

Effect of economic inequality on chronic childhood undernutrition in Ghana

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Abstract

Objective: Food insecurity and undernutrition remain particularly severe in developing countries where improvements in economic conditions have tended to benefit the advantaged groups and resulted in widespread inequalities in health. This study examined how economic inequality is associated with chronic childhood undernutrition.

Design: A child was defined as chronically undernourished (stunted) if his or her height-for-age index was more than two standard deviations below the reference median. Household economic status was measured by an index based on household ownership of durable assets. Bivariate and multivariate analyses were used to estimate the effects of household economic status on stunting.

Setting: A nationally representative sample of 6251 household interviews in Ghana.

Subjects: A total of 3077 children aged 0–59 months included in the 2003 Ghana Demographic and Health Survey.

Results: Children in the poorest 20% of households are more than twice as likely to suffer from stunting as children in the richest 20% of households independent of the child's age, sex, birth order, breast-feeding duration, birth weight; mother's age at childbirth, body mass index, education; and household access to safe drinking water, hygienic toilet facilities, residence and geographic region (odds ratio = 2.3; 95% confidence interval 1.4–3.7). Also children in the next poorest and in the middle quintiles are significant more likely to be chronically undernourished than children in the richest 20% of households.

Conclusion: This study concludes that economic inequality is strongly associated with chronic childhood undernutrition; and reducing economic inequalities and making services more accessible to the poor will be key to improving the health and nutritional status of children in Ghana.

Keywords
Stunting
Undernutrition
Economic status
Wealth index
Inequality
Ghana

Despite impressive advances in health in recent decades, many people in developing countries remain vulnerable to food insecurity, undernutrition and ill health¹. These problems tend to be particularly severe in the African region². In counties with economic development in transition, health and nutritional benefits of economic growth tend to be distributed unequally among different groups of the population^{3–6}.

In the past decade, Ghana has achieved some degree of socio-economic development paralleled by modest improvements in the health sector, but childhood nutrition still lags far behind that of most other health indicators. Forty-five per cent of the country's population is estimated to be absolutely poor (with earnings less than \$US 1 per day), mostly concentrated in rural areas lacking many of the basic amenities^{7,8}. A vast majority of the population does not have adequate access to food, clean drinking water, hygienic toilet facilities or health care⁹. The food insecurity and undernutrition is particularly severe in rural

areas and for young children¹⁰. Recent improvements in economic conditions are believed to have benefited the rich more than the poor, and the effects of this wide and apparently growing economic inequality on health and nutrition are poorly understood^{3,9}.

In Ghana, as in many other developing countries, including those in sub-Saharan Africa, undernutrition is the leading causes of childhood morbidity and mortality. Undernutrition among children is often caused by the synergistic effects of inadequate or improper food intake, poor child feeding practices including breast-feeding, repeated episodes of parasitic or other childhood diseases such as diarrhoea, and improper care during illness¹⁰. On the other hand, childhood undernutrition affects physical growth and cognitive development, impairs the immune system and increases the risk of morbidity and mortality^{11–13}. In developing countries around the world, an estimated 148 million children are stunted, 127 million are underweight and 46 million are wasted². A recent comparative risk

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assessment by the World Health Organization shows that undernutrition is by far the largest contributor to the global burden of disease¹⁴. Reducing poverty and undernutrition for children aged < 5 years is among the indicators of United Nations' Millennium Development Goal number one, which aims at eradicating poverty and hunger¹⁵.

Previous studies have linked childhood nutrition with the mother's education and nutritional status, the father's employment, feeding practices including breast-feeding, water supply and sanitation, access to health care, prevalence of parasitic and infectious diseases, health-seeking behaviour, race/ethnicity, rural residence, and social network and family support^{3,16–19}. Demographic characteristics such as the child's age and sex, birth interval (both preceding and following) and mother's age at childbirth have also been associated with child nutrition²⁰.

Economic growth does not benefit all sections of the society equally, and the resulting economic inequality within a country affects different sections of society differently. Economic well-being at the household level operates mainly through better food availability, more hygienic living conditions and better access to health services in affecting the health and nutritional status of children.

