the number of hospitalisations from each geographical unit, per 1000 inhabitant-years. Admission rates for the geographical units where health centres were opened during the study year, have been calculated separately for the period before and after the creation of the health centre.

There are no indications of important small area variations for other pathology than trypanosomiasis, which occurs in well-defined geographical pockets. With that exception, it is not too hazardous to make the—admittedly questionable—assumption that the population from covered and from non-covered areas are basically exposed to the same morbidity-risks, and have an equal *a priori* need for hospitalisation.

The comparison of admission rates for covered and non-covered areas does not include the hospitalisations for trypanosomiasis: it would not make sense within the context of this paper, to compare admission rates for trypanosomiasis, between covered and non-covered areas that anyway have a different case-load. Deliveries and the directly associated hospitalisations (such as prematurity, or caesarean section) were also excluded from analysis, because their relation to coverage is to be interpreted in a different way than is done for other admissions [6].

For all the analysed admissions a distinction is made between justified and non-justified hospitalisations. A hospitalisation was classified as justified if during the hospitalisation diagnostic or therapeutic skills were used that are not available at health centre level, e.g. surgery, certain drugs, certain laboratory examinations . . ., or if the patient needed a level of nursing care that cannot be provided ambulatorily. This information was recorded routinely by the ward physicians, at the end of the patient's hospitalisation. It should be stressed that the physicians recorded this information for planning purposes and to have a feed-back on the criteria used for hospitalisation by the outpatient department. They were not aware that it was going to be used to assess the impact of coverage on admission rates. A routine weekly peer review of a sample of patient files, done in order to maintain and improve quality of service, also included a check of the information recorded. The general impression was one of good inter-physician agreement on the classification of the patients.

The two main possible biasses that may affect the interpretation of hospitalisation rate differentials between the covered and non-covered rural areas, are the geographical distribution of the population and possible patient selection. Indeed, a larger admission rate for non-covered areas would not be an indication of health centre effectiveness or efficiency if the hospital is more accessible to patients from the non-covered area. This would have been the case either if physical access was easier for people from the non-covered area, or if they were more readily hospitalised by the hospital physician.

Possible patient selection, which supposedly would favour hospitalisation of patients from non-covered areas whereas more stringent criteria would be used for patients from covered areas, is assessed by an analysis of the outcome of the hospitalisation (improvement or deterioration 'or death' by the time of discharge) and of the *post hoc* justification of the hospitalisation.

The second problem is the possible influence of distance, whereby better physical accessibility could lead to higher admission rates by its own right, and thus obscure the interpretation of any covered–non-covered admission rate differentials. In order to assess the influence of distance a weighted logistic regression model [7], using admission-rates as dependent and median distance between the area's inhabitants' homes and the hospital as independent variable, was fitted to the data, separately for justified and non-justified hospitalisations. In contrast to a comparison of aggregate admission rates, the regression curves for covered and non-covered areas make it possible to take distance decay into account.

Another level of analysis is the following. If the health centres are directly responsible for a decrease in admission rates, then the excess admissions from non-covered areas should be admissions for diseases which otherwise could have been treated or prevented in the health centre. In other words, treatment or prevention tools of known efficacy for those diseases must exist at health centre level. As for each admission a final diagnosis (on basis of the 1965 revision of the ICD-classification) was recorded by the ward physicians, disease-specific hospitalisation rates can be compared for covered and non-covered areas. The distribution of the excess admissions over various disease categories is used to identify which health centre activities, if any, are likely to have been instrumental in obtaining the reduction. It is also used to check whether a similar reduction could have been obtained had the health centre activities been limited to the categorical disease control programmes usually advocated under the selective approach [8].

RESULTS

Non-covered areas have admission rates that are more than two times higher than covered areas. Table 1 shows that the differences are significant, both for justified and non-justified hospitalisations. Table 2 shows the differences and similarities between the admissions from covered and non-covered areas. The slightly longer average stay in the hospital for

Table 1. Justified and non-justified hospital admissions from non-covered and covered rural areas; rates are expressed as number of admissions per 1000 inhabitant-years

	Non-covered areas	Covered areas	Odds ratio: non-covered/covered (95% conf. interval)
Justified hospitalisations	5.17 (318/61,548)	2.45 (221/90,010)	2.1 $\chi^2 = 75.8$* (1.78–2.50)
Unjustified hospitalisations	2.10 (129/61,548)	0.97 (87/90,010)	2.2 $\chi^2 = 32.9$* (1.67–2.84)
Total hospitalisations	7.26 (447/61,548)	3.42 (308/90,010)	2.1 $\chi^2 = 108.8$* (1.68–2.24)

*$P < 0.001$.

