# Decreased attendance at routine health activities mediates deterioration in nutritional status of young African children under worsening socioeconomic conditions

Yves Martin-Prével, Pierre Traissac, Francis Delpeuch and Bernard Maire

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| **Background** | Economic crisis and sociopolitical instability are generally associated with worsening health and nutrition in developing countries. This study examines the role played by the attendance rate of young children at routine health activities in the deterioration of their nutritional status under adverse social and economic conditions. |
| **Methods** | Two nutritional cross-sectional surveys were carried out in two districts of Brazzaville, capital city of The Congo, in 1993 and 1996. They included respectively 2807 and 1695 randomly selected children 4–23 months old. The children's nutritional status was assessed by height-for-age in z-scores. Using embedded general linear regression models, explanatory variables (routine health activities index, socio-demographic context, household economic level, prenatal factors) were tested as potential mediators for the effect of the year of survey on child mean height-for-age. |
| **Results** | The routine health activities index declined sharply from 1993 to 1996. Its introduction in the regression model including all other explanatory variables led to a sharp decrease in the effect of the year on children's nutritional status, showing the important mediating effect of routine health activities. This result was encountered across all economic categories of households. Other explanatory variables showed more limited mediating effect. |
| **Conclusions** | Attendance at preventive health activities should be fostered in African urban communities facing harsh socioeconomic situations to prevent further deterioration in the nutritional status of children. |
| **Keywords** | Public health, attendance rate, caring, economic crisis, nutritional status, embedded regression models, mediating effect, children, Africa |
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The extent to which health and nutrition in developing countries have been affected by economic crises and subsequent adjustment policies has been addressed by many authors but with differing conclusions. It was first argued that adjustment policies had or might have serious adverse effects on health and nutrition, especially of poor people.[1,2] This led to claims for 'adjustment with human face' in the middle of the 1980s.[3] Today, many authors continue to share the view that adjustment policies are associated with growing poverty and

malnutrition.[4] Others, without denying the existence of some adverse effects, have concluded that the impact of economic adjustment policies was much more limited and varied considerably from one country to the next, depending on the commitment of countries to the adjustment process and to the effective reallocation of resources to the poor.[5,6]

It is broadly acknowledged that health and nutrition can be affected by economic policies in three main ways: reduced income, reduced quality of health environment and social services, and reduced mother and child care.[7] Nevertheless, empirical information is still needed about the links between these three 'underlying causes' and the nutritional or health status of the population. The aim of the present study was to examine the role played by the decline in the attendance of

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young children at routine health activities in the degradation of their nutritional status, within a context of economic adjustment (currency devaluation) and social crisis, in an urban setting in central Africa (Brazzaville, capital city of The Congo).

The Congo, a small country in central Africa, enjoyed fairly good economic growth in the early 1980s, mainly due to oil revenues. However, since then the real gross domestic product per capita has declined from $US 900 in 1980 to $US 540 in 1995. Economic shocks such as the decrease in the price of crude oil and numerous policy errors resulted in an increase in poverty until the middle of the 1990s.[8] At the end of 1993 and at the beginning of 1994 two new events further affected the welfare and livelihood of households, particularly those in the capital city: first, civil unrest and second, the devaluation by 50% of the African Financial Community (CFA) franc which reduced real wages and food expenditure.[8] Comparison of data from two nutritional cross-sectional surveys carried out in two districts of Brazzaville, in 1993 and in 1996, respectively, showed that the overall nutritional situation of both infants and their mothers had deteriorated.[9] The present paper addresses the importance, from a nutritional standpoint, of sustaining routine health activities in such a context of economic crisis and civil disturbance.

## Methods

### Nutritional surveys

Two similar questionnaire-based cross-sectional surveys including anthropometric measurements were carried out in two districts of Brazzaville (Poto-Poto and Bacongo), in 1993 and 1996, respectively. The study zone was very homogeneous in terms of housing and included approximately 60 000 inhabitants in each district. Using random cluster sampling, 2807 and 1695 children 4–23 months old were included, in 1993 and 1996, respectively.[9] We specifically chose not to take the sampling design into account in the analysis, due to the high number of clusters (257 in 1993 and 263 in 1996) and to the rather high sampling fraction.