A number of studies have shown that children in poorer households tend to be more undernourished than children in better-off households^{3,4,17,21–23}. Social deprivation has also been linked with the nutritional status of children²⁴. However, the relationship between economic inequality and children's nutritional status is not conclusive. A recent study in Mexico found that household poverty is not a necessary condition for children to be undernourished¹⁶. Another recent study in Ecuador found inconsistent evidence of a relationship between economic inequality and childhood undernutrition⁹. A thorough discussion of the linkages between economic and health inequalities is provided in two separate studies by Wagstaff^{25,26}.

While inequality is the condition of being unequal and of social and economical disparity, inequity bears moral and ethical dimensions, and inequity is an inequality that is unnecessary, avoidable, unfair and unjust²⁷. In this study, we examine how inequality in household economic status is associated with the nutritional status of young children. Using data from a recent cross-sectional national survey in Ghana, we examine the extent to which children in poorer households are at greater risk of chronic undernutrition than children in richer households.

Materials and methods

The analysis in this study is based on 3077 children aged 0–59 months included in the 2003 Ghana Demographic and Health Survey (GDHS). The GDHS collected demographic, socio-economic and health data from a nationally representative sample of 5691 women aged 15–49 years in 6251 households included in the

survey. The sampling design was a three-stage stratified process with an overall household response rate of 99% and an overall woman response rate of 96%. Details of the sampling design are provided in the main GDHS report²⁸.

To assess physical growth and nutritional status of children, measurements of height/length and weight were obtained for children aged 0–59 months. The children's weights were measured using a lightweight scale with a digital screen display and their heights were measured using a measuring board. Children younger than 24 months were measured lying down on the board, and standing height was measured for older children²⁸. Nutritional status of children in this study is measured by a Z-score of height-for-age. Height-for-age index serves as a good proxy for the state of chronic undernutrition among children, which is not much affected by recent episodes of ill health. A child is defined as stunted (chronically undernourished) if her or his height-for-age is more than two standard deviations below the median of an international reference population recommended by the World Health Organization^{29–31}.

The GDHS did not collect direct information on household income and expenditure. This study uses a household wealth index, estimated from asset variables using principal components analysis (PCA), as a proxy indicator for household economic status in this analysis. The first component of PCA is used to create an index to represent the household wealth³². Economic inequality is measured by dividing the wealth index into quintiles, with the lowest quintile representing the 20% poorest households and the highest quintile representing the 20% richest households in Ghana.

Because household economic status is correlated with maternal nutrition and other sociodemographic factors that can also affect the nutritional status of children, the effects of household economic status on stunting are estimated after statistically controlling for the effects of these other potentially confounding factors^{33,34}. These factors include the child's age (0–11, 12–23, 24–35, 36–47, 48–59 months), sex (boy, girl), birth order (1, 2, 3, 4+), duration of breast-feeding (0–11, 12–17, ≥ 18 months), early initiation of breast-feeding (within 1 h, 24 h, 24+h after delivery), exclusive breast-feeding (no, yes), birth weight (< 2500 g, ≥ 2500 g), complementary feeding (0–1, 2+ times per day), full immunisation (no, yes); mother's age at childbirth (15–24, 25–34, 35–49 years), body mass index (BMI) (< 18.5, 18.5–24.9, ≥ 25.0 kg m⁻²) and education (no education, primary or less, secondary or more); household access to safe drinking water (yes, no), availability of a hygienic toilet facility (yes, no), residence (urban, rural) and geographic region (North, Southeast, Southwest, Central). For further details on variable definitions, see Table 1.

The effects of household economic status and other factors on stunting were estimated using multivariate

Table 1 Sample distribution and prevalence of stunting among children aged 0–59 months by household economic status and other selected characteristics, Ghana 2003