Table 2. Some features of the hospitalisations from non-covered and covered rural areas

	Non-covered areas	Covered areas
Proportion of hospitalisations classified as 'justified'	28.9%	28.2%
Average stay in the hospital	14.0 days	12.5 days
Hospitalisation days/inhabitant/year	0.10	0.04
Proportion with unsatisfactory outcome	15.4%	15.4%
Proportion cured	75.6%	74.3%

patients from non-covered areas (14.0 days against 12.5), in combination with the higher admission rates results in 0.10 hospitalisation days per inhabitant per year for non-covered, and 0.04 hospitalisation days per inhabitant per year for covered areas. The variability of admission rates is larger in the non-covered areas: for justified hospitalisations it ranges from 0.0 to 21.1‰ against from 0.6 to 4.8‰ in covered areas; for non-justified hospitalisations the rates range respectively from 0.0 to 9.5 and from 0.0 to 5.8‰. There are no differences in outcome for patients from covered and non-covered areas. The proportion of patients that either died or had gone from bad to worse on discharge is identical for covered and non-covered areas: 15.4%; the proportion cured or improved was almost identical for both areas.

Figure 2 shows the relationship between admission rates and distance from the hospital. Admission rates decrease as the distance from the hospital increases. Once beyond 50 km they drop to 2.3‰ for covered and 0.6‰ for non-covered areas.

Table 3 summarises the regression equations. There is little difference in the slopes of the curves for non-justified hospitalisations from non-covered and covered areas. The covered area admission rates for any given distance amount to 50–60% of those of the non-covered areas, but the difference in intercept is only marginally significant, and once one goes beyond a distance of 60 km, both drop to very low figures, below 0.5‰.

For justified hospitalisations however, the patterns are very much different for covered and non-covered areas. The distance decay in admission rates is much less pronounced for the covered areas: there the curve is markedly flatter (the difference between the *b*s of the regression equations is statistically significant). Whereas admission rates are much lower in covered than in non-covered areas near to the hospital, the situation inverses once the distance from the hospital becomes larger than 50–60 km. The admission rate for the covered population living at more than 50 km from the hospital is of 1.75, for an average population weighted distance of 97 km. For the non-

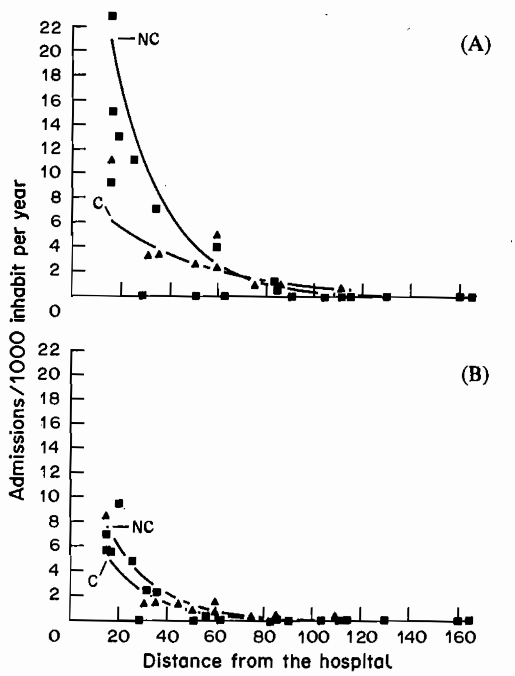

Fig. 2. Relationship between area-specific admission rates and distance from the hospital. (A) Justified hospitalisations. (B) Non-justified hospitalisations. (■) Non-covered; (▲) covered.

covered areas, even excluding the population groups at more than 130 km, this is of only 0.7, for an average population weighted distance of 92 km. The odds ratio is of 2.5 (chi-square = 14.8; $P < 0.001$).

Cause-specific admission rates are slightly smaller in non-covered areas for three groups of diseases only: diabetes, inguinal hernia and mental disorders, with a total difference of 0.09 admissions per 1000 inhabitants per year.