In the present study, changes in the nutritional status of the infants were assessed by changes in the mean height-for-age index. As this index reflects achieved linear growth and its deficit indicates long-term, cumulative inadequacies of health or nutrition, it is useful for monitoring changes in nutritional situations.[10] Anthropometric measurements were made under standardized conditions, according to World Health Organization (WHO) recommendations.[11] The birth date of each child was carefully verified, on official documents whenever possible (i.e. in 93.6% of the cases). Using the Epinut module of Epi-Info software, version 6.04,[12] the height-for-age index was calculated for each child and expressed as z-scores with respect to international reference values. Hereafter this index is referred to as HAZ (height-for-age z-score).

### Explanatory variables

An empirical 0–3 point score was built to assess the level of routine health activities received by each sampled child. One point was attributed for the presence of a health-monitoring document (immunization card, growth chart, health booklet or other). A further point was attributed if the child had been weighed at least twice every 3 months; only the first year of life

was taken into account in order to avoid any age bias due to the dramatic drop-out rate for growth monitoring that was observed in older children. Another point was added if the immunization status of the child was considered good for his/ her age with respect to a different minimal number of received antigens in each trimester of age. Finally, according to the distribution of the score among the sample from the two surveys combined, the children were grouped in three categories for their 'routine health activities index': high (3 points), medium (2 points) and low (0 or 1 point).

The questionnaire also gathered demographic, social and economic information and the corresponding variables were grouped in three subsets: socio-demographic context, household economic welfare, prenatal factors. (1) Socio-demographic context included district of residence, gender and age of the head of household, nationality, age, schooling and number of children of the mother, family ties between the head of household and the mother, presence of the father in the household, sex and age of the child. (2) Household economic welfare was assessed by the type of occupation of both the mother and the head of household and by a summary economic index of the household. This index took into account characteristics of the dwelling, utilities (water, electricity) and appliances (radio, television, etc.). A correspondence analysis[13] was performed on the matrix of indicator variables coding these characteristics. The first principal component of the correspondence analysis (weighted linear combination of the indicator variables that maximizes variance between households) displayed a gradient of household wealth. The score of each household on the first principal component axis was then used as a summary index of wealth; the latter was introduced in the analyses after breakdown into terciles to group the households in three economic levels: poor, medium and rich. (3) Prenatal factors included the mother's height and body mass index (BMI): weight (kg)/square of the height $(m^2)$.

### Conceptual framework

The hypothesized relationships between the outcome under study and explanatory factors are outlined in the conceptual framework shown in Figure 1, which was based on a hierarchical
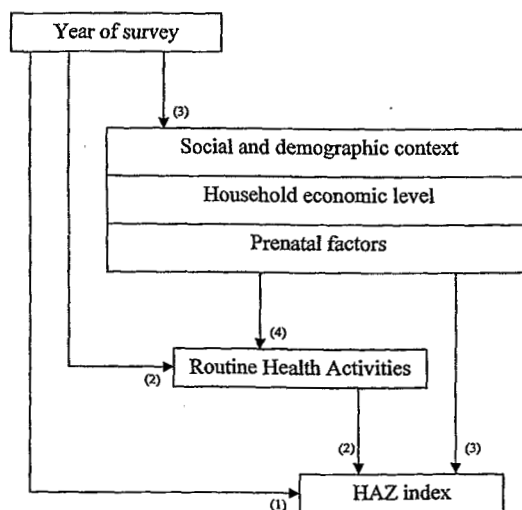
**Figure 1** Conceptual framework

approach.[14] According to this framework, the nutritional status of the children could have worsened from 1993 to 1996 (i.e. it could be linked to the variable 'year of survey') by several pathways: directly, through factors that are not accounted for here or are even unknown (arrow 1); through a modification in routine health activities, which is the main hypothesis tested in the present study (arrows 2); through modifications in the overall context (arrows 3). Of course, changes in the overall context could also induce changes in the routine health activities (arrow 4).