Characteristic	No. of children	Percentage distribution of children	Percentage stunted	Standard error
Ghana	3077	–	29.6	0.82
Economic status				
5th quintile (richest)	463	15.0	13.8	1.76
4th quintile	512	16.7	22.5	2.02
3rd quintile	618	20.1	30.2	1.96
2nd quintile	690	22.4	31.7	1.77
1st quintile (poorest)	794	25.8	41.1	1.54
Child's age (months)				
0–11	638	20.7	12.2	1.28
12–23	662	21.5	35.3	1.86
24–35	617	20.1	33.0	1.91
36–47	632	20.6	34.5	1.87
48–59	528	17.2	33.6	2.08
Child's sex				
Boy	1,553	50.5	32.5	1.19
Girl	1,524	49.5	26.7	1.14
Child's birth order				
1	654	21.3	27.3	1.75
2	610	19.8	26.0	1.82
3	484	15.7	26.9	2.04
4+	1329	43.2	33.4	1.27
Breast-feeding status				
Never breast-fed	9	0.3	37.9	1.72
0–11 months	742	24.5	15.2	0.13
12–17 months	1406	46.4	32.2	1.28
≥ 18 months	877	28.9	37.2	1.57
Early initiation				
Within 1 h	1402	45.6	28.3	1.21
Within 24 h	901	29.3	29.7	1.53
24+h*	774	25.2	31.8	1.66
Exclusive breast-feeding				
No	2,678	87.3	32.0	0.92
Yes	390	12.7	13.7	1.76
Child's birth weight (kg)				
< 2.5	482	15.8	40.8	2.21
≥ 2.5	2582	84.3	27.6	0.88
Complementary feeding				
0–1 time per day	633	20.8	18.7	1.52
2+ times per day	2406	79.2	32.5	0.96
Full immunisation				
No	1564	50.8	29.9	1.14
Yes	1513	49.2	29.3	1.19
Mother's age at childbirth (years)				
15–24	1072	34.8	29.5	1.40
25–34	1390	45.2	28.8	1.22
35–49	615	20.0	31.6	1.85
Mother's BMI (kg m ⁻²)†				
< 18.5	254	8.5	34.3	2.95
18.5–24.9	2039	67.8	31.7	1.01
≥ 25.0	716	23.8	20.9	1.63
Mother's education				
None	1223	39.8	38.2	1.28
Primary or less	701	22.8	24.1	1.68
Secondary or more	1152	37.5	23.8	1.35
Safe drinking water‡				
No	1203	39.4	33.5	1.34
Yes	1852	60.6	27.0	1.04
Hygienic toilet§				
No	908	29.7	39.5	1.41
Yes	2146	70.3	25.5	1.01
Urban/rural				
Urban	1002	32.6	20.0	1.39
Rural	2075	67.4	34.2	1.00

Table 1. Continued

Characteristic	No. of children	Percentage distribution of children	Percentage stunted	Standard error
Geographic region¶				
North	666	21.6	42.4	1.58
Southeast	902	29.3	20.3	1.47
Southwest	594	19.3	29.6	2.05
Central	915	29.8	29.5	1.57

BMI – body mass index.

* Include nine cases of never breast-fed.

† Body mass index (BMI) is measured as the ratio of body weight in kg and the square of the height in m. A woman is undernourished if her BMI is $< 18.5 \text{ kg m}^{-2}$, overweight if her BMI is $\geq 25.0 \text{ kg m}^{-2}$, and normally nourished if her BMI is between 18.5 and 24.9 kg m^{-2} .

‡ Safe drinking water includes piped water, piped well and protected dug well.

§ A hygienic toilet includes toilet or latrine connected to sewage or having a septic tank.

¶ The North region includes Northern, Upper East and Upper West; the Southeast region includes Greater Accra, Volta and Eastern; the Central region includes Ashanti and Brong Ahafo; and the Southwest region includes Western and Central.

logistic regression procedures in STATA³⁵. A number of alternative logistic regression models were estimated to assess the relative significance of different confounding factors included in the analysis. We also carried out this analysis using a continuous response variable of height-for-age Z-scores and using a linear regression model, but the results of this analysis (not shown) were similar to those from the logistic regression models presented here.

In the survey, certain categories of respondents were oversampled, and non-response rates varied from one geographical area to another. In our analysis, weights were used to restore the representativeness of the sample²⁸. Results of bivariate analysis are presented with standards errors, and results of multivariate analysis are presented as odds ratios (ORs) with 95% confidence intervals (CIs).

Ethics

This study is based on secondary analysis of existing survey data with all identifying information removed. The survey acquired informed consent from mothers of the children included in this study before asking any questions and before obtaining anthropometric measurements.