For all other causes of hospitalisation the cause-specific admission rates show an excess in non-covered as compared to covered areas. This total excess amounts to 3.94 admissions per 1000 inhabitants per year. Table 4 shows the relative responsibility of each group of causes in this excess. 49.7% of the excess is due to infective and parasitic diseases and accidents; a further 35.5% is due to diseases of the respiratory system, ill defined conditions, skin diseases, diseases of the genito-urinary system and diseases of the blood (essentially anaemia).

Admission rates for diarrhoea, diphteria, pertussis, tetanos, malaria, malnutrition and measles are of 1.32‰ for non-covered and 0.18‰ for covered areas. The coverage-associated difference in admission rates for these causes is of 1.14, i.e. 28.6% of the total

Table 3. MLE parameters (and asymptotic standard deviations) obtained for fitting a logistic model, logit (admission rate) = $a + b$ (distance), to the different data sets

		Non-covered areas	Covered areas	Covered–non-covered
Non-justified admissions	a:	−4.091 (0.257)	−4.460 (0.519)	−0.037 $t = 2.0$*
	b:	−0.051 (0.012)	−0.053 (0.014)	0.002 $t = 0.3$
Justified admissions	a:	−3.319 (0.212)	−4.711 (0.383)	−1.39 $t = 10.0$**
	b:	−0.047 (0.010)	−0.024 (0.008)	0.022 $t = 5.3$**

All MLEs are significantly different from 0 ($P < 0.005$); t-tests on differences between parameters have 28 *df*; *$P < 0.05$ (one-sided); **$P < 0.001$.

Table 4. Distribution by cause of those reasons for hospitalisation for which the admission rate is higher in non-covered than in covered areas

Reason for hospitalisation	Proportion of difference in admission rates
I: Infective and parasitic diseases	0.371
XVII: Accidents, poisonings and violence	0.126
VIII: Diseases of the respiratory system	0.088
XVI: Symptoms and ill defined conditions	0.074
XII: Diseases of the skin and subcutaneous tissue	0.067
X: Diseases of the genitourinary system	0.064
IV: Diseases of the blood	0.062
No information	0.047
XI: Certain conditions related to pregnancy*	0.036
VII: Diseases of the circulatory system	0.023
IXb: Diseases of the digestive system exclusive hernias	0.018
II: Neoplasms	0.011
VI: Diseases of the nervous system and sense organs	0.005
XIV: Congenital anomalies	0.004
XIII: Diseases of the musculoskeletal system	0.004

*Only those not related to delivery.

Causes are classified according to the ICD-classification, 1965 revision. The proportions are relative to the total difference in admission rates, which is of 3.94 admissions per thousand inhabitants per year (not controlled for distance).

coverage-associated difference of 3.94 admissions per 1000 inhabitants per year.

DISCUSSION

The reduction of admission rates in the covered areas

Admission rates are significantly lower for the population living in covered areas, and apparently this can be attributed to the presence of the health centres.

There are no indications that the difference in admission rate would be an artefact due to patient selection. Hospitalisations in Kasongo are decided upon by the physician in charge of the outpatient department of the hospital. Access to this outpatient department is made easier for patients referred by a health centre—attendance is faster and cheaper. This would not make us expect lower, as is the case, but rather higher hospitalisation rates for patients from covered areas. Theoretically it is possible that this would be compensated for by broader indications for hospitalisation for people from non-covered areas. If this were the case, we would expect a higher proportion of non-justified hospitalisations among patients from non-covered areas. However, the proportions of non-justified hospitalisations are not different: 28.2% for the patients from covered and 28.9% for those from non-covered areas. The impression of lack of selection bias is further substantiated if we look at the outcome of the hospitalisation for patients of both areas. If the physician in charge of the outpatient department uses broader indications for patients from non-covered areas, hospitalising patients that would otherwise be treated on an outpatient basis at the health centre, then one would expect a higher cure rate or less failures among those patients than among the more serious or more complicated cases referred from the health centre. In fact, the outcome is near to identical for patients from covered areas and from non-covered areas. All this indicates that the physician's criteria for deciding on an hospitalisation were the same whether patients came from non-covered or from covered areas.

Controlling for distance by fitting the logistic regression models shows that the excess in admission rates for non-covered areas is not due to a better physical accessibility. Rather, the observed aggregate differences are an underestimation of the differences one would find if both covered and non-covered areas were at equal distances of the hospital.