From an epidemiological standpoint, it should be noted that the explanatory variables within such a framework are called 'mediators' rather than 'confounders'. In fact, as confounding factors they are linked to both the main factor studied (here the effect of the year) and the outcome (here child nutritional status), but they belong to the causal chain between the two.[15]

### Statistical analysis

According to the above hierarchical framework, the statistical analysis was performed by five embedded general linear regression models.[16] It should be underlined that, from a statistical standpoint, regression models do not allow one to distinguish between a confounder and a mediator, as the two types of variables are dealt with in the same way within the models. It is the extraneous information contained in the conceptual framework that allowed interpretation of the results in terms of 'mediating effect' for some explanatory variables.

Only children with no missing value for all the variables of the framework were included in the regression models, i.e. 2559 children from the 1993 survey (91.2%) and 1564 children from the 1996 survey (92.3%). The dependent variable was HAZ. Model 1 included as explanatory variable only the year of survey, and thus assessed the raw deterioration in the nutritional status of children from 1993 to 1996. The magnitude of this 'year-effect' was represented by the difference in the mean HAZ of the children from 1993 to 1996. In model 2 the subset of variables accounting for the social and demographic context was added; the year-effect in this model then assessed only the part of the change from 1993 to 1996 that was not mediated by modifications in the context. Thus it was possible to assess the part of the year-effect that was mediated by the social and demographic context while comparing the decrease in the adjusted mean HAZ from 1993 to 1996 in model 2 to that in model 1. Comparing the deviance of model 2 to that of the model 1 one could also assess the effect of the subset of variables accounting for the social and demographic context when year is controlled for. Similarly, for the other explanatory variables, the mediated parts of the year-effect were estimated while adding to the regression model 2 the subsets of variables accounting for the household economic level (model 3), then the prenatal factors (model 4) and finally the routine health activities index (model 5). By comparing the deviance of a particular model to that of the previous one, it was also possible to assess the effect on HAZ of the added subset of variables, all the variables already in the model being controlled for. When making these comparisons, the mean square error used was always that of the most complete model (i.e. model 5).

Before running the embedded regression models described above, it was necessary to check the potential modifier effect of the variables assumed to mediate the year-effect on child nutritional status according to the conceptual framework. This was done by testing, in separate models, the significance of interaction terms between the year of survey and all the potential effect modifiers (i.e. variables exhibiting a strong relationship with HAZ and/or the year of survey). Given a type I error threshold of $P = 0.10$ for those interaction terms, none showed a significant effect; but the interaction term between the year of survey and the household summary economic index exhibited a borderline $P$-value of 0.11. The presence of interaction theoretically prevents interpretation of the main effect (year-effect) in a model including the other term of the interaction (summary economic index) and should therefore lead to a disaggregated analysis. In this particular case, the borderline significance of the interaction and the fact that it was only quantitative (i.e. it did not change the relationship but only altered its strength) was balanced against the presumed importance of household economic capacity for child nutritional status. It was eventually decided to conduct two analyses: the first on the whole sample, hence ignoring the interaction, and the second on three separate subsamples, disaggregated according to the terciles of the summary economic index.

Finally, multivariate logistic and linear regression models were used to elucidate the relationships between the routine health activities index, here the dependent variable, and the three subsets of explanatory variables accounting for changes in the overall context.