Results

One in every four children aged 0–59 months in Ghana lives in the poorest 20% of households, while 15% live in the richest 20% of households (Table 1). Children are more or less evenly distributed by age and sex. Twenty-one per cent of children are first-order births, and another 20% are second-order births. Sixteen per cent of children are born with birth weight $< 2500 \text{ g}$. Slightly less than one-half (45%) of all children are born to mothers aged 25–34 years. Almost all children are breast-fed in Ghana, with three-quarters being breast-fed for > 1 year. The prevalence of exclusive breast-feeding of infants

younger than 6 months is 53% in Ghana. According to the GDHS, the median duration of exclusive breast-feeding is ~ 2.3 months (not shown in Table 1)²⁶. Almost half of the children (46%) are breast-fed within 1 h after birth, and one in four children is breast-fed after 24 h. Thirteen per cent of all children are exclusively breast-fed, 21% receives one or less complementary feeding per day and 49% are fully immunised. The mothers of 68% of the children have a normal body weight ($18.5 \leq \text{BMI} < 25.0 \text{ kg m}^{-2}$), 9% are underweight ($\text{BMI} < 18.5 \text{ kg m}^{-2}$) and 24% are overweight ($\text{BMI} \geq 25.0 \text{ kg m}^{-2}$). About four in every 10 children have illiterate mothers, and 38% have mothers with secondary or more education. Thirty-nine per cent of children live in households without safe drinking water and 30% without a hygienic toilet facility. One-third of children live in urban areas.

Overall, 30% of children aged 0–59 months in Ghana are chronically undernourished (Table 1). This figure represents one of a highest rate of undernutrition in African countries³⁶. The prevalence of stunting declines as the household economic status increases, from 40% in the poorest 20% of the households (lowest wealth index quintile) to 14% in the richest 20% of the households (highest wealth index quintile). The prevalence of stunting is considerably less common in the first 12 months of life. The prevalence increases rapidly after 12 months of age and remains constant. The prevalence of stunting among boys (33%) is significantly higher than for girls (27%). The prevalence is about the same among children of birth order 1–3 (26–27%), but is significantly higher among children born fourth. This is because birth order is correlated with age, and competition for food is likely to be greater in households with more children.

Among children who receive some breast-feeding, the prevalence of stunting is associated with duration of breast-feeding. The prevalence of stunting is also higher among children who are never breast-fed (38%) compared

with those who are breast-fed (15%), and among children who are not exclusively breast-fed (32%) compared with those who are exclusively breast-fed (14%). There is no significant relationship between early initiation, full immunisation and mother's age at childbirth and stunting. The prevalence of stunting is strongly negatively associated with the child's birth weight and the mother's BMI and educational status.

Availability of safe drinking water is significantly associated with prevalence of stunting. Also, children in households with an unhygienic toilet facility are significantly more likely to be stunted (40%) than those in households with a hygienic toilet facility (26%). The prevalence of stunting is lower in urban areas (20%) than in rural areas (34%), and it is much lower in the Southeast region (20%) than in other regions of Ghana (30–42%).

Effect of household economic status on stunting

The unadjusted odds of stunting are more than four times higher among children living in the poorest (lowest wealth index quintile) households than among children in the richest (highest wealth index quintile) households (OR = 4.3; 95% CI: 3.1–6.0) (Table 2, model 1). Children living in the third and fourth wealth quintile households are also at a greater risk of stunting than children living in the richest 20% households. The odds of stunting decline monotonically with increase in economic status. The relationship remains unchanged when controlling for child's age, sex, birth order, duration of breast-feeding and birth weight. Additionally controlling for the mother's characteristics (age at childbirth, BMI and education) reduces the effect of economic status slightly. When the availability of safe drinking water, hygienic toilet facilities, urban/rural residence and geographic region are also controlled in model 4, the effect of household economic status on stunting remains large and highly statistically significant. With other factors controlled, children who live in the poorest 60% of households are more than twice as likely to be chronically undernourished as those born in the richest 20% of households (OR = 2.3, 95% CI 1.4–3.7 for the poorest 20% of households; OR = 2.0, 95% CI 1.3–3.2 for the next poorest 20% of households; and OR = 2.1, 95% CI 1.3–3.2 for the middle 20% of households).