The regression analysis shows that coverage is not only associated with a different level of admission rates at a given distance, but also with differences in the slope of the distance decay—at least for the justified hospitalisations, i.e. for the true positives. These findings indicate that the health centres are an element of rationalisation in the health system. They facilitate the use of the hospital structure when this is necessary and help avoid it where this is possible. Indeed, coverage is associated with reduced rates of non-justified hospitalisations, both near to and far from the hospital. Near to the hospital coverage is also associated with reduced rates of justified hospitalisations—conceivably because a number of problems are solved at health centre level. Further away, beyond 50–60 km from the hospital, the distance barrier is too important for such patients from non-covered areas, and they do not reach the hospital. But even at those distances a small number of patients still arrives from the covered areas—many of them referred by the health centre, and most of them classified as justified hospitalisations.

That the reduction in admission rates is a result of the presence of the health centres is further circumstantiated if we consider the nature of problems for which extra hospitalisation is required for non-covered areas. Table 4 shows that 37% of excess of admission rates from non-covered areas is constituted by infective and parasitic diseases. The five leading causes of excess hospitalisation for infective diseases are, in order of importance, measles, amoebiasis, diarrhoea, helminthiasis and tetanos, all of which are diseases for which a specific and effective treatment or prevention exists and is available at the health centre level. The same goes for a large part of the other causes of excess hospitalisation, such as respiratory diseases, anaemia, diseases of the genitourinary system, etc. This increases the plausibility that the lower admission rates can be interpreted as the result of a direct contribution of the health centres to avoiding or solving health problems.

This study thus illustrates how properly used routine information can be used to contribute to the evaluation of district health services. Obviously the evalution of a complex social entity such as a health system cannot be based on one single test. Still, this kind of observation may be all but trivial to a project manager who can put them in their context, and who cannot and should not resort to huge data collection operations.

Effectiveness through comprehensiveness

If a health care system reduces the number of hospitalisations by providing adequate treatment or prevention at first contact level (as is suggested by the profile of the diseases for which hospitalisation has been avoided), and if furthermore it succeeds in reducing the accessibility barrier for the cases that really need hospitalisation (as is suggested by the curves for justified hospitalisations), then this can be considered evidence for its usefulness. The health centre coverage associated reduction of admission rates cannot be used as an absolute measure of the degree to which health problems have been solved (and it is not intended to do so). But in as much as this reduction is a desirable result, it is relevant to identify which health centre activities have been instrumental in obtaining it.

Much of the PHC policy discussions of this last decade has focussed on the effectiveness–efficiency issues. The reaction against the disastrous results of inducing and unconditionally responding to irrational demand, which characterises many health care systems, has prompted a variety of selective approaches, supposedly more realistic, effective and efficient. The key interventions advocated under such an approach are [8]: measles and DPT vaccination for children over six months; tetanus toxoid to pregnant women; encouragement of long term breast feeding; chloroquine for children under three years in malarious areas to ingest during episodes of fever; oral rehydration packets and instruction. The whole problem is then stated in terms of finding the most expedient way of reaching the population with these interventions.

Hospitalisation for diarrhoea, diphteria, pertussis, tetanus, malaria, malnutrition and measles—the diseases targetted by selective interventions—is reduced by 85.6% in the covered areas. This indicates that the health centre activities in this field are carried out in an effective way. However, the coverage-related reduction in hospitalisation rates for those diseases represents only 28.6% of the total coverage related reduction. Most of the technical acts that explain the rest of the reduction are those that are performed by the auxiliary nurse at the general curative consultation (e.g. treatment of cases of amoebiasis, or of pneumonia).

Starting from an analysis of the interaction between the health care system and society, and particularly of its role in development and increasing self-reliance of the population, CPHC approaches point out the limitations of reducing the discussion to one single medico-technical dimension [9]. Other issues are at stake as well. But this does not mean that a comprehensive approach does not also aim at effective PHC; rather, it claims a better potential for achieving optimal effectiveness. Part of this is to be achieved through better possibilities for higher coverage with such selected activities [10]. Part of this also has to be achieved through a better tailoring of the health system to the needs, expectations and resources of the people.