All the statistical analyses were performed using SAS software, version 6.12 for Windows.[17]

## Results

### Characterization of the routine health activities index

There was a dramatic decline in routine health services received between the two years of survey: the distribution of children in the three categories of the summary index (high, medium, low) was respectively 63%, 26% and 11% in 1993, and 35%, 38% and 27% in 1996 ($\chi^2 = 341$, $P < 0.0001$). Among the three components used to build the summary index (i.e. 'document', 'weighing' and 'immunization'), the magnitude of the 1993–1996 drop in the proportion of children having one point for the weighing component was the largest (from 65% to 37%) compared to that for the immunization component (from 87% to 70%) and for the document component (from 96% to 88%).

At the univariate level, the routine health activities index showed significant links with numerous other explanatory variables of the child nutritional status: district of residence, summary economic index, sex, age and occupation of the head of household, age, parity, occupation, BMI, level of schooling and nationality of the mother, family ties between the head of household and the mother or between the head of household and the child. Using multivariate regression models, the routine health activities index remained significantly lower ($P < 0.001$) in Bacongo than in Poto-Poto, when the households were poorer, when mothers had more children, among non-Congolese women, and when mothers had a lower level of schooling.

The routine health activities index was also strongly linked to the nutritional status of the children: the mean HAZ was $-0.670$, $-0.890$ and $-1.130$ z-scores when the index was high, medium and low, respectively ($F = 54.6$, $P < 0.0001$).

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## Analysis of the year-effect on HAZ using embedded regression models on the whole sample

The result of model 1 (Table 1) shows the very significant crude effect of the year of survey on the mean HAZ, which dropped from −0.735 z-scores in 1993 to −0.957 z-scores in 1996 (F = 41.6, P < 0.0001), i.e. a decrease of −0.221 z-scores (95% CI : −0.154, −0.289). When the subset of variables accounting for the social and demographic context was added (model 2), the year-effect on HAZ remains highly significant (F = 33.1, p < 0.0001) and the adjusted decrease in the mean HAZ from 1993 to 1996 is reduced to −0.189 z-scores, i.e. a difference of 0.032 z-scores compared to model 1. In the following steps, the introduction of the variables accounting for the economic level of the households (model 3), and then of the prenatal factors (model 4), only marginally modify the year-effect on HAZ and the 1996–1993 adjusted decreases in the mean HAZ remain roughly at the same level. By contrast, when the routine health activities index is added (model 5), the year-effect on HAZ, though it remains highly significant, is considerably reduced and the 1996–1993 adjusted decrease in the mean HAZ sharply declines to −0.126 z-scores, i.e. a difference of 0.062 z-scores compared to model 4. Thus, with reference to the conceptual framework, a large proportion of the year-effect on child nutritional status appears to be mediated through routine health activities.

To test whether the assumed mediating effect is shared equally between the three components of the routine health activities index, the latter was successively replaced by one of its components in model 5. When the 'document' or the 'immunization' component is introduced, the year-effect remains high (respectively F = 29.4, P < 0.0001 and F = 25.8, P < 0.0001) and the difference in the 1996–1993 adjusted decrease in the mean HAZ with that in model 4 is low (respectively 0.013 and 0.023 z-scores). By contrast, when the 'weighing' component is introduced, the results are very close to those obtained with the summary index: the year-effect decreases sharply (F = 15.2, P = 0.0001) and the difference in the 1996–1993 adjusted decrease in the mean HAZ with model 4 is of 0.060 z-scores. Thus, the proportion of the year-effect on the child nutritional status that appears to be mediated through routine health activities is mainly supported by the weighing component of the index.

## Disaggregated analysis of the year-effect on HAZ, according to the terciles of the summary economic index

Table 2 details the results of embedded regression models in rich, medium and poor households. In the three subsamples, when comparing one model to the next, the biggest difference in the 1996–1993 adjusted decreases in the mean HAZ is between models 4 and 5, i.e. when the routine health activities index is introduced among the explanatory variables.