Effects of other risk factors and confounders

Among the control variables, child's age has the strongest effect on the risk of stunting, and this effect is independent of the economic status and other maternal and household characteristics (Table 2). With household economic status and other factors controlled, the child's sex and birth weight, and access to care (fully immunised) all have statistically significant effects, but these effects are generally small. Also, the adjusted prevalence of stunting is significantly lower in the Southeast region than in other regions (OR = 0.6; 95% CI 0.4–0.8). With other factors controlled in model 4 (Table 2), the effects of child's birth

order, breast-feeding duration, early initiation, exclusive breast-feeding, complementary feeding; mother's age at childbirth and BMI; safe drinking water, hygienic toilet facilities and urban/rural residence are small and statistically not significant.

Separate analyses by sex of child and urban/rural residence

We also carried out the above multivariate analyses separately for boys and girls and separately for urban and rural areas. Household economic status has a strong negative effect on stunting in each case (results not shown).

Discussion

The association between poverty and undernutrition is a manifestation of somatic development patterns of children who live in poorer conditions with insufficient food intake, greater exposure to infections and lack of access to basic health services³⁷. Results of this study show that childhood undernutrition is a serious problem in Ghana. Children in poorer households are at a much greater risk of being chronically undernourished than children in better-off households. Children in the poorest 60% of households are at more than twice the risk of being stunted than children in the richest 20% of households, independent of the characteristics of the children, mothers, household and other factors. The results hold in separate analyses by sex of child and by urban/rural residence. These findings are consistent with the results from previous research in other developing countries^{22,23}, and provide further evidence that household economic status is an important determinant of childhood undernutrition in developing countries.

An increasing pattern of stunting by age is consistent with the typical pattern of increasing prevalence of childhood diseases such as acute respiratory infections and diarrhoea by age in many developing countries³⁸. This may partly be due to starting feeding solid foods at ~4–6 months of age, which increases the likelihood of consuming contaminated foods and removes the protection provided by breast milk. Also, children start crawling around this age and are more likely to be carried outdoors, which exposes them to infections. The association of stunting with duration of breast-feeding may be due to the reverse causality whereby mothers of malnourished children breast-feed for longer or poorer mothers are more likely to continue breast-feeding as a substitute for appropriate complementary feeding. However, the effect of duration of breast-feeding is not significant in the multivariate models. Contrary to the expectation, our analysis finds no significant effects of household water and sanitation conditions on stunting in children.

In previous research, a mother's education has been identified as one of the key factors in promoting health

Table 2 OR (95% CI) estimates of effects of household economic status and other selected characteristics on stunting among children aged 0–59 months, Ghana 2003