In the Kasongo health care system both participation and rationalisation were the key principles in structuring the health care system. Starting from the communication with the population to build a health service system also means that one has to cope with an important demand for general curative services. Readily accessible general curative care is therefore a key feature of the Kasongo health care system, and has been so from the beginning. However, this curative care is as much the object of an effort of rationalisation as other components of the system (a.o. through the use of standardised problem solving algorithms), and it is integrated with other activities such as, e.g. vaccination or growth monitoring. It goes without saying that the interventions advocated under the selective approach are also included in the range of activities of the Kasongo health centres. But the scope is much wider and problems, which from the technocratical point of view are of low priority, are not rejected. The observations reported here support the hypothesis that starting from felt and expressed needs can be balanced with rationalisation in such a way that effectiveness at affordable cost is not sacrificed but rather enhanced.

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REFERENCES

1. Kasongo is a rural district of approx. 16,000 km^2 in the East of Zaire, with some 200,000 inhabitants. It borders on forest and savanna and has a tropical climate. The economy is mainly agricultural (rice, cotton, groundnuts) and the annual income per head is about US $200. Between 25 and 50% of adults and 80% of children in the town and the larger villages are literate, compared with about 10% of adults and 50% of children in the country areas.
2. The Kasongo Project Team. The Kasongo Project: lessons of an experiment in the organisation of a system of primary health care. *Annls Soc. belge Med. trop.* **61,** suppl, 1981; *Wld Hlth Forum* **4,** 41–45, 1983.
3. The system is managed within the financial limits of national resources, with a total expenditure of about US $3 per inhabitant per year. The district health care system has the responsibility for the health care for about 200,000 inhabitants, a larger scale than most pilot projects. This makes it more subject to the operational constraints one finds in a routine situation than most pilot projects.

4. Health systems research has confirmed such an effect of PHC on hospitalisation patterns in the case of low income groups in North America. WHO study group. Research for the reorientation of national health systems. *Technical Report Series* no. 694, 1983.
5. The Kasongo Project Team. PHC for less than 1 US $ per inhabitant per year. *Wld Hlth Forum* 211–215, 1984.
6. The health centre is supposed to find an optimal balance between sensitivity and specificity of referral of women at risk for complications of delivery. See The Kasongo Project Team. Antenatal screening for fetopelvic dystocias. A cost-effectiveness approach to the choice of simple indicators for use by auxiliary personnel. *J. Trop. Med. Hyg.* **87,** 173–183, 1984. If the health centre assumes this responsibility, this will in some instances lead to an increase, in some to a decrease of hospital deliveries. This makes it difficult to interpret admission rates for deliveries and associated pathology simultaneously with other reasons for hospitalisation.
7. The logistic transformation performs well for small proportions with unstable variance. Regression equations were calculated using a programme based on a Gaus–Newton algorithm for iterative least square estimation of non-linear regression, adapted for maximum likelihood estimation. Engelman L., Frane J. W. and Jemrich R. I. *BMDP Biomedical Computer Programs.* University of California Press, Berkeley, Calif., 1977. Weighting of the observations was done proportionate to the relative size of the population of each geographical unit, in order to take the variability of the population sizes into account: six out of 20 geographical units of the non-covered areas (i.e. nearly one third of the data points that define the regression parameters) make up only 10% of the population. Weighting resulted in very slight modifications of the regression parameters.

8. Walsh J. A. and Warren K. S. Selective primary health care: an interim strategy for disease control in developing countries. *New Engl. J. Med.* **301,** 967–974, 1979.
9. Berman P. Selective primary health care: is efficient sufficient? *Soc. Sci. Med.* **16,** 1045, 1982. Banerji D. Can there be a selective primary health care? Consultation on operational issues in the transition from vertical programmes toward integrated primary health care. Unpublished paper, 1984. Unger J. P. and Killingworth J. Selective primary health care: a critical review of methods and results. *Soc. Sci. Med.* **22,** 1001, 1986. Rifkin S. and Walt J. Why health improves: defining the issues concerning comprehensive primary health care and selective primary health care. *Soc. Sci. Med.* **22,** 559, 1986.
10. Gish O. Selective primary health care: old wine in new bottles. *Soc. Sci. Med.* **16,** 1049, 1982. The Kasongo Project Team. The impact of primary and secondary health care levels on tuberculosis control activities in Kasongo (Zaire). *Bull. Int. Union Tuberculosis* **57,** June, 1982.