Other results differ from one group to another: first, the mediating effect of routine health activities is more pronounced in the poor and medium households (the differences between model 5 and model 4 in 1996–1993 adjusted decreases in the mean HAZ are 0.076 and 0.071 z-scores, respectively) compared to the rich households (difference of 0.034 z-scores). Second, among the latter there is no significant adjusted year-effect on the child nutritional index, in any of the models, except model 4 (F = 4.55, P = 0.032). Third, in the poor households the introduction of prenatal factors (model 3 to model 4) leads to a substantial difference of 0.029 z-scores between the 1996–1993 adjusted decreases in the mean HAZ. Given the conceptual

**Table 1** Effect of the year of survey and of other covariates on the mean height-for-age z-score (HAZ), using embedded linear regression models. Whole sample of 4123 children 4–23 months old (2559 children in 1993 and 1564 children in 1996)

| Model No. | Adjusted year-effect on the mean HAZ of children | | | | | | Sequential F tests for added groups of variables (in bold) | | | |
| | Test | | Mean HAZ: values and differences | | | | Comparison of model deviances | | | |
| | $F^a$ | P | 1993 adjusted value | 1996 adjusted value | 1996–1993 adjusted decrease | Difference in adjusted decrease compared with preceding model | Sum of Squares[b] | d.f. | $F^c$ | P |
|---|---|---|---|---|---|---|---|---|---|---|
| (1) Y | 41.6 | <0.0001 | −0.735 | −0.957 | −0.221 | − | − | − | − | − |
| (2) Y + Socio | 33.1 | <0.0001 | −0.802 | −0.992 | −0.189 | +0.032 | 548.63 | 22 | 27.1 | <0.0001 |
| (3) Y + Socio + Eco | 33.6 | <0.0001 | −0.761 | −0.951 | −0.190 | −0.001 | 86.17 | 6 | 15.6 | <0.0001 |
| (4) Y + Socio + Eco + PF | 34.9 | <0.0001 | −0.832 | −1.020 | −0.188 | +0.002 | 281.30 | 5 | 61.1 | <0.0001 |
| (5) Y + Socio + Eco + PF + Health | 14.5 | 0.00014 | −0.876 | −1.002 | −0.126 | +0.062 | 41.62 | 2 | 22.6 | <0.0001 |

[a] Using mean square error of the current model.

[b] 'Sum of squares of the current model − sum of squares of the previous model'.

[c] Using mean square error of the most complete model (= 0.9209).

**Explanatory variables in the models:**

**Y = Year of survey** = 1996 versus 1993.

**Socio = Social and demographic context** = district of residence (Bacongo/Poto-Poto), gender of the head of household, age of the head of household (<30/30–39/≥40 years), nationality of the mother (Congo/central Africa: mainly Zaïre/others: mainly West Africa), age of the mother (<20/20–29/≥30 years), parity (1/2 or 3/≥4 children), sex and age of the infant (age in trimesters), the mother is the wife of the head of household (yes/no), level of schooling of the mother (none/primary/high school level 1/high school level ≥2), father resides in the household (yes/no).

**Eco = Household economic level** = summary economic index divided into terciles (poor/medium/rich), occupation of the head of household (regular income/informal/no occupation), occupation of the mother (regular income/informal/no occupation).

**PF = Prenatal factors** = height of the mother (<1.55/1.55–1.59/1.60–1.64/≥1.65 m), body mass index of the mother (<18.5/18.5–24.9/≥25.0 $kg/m^2$).

**Health = Routine health activities** = summary routine health activities index (low/medium/high).

**Table 2** Effect of the year of survey and of other covariates on the mean height-for-age z-score (HAZ), using embedded linear regression models—Disaggregated analysis according to the terciles of the summary economic index