Variable	OR (95% CI)			
	Model 1	Model 2	Model 3	Model 4
Economic status				
5th quintile (richest)*	–	–	–	–
4th quintile	1.8 (1.2–2.7)	1.8 (1.2–2.7)	1.6 (1.0–2.4)	1.5 (1.0–2.3)
3rd quintile	2.7 (1.9–3.9)	2.6 (1.8–3.8)	2.4 (1.6–3.5)	2.1 (1.3–3.2)
2nd quintile	2.9 (2.0–4.1)	2.8 (1.9–4.1)	2.4 (1.6–3.6)	2.0 (1.3–3.2)
1st quintile (poorest)	4.3 (3.1–6.0)	4.2 (2.9–6.0)	3.2 (2.1–4.7)	2.3 (1.4–3.7)
Child's age (months)				
0–11*	–	–	–	–
12–23	–	4.9 (2.7–9.0)	5.3 (2.8–9.9)	5.2 (2.8–9.9)
24–35	–	4.0 (2.2–7.3)	4.4 (2.4–8.3)	4.4 (2.4–8.3)
36–47	–	4.0 (2.2–7.2)	4.5 (2.4–8.4)	4.6 (2.5–8.6)
48–59	–	3.9 (2.1–7.2)	4.4 (2.3–8.4)	4.6 (2.4–8.7)
Child's sex				
Boy*	–	–	–	–
Girl	–	0.7 (0.6–0.9)	0.7 (0.6–0.9)	0.7 (0.6–0.9)
Child's birth order				
1*	–	–	–	–
2	–	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.3)
3	–	1.0 (0.7–1.3)	0.9 (0.7, 1.3)	0.9 (0.7–1.3)
4+	–	1.2 (0.9–1.5)	1.1 (0.8–1.6)	1.1 (0.8–1.6)
Breast-feeding status (months)				
0–11 months*,†	–	–	–	–
12–17 months	–	0.9 (0.5–1.4)	0.8 (0.5–1.3)	0.8 (0.5–1.3)
≥ 18 months	–	0.9 (0.6–1.5)	0.8 (0.5–1.3)	0.8 (0.5–1.3)
Early initiation				
Within 1 h†	–	–	–	–
Within 24 h	–	1.1 (0.9–1.4)	1.1 (0.9–1.4)	1.2 (0.9–1.5)
24+ h†	–	1.1 (0.8–1.3)	1.0 (0.8–1.3)	1.1 (0.9–1.4)
Exclusive breast-feeding				
No*	–	–	–	–
Yes	–	0.8 (0.5–1.3)	0.8 (0.5–1.3)	0.8 (0.5–1.3)
Child's birth weight (kg)				
< 2.5*	–	–	–	–
≥ 2.5	–	0.6 (0.4–0.7)	0.6 (0.4–0.7)	0.6 (0.4–0.7)
Complementary feeding				
0–1 time per day*	–	–	–	–
2+ times per day	–	1.3 (0.9–1.9)	1.4 (0.9–1.9)	1.4 (1.0–1.9)
Full immunisation				
No*	–	–	–	–
Yes	–	0.7 (0.6–0.9)	0.7 (0.6–0.9)	0.7 (0.6–0.9)
Mother's age at childbirth (years)				
15–24*	–	–	–	–
25–34	–	–	1.0 (0.8–1.3)	1.0 (0.8–1.3)
35–49	–	–	1.0 (0.7–1.4)	1.0 (0.7–1.4)
Mother's BMI (kg m⁻²)				
< 18.5*	–	–	–	–
18.5–24.9	–	–	1.0 (0.7–1.4)	1.0 (0.8–1.4)
≥ 25.0	–	–	0.8 (0.6–1.2)	0.9 (0.6–1.4)
Mother's education				
None*	–	–	–	–
Primary or less	–	–	0.6 (0.4–0.7)	0.7 (0.5–0.9)
Secondary or more	–	–	0.7 (0.5–0.9)	0.8 (0.6–1.1)
Safe drinking water				
No*	–	–	–	–
Yes	–	–	–	1.0 (0.8–1.2)
Hygienic toilet				
No*	–	–	–	–
Yes	–	–	–	0.9 (0.6–1.2)
Urban/rural				
Urban*	–	–	–	–
Rural	–	–	–	1.2 (0.9–1.6)
Geographic region				
North*	–	–	–	–
Southeast	–	–	–	0.6 (0.4–0.8)
Southwest	–	–	–	0.8 (0.5–1.2)
Central	–	–	–	0.8 (0.6–1.2)
Number of children	3077	3025	2958	2933

OR – odds ratio; CI – confidence interval; BMI – body mass index.

*Reference group.

†Includes nine cases of never breast-fed.

For definitions, see Table 1.

and nutrition, increasing household earnings and mediating the effect of economic status on health^{39–42}. However, in our analysis, maternal education is found to have only a small effect on childhood stunting, and controlling for education does not alter the effect of household economic status on stunting much. This may be partly because a large majority (63%) of mothers in Ghana have only primary or no education.

One potential criticism is the cross-sectional nature of the study, but, because the causation runs principally from household economic status to childhood undernutrition, the estimation in this study is a good measure of the causal relationship between household economic status and childhood stunting. The study can also be criticised for using an indirect measure of household economic status; however, because in developing countries such as Ghana it is hard to obtain reliable income and expenditure data, an asset-based index is generally considered a good proxy for household economic status. Moreover, we were unable to account for the impact of exclusive breast-feeding on stunting because in Ghana few children under 6 months of age are exclusively breast-fed.

Despite these potential limitations, consistency in the direction and strength of the relationship between household economic status and childhood undernutrition suggests that reducing economic inequality and making services more accessible to the poor will be key to improving health and nutritional status of children in Ghana. Results from this study demonstrate that addressing such socio-economic gradients in health and nutrition is a key to develop a sound policy for child health and nutrition; a policy that is responsive to improvement of household economic status. Supporting strategies for reducing and preventing undernutrition always involves a combination of macroeconomic policies and targeted intervention programmes.

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