| | | | Adjusted year-effect on the mean HAZ of children | | | |
| | Test | | Mean HAZ values and differences | | | |
| Model[a] No. | F | P | 1993 adjusted value | 1996 adjusted value | 1996–1993 adjusted decrease | Difference in adjusted decrease compared with preceding model |
|---|---|---|---|---|---|---|
| **A Subsample of 1315 children 4–23 months old, living in rich households** | | | | | | |
| (1) **Y** | 3.09 | 0.079 | −0.516 | −0.621 | −0.105 | – |
| (2) **Y + Socio** | 3.21 | 0.074 | −0.573 | −0.679 | −0.107 | −0.002 |
| (3) **Y + Socio + Eco**[b] | 3.27 | 0.071 | −0.566 | −0.675 | −0.109 | −0.002 |
| (4) **Y + Socio + Eco + PF** | 4.55 | 0.033 | −0.666 | −0.791 | −0.125 | −0.016 |
| (5) **Y + Socio + Eco + PF + Health** | *2.34* | *0.13* | −0.730 | −0.821 | *−0.091* | *0.034* |
| **B Subsample of 1296 children 4–23 months old, living in medium households** | | | | | | |
| (1) **Y** | 10.3 | 0.0013 | −0.749 | −0.943 | −0.194 | – |
| (2) **Y + Socio** | 9.51 | 0.0021 | −0.834 | −1.012 | −0.178 | 0.016 |
| (3) **Y + Socio + Eco**[b] | 10.2 | 0.0014 | −0.839 | −1.025 | −0.185 | −0.007 |
| (4) **Y + Socio + Eco + PF** | 11.7 | 0.0007 | −0.922 | −1.114 | −0.193 | −0.008 |
| (5) **Y + Socio + Eco + PF + Health** | *4.23* | *0.040* | −0.974 | −1.095 | *−0.122* | *0.071* |
| **2C Subsample of 1512 children 4–23 months old, living in poor households** | | | | | | |
| (1) **Y** | 25.1 | <0.0001 | −0.935 | −1.214 | −0.279 | – |
| (2) **Y + Socio** | 20.8 | <0.0001 | −1.074 | −1.318 | −0.245 | 0.034 |
| (3) **Y + Socio + Eco** [b] | 23.0 | <0.0001 | −0.985 | −1.243 | −0.258 | −0.013 |
| (4) **Y + Socio + Eco + PF** | 18.9 | <0.0001 | −0.961 | −1.189 | −0.229 | 0.029 |
| (5) **Y + Socio + Eco + PF + Health** | *7.81* | *0.0053* | −1.005 | −1.159 | *−0.153* | *0.076* |

[a] Explanatory variables in the models as in Table 1, except for Eco.

[b] **Eco** = occupation of the head of household (regular income/informal/no occupation), occupation of the mother (regular income/informal/no occupation).

framework, this is interpreted as a mediating effect of prenatal factors, which does not appear in the other economic categories or in the whole sample. Fourth, the poorer the households the bigger the mediating effect of the social and demographic context: in fact, the 1996–1993 adjusted decrease in the mean HAZ in model 2, compared to model 1, remains stable for the rich households (difference of −0.002 z-scores) but declines by 0.016 z-scores for the medium households and by 0.034 z-scores for the poorest. All the above-mentioned differences in the mediating effects of the subsets of variables from one economic category of households to another are illustrated in Figure 2.

## Discussion

### Mediating factors for the deterioration of the child nutritional status

The aim of the above analysis was to elucidate the pathways involved in the deterioration of the nutritional status of young children in a context of economic and social crisis in an urban setting in central Africa. According to the conceptual framework, embedded linear regression models allowed us to test to what extent the four subsets of explanatory variables mediated the year-effect on the decrease in the mean HAZ. The main result was the predominant mediating effect of routine health
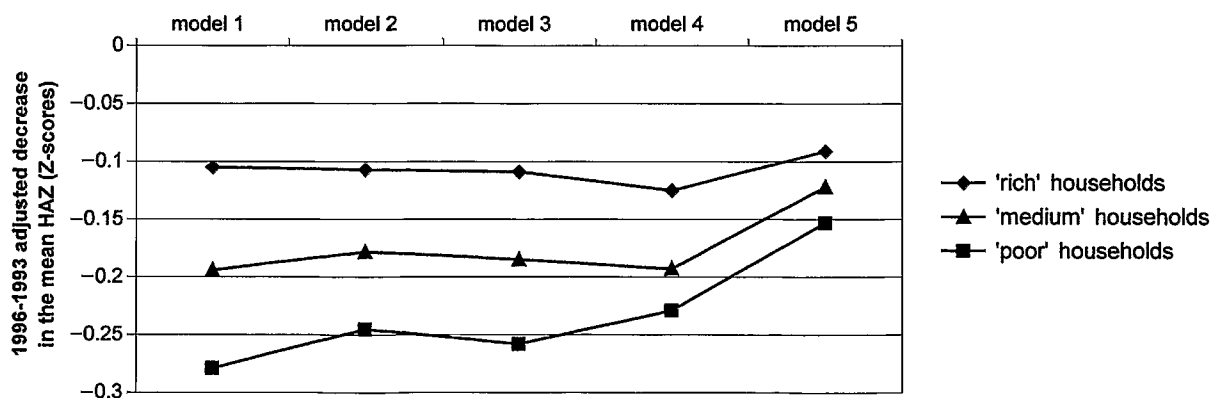


**Figure 2** Adjusted decreases in the mean height-for-age z-score (HAZ) from 1993 to 1996 using different embedded regression models and according to household economic level

activities. From a statistical standpoint, the stronger the links between a mediating factor and the outcome, and between this mediating factor and the main factor, the greater the mediating effect. The routine health activities index was strongly linked to HAZ in this study, as were most of the explanatory variables (details not shown). But there was a very marked decrease in routine health activities from 1993 to 1996, whereas the level of the other explanatory variables did not vary to the same extent. The predominant mediating effect of the routine health activities index is consequently mainly due to the dramatic change in the index. Similarly, among the components of the index, the marked decrease in 'weighing' from 1993 to 1996 explains the importance of its role.

The conceptual framework used in the study does not pretend to take into account all the determinants of child nutritional status. In fact, an important proportion of the year-effect on HAZ remains unexplained in the most complete model (year-effect in model 5: $F = 14.5$, $P = 0.00014$). This indicates that other mediating factors also played an important role in the deterioration in the child nutritional status from 1993 to 1996 (arrow 1 in Figure 1). These factors are possibly numerous but among them the food factor deserves special mention, especially complementary feeding in view of the age of the children (4–23 months). It is widely recognized that poor complementary feeding is an important factor of malnutrition in young children,[18] and in our study a marked decrease in the quality of complementary feeding has already been reported in a previous publication.[9] Nevertheless, the corresponding indicators were not included in the present analysis since they are only relevant for a limited age group.

A moderate mediating effect of changes in the social and demographic context from 1993 to 1996 was also observed. This is thought to be mainly linked to population movements that occurred at the end of 1993/beginning of 1994 because of civil unrest. The poorer the households, the more pronounced the effect. This must be considered together with two other findings: first, there was also a moderate mediating effect of prenatal factors, i.e. of the mother's nutritional status, but this is only observed among the poorest households; second, there was almost no year-effect on child nutritional status among the richest households. Thus, it seems that in rich households the children did not suffer so much from the crisis from a nutritional standpoint, whereas the effects were more pronounced among the poor. Overall, these results account for the borderline interaction that was found between the year of survey and the household summary economic index. The differential effect on nutrition of economic crisis and/or adjustment programmes depending on the wealth/poverty status of the household has already been shown in Africa.[19]

## Importance of routine health activities for nutrition

Whereas the efficacy of immunization programmes in improving the health status of communities is generally not questioned, for the last 15 years there has been controversy about the efficacy of growth monitoring programmes within primary health care strategies. This controversy led to a review of experiences through the Nyeri Colloquium in 1992.[20] It must be admitted that growth monitoring *per se* failed to demonstrate any significant impact on health outcomes.[21–23] However, as an integrated strategy, 'growth monitoring and promotion' is thought to be extremely useful for nutritional education, the motivation of both health workers and mothers and the community, and the promotion of other health services.[24] Our analysis strongly supports this statement since the routine health activities index roughly corresponds to attendance at health preventive services. When this index is high, i.e. when children are brought to these services, the impact of adverse socioeconomic conditions on their nutritional status is much weaker. The mediating effect of the use of health preventive services on the health status of children in developing countries is rarely evidenced, but has already been shown on the incidence of diarrhoea.[25]

## Reasons for the decline in routine health activities

Two factors can be put forward to explain why the attendance at routine health activities, particularly weighing, decreased so sharply from 1993 to 1996: first a decrease in the provision of health services; second a decline in the ability or willingness of mothers to bring their children to health centres.

Numerous studies deal with the impact of crisis and/or adjustment programmes on the provision of health care services. One study showed that public health expenditure increased on average in those countries that started the adjustment process early and took it seriously and even in other adjustment lending countries, but decreased in non-adjustment lending countries.[26] Nevertheless, it remains unclear whether public health expenditure actually has significant positive health outcomes in developing countries.[27] The dire consequences of the adjustment programmes have most frequently been linked to accessibility and quality of health services.[28,29] An in-depth study conducted in Ghana showed that low quality and lack of availability of health services have a clear negative effect on the height of children in rural communities, though the same result was not found in urban areas.[30] However, it should be noted that in this study the data on health facilities nearest to a cluster of sampled households are matched with individual data from that cluster: in urban settings this does not necessarily imply use of these particular facilities by the population. As far as the devaluation of the CFA Franc is concerned, the decrease in the provision of health services was particularly threatening for urban communities. The impact on the provision of preventive as well as curative health services was also exacerbated during periods of social instability and political violence. In Brazzaville, as the recurrent economic crisis, currency devaluation and social instability were combined, it can be assumed that the provision of health care services from 1993 to 1996, even if not measured as such, decreased sharply, in quality as well as in accessibility. Lack of accessibility, at least, is corroborated in our study by the fact that use of health services, as measured by the routine health activities index, remained lower for the poorer households, for non-Congolese mothers and for those living in the Bacongo district, which suffered the most from civil disturbance during the study period.

Although obviously closely related, the ability and the willingness of mothers to bring their children to health centres must be separated for the clarity of our purpose. Concerning the ability of the mothers, many studies have highlighted the increasing time constraints that women face in developing countries, especially when dealing with socioeconomic adversity in urban areas.[31] Because the potential benefit for child

nutritional status of additional income earned by the mother is counterbalanced by less time devoted to children, the final effect remains highly controversial.[32,33] It has been argued that, by carefully weighing the time and income costs of health care activities, mothers could differentiate between 'time-saving' (such as immunization) and 'time-costing' (such as growth monitoring) health activities.[34] Our data, which show a particularly marked decrease in weighing among routine health activities, are consistent with this assumption. This is also corroborated by the fact that attendance at routine health activities was less frequent when the mother had to care for many children. However, the available time to care for the child is not the only factor to be considered when examining the use of health service facilities. Studies on this topic in developing countries, especially under harsh socioeconomic conditions, also showed the importance of the caregiver's autonomy and of a 'positive attitude' towards the preventive health activities.[35,36] There are also numerous studies that emphasize that this 'positive attitude' and its consequences in terms of health outcomes are also linked to the level of schooling of the caregiver,[37,38] which often also interacts with the economic level of the household.[39–41] This is again supported by our data, one of the major factors of attendance at routine health activities being the level of schooling of the mother, after adjusting for potential confounders.

Thus, both government responsibilities in providing adequate and accessible health care and mothers' dilemma in bringing their children to health preventive activities can be put forward to explain the dramatic decrease in routine health activities that was observed in our study. In any case, the important mediating role played by these activities in the deterioration of the nutritional status of children should foster preventive health services, especially when dealing with a deteriorating social and economic situation that is more and more frequent in poor African urban communities.

## Acknowledgements

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