Changes in birthweight distribution from 1973 to 1982 in Addis Ababa

CARMELA GREEN-ABATE

Birthweight data for 29,586 infants born in health-care facilities in Addis Ababa in 1973 and 1982 indicate that 40–60% of all deliveries took place within the formal health-care system. The mean birthweight increased by 107 g from 3075 ± 585 g in 1973 to 3181 ± 550 g in 1982. This increase was uniform over the entire birthweight range but was statistically significant only for infants of low birthweight, the frequency of such births decreasing from 13% to 8% over the period. Stratification of the data by sex indicated a similar increase in birthweight. The stillbirth rate decreased from 51.1 per 1000 births in 1973 to 34.1 per 1000 in 1982, but was statistically significant only for birthweights in the range 3000–4000 g. The shift in birthweight distribution reported here may reflect either changes in the demographic characteristics of the population or unidentified changes in medical treatment.

Birthweight is a predictor of neonatal outcome. It also reflects the health and nutritional status of the mother, since mothers who suffer ill health, malnutrition, or other deprivations are more likely to deliver prematurely or have low birthweight babies (1). A commonly used indicator of general health in the community is the frequency of low birthweight babies, and WHO estimates that the global rate of such deliveries is 17–18%, i.e., 21–22 million annually (2). The incidence of low birthweight babies is not uniform throughout the world; in developing countries estimates vary from 10% to 30%, whereas in developed countries the rate is 3–8% (2). Data on the birthweight distribution in developing countries are scanty, and there have been no studies of its variation with time. In identifying the sources of the recent decline in the perinatal mortality rate in California, Williams & Chen (3) noted that the greatest differences in perinatal mortality rate could be attributed to variations in the distribution of birthweight rather than to specific medical interventions. This paper reports the distribution of birthweight among infants born in 1973 and 1982 in health-care facilities in Addis Ababa, Ethiopia.

METHODS

Birth records at four hospitals and two mother-child health clinics, all of which were affiliated to the University of Addis Ababa, were used as a data base. The following information on all deliveries of birthweight > 500 g in 1973 and 1982 were recorded: birthweight, sex, number of stillbirths, and whether singleton or multiple gestation. Birthweights were grouped into 500-g intervals and their distribution was analysed (Student’s t-test and χ²-test) on an Apple II microcomputer using the QUEST and STAT programs.

RESULTS

Altogether 30,174 births were registered in the six health-care facilities in 1973 and 1982; birthweights were available for 12,911 deliveries in 1973 and for 16,675 in 1982. The male-to-female ratio was 1.1:1.0 for both these years, while the frequency of multiple gestation was 4.3% (1973) and 3.3% (1982). There was a 22.6% increase in the number of deliveries in the health-care facilities between 1973 and 1982, mainly due to an increase in the proportion of hospital deliveries from 70.4% (1973) to 76.2% (1982); in contrast, the proportion of deliveries in clinics decreased from 29.2% to 23.8%, respectively.

The mean birthweight increased by 107 g from 3075 ± 585 g in 1973 to 3181 ± 550 g in 1982, and the birthweight distributions in both years (Table 1) are statistically different (P < 0.0001). The proportion of infants of low birthweight decreased from 13%

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* QUEST and STAT programs were provided by the Department of Preventive and Social Medicine, University of Umeå, Sweden.
Table 1. Birthweight distribution in Addis Ababa in 1973 and 1982

<table>
<thead>
<tr>
<th>Birthweight (grams)</th>
<th>Males</th>
<th></th>
<th>Males</th>
<th></th>
<th>Males</th>
<th></th>
<th>Males</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1973</td>
<td>%</td>
<td>1982</td>
<td>%</td>
<td>1973</td>
<td>%</td>
<td>1982</td>
<td>%</td>
</tr>
<tr>
<td>500–999</td>
<td>0.6 (37)</td>
<td>0.3 (23)</td>
<td>0.6 (34)</td>
<td>0.1 (11)</td>
<td>0.6</td>
<td>0.2</td>
<td></td>
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<tr>
<td>1000–1499</td>
<td>1.3 (88)</td>
<td>0.9 (73)</td>
<td>1.2 (76)</td>
<td>0.9 (67)</td>
<td>1.9</td>
<td>1.1</td>
<td></td>
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</tr>
<tr>
<td>1500–1999</td>
<td>2.4 (158)</td>
<td>1.7 (142)</td>
<td>3.0 (183)</td>
<td>1.8 (139)</td>
<td>4.6</td>
<td>2.8</td>
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<tr>
<td>2000–2499</td>
<td>7.0 (466)</td>
<td>4.5 (386)</td>
<td>9.1 (565)</td>
<td>6.2 (489)</td>
<td>12.6</td>
<td>8.1</td>
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<tr>
<td>2500–2999</td>
<td>23.7 (1578)</td>
<td>20.9 (1797)</td>
<td>29.8 (1852)</td>
<td>27.9 (2215)</td>
<td>39.2</td>
<td>32.3</td>
<td></td>
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<tr>
<td>3000–3499</td>
<td>41.7 (2776)</td>
<td>42.3 (3641)</td>
<td>40.4 (2507)</td>
<td>42.2 (3349)</td>
<td>80.3</td>
<td>74.5</td>
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<tr>
<td>3500–3999</td>
<td>19.2 (1278)</td>
<td>24.0 (2064)</td>
<td>13.6 (846)</td>
<td>17.6 (1399)</td>
<td>96.8</td>
<td>95.4</td>
<td></td>
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<tr>
<td>4000–4499</td>
<td>3.5 (231)</td>
<td>5.2 (449)</td>
<td>2.0 (122)</td>
<td>2.8 (225)</td>
<td>99.5</td>
<td>99.4</td>
<td></td>
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<tr>
<td>4500–4999</td>
<td>0.6 (39)</td>
<td>0.6 (53)</td>
<td>0.3 (20)</td>
<td>0.4 (35)</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>(6651)</td>
<td></td>
<td>(6607)</td>
<td></td>
<td>(6211)</td>
<td></td>
<td>(7929)</td>
<td></td>
</tr>
</tbody>
</table>

* Figures in parentheses are the number of patients.

(1973) to 8% (1982) for all birthweight intervals <2500 g, and was statistically significant ($\chi^2 = 8.20$; 3 degrees of freedom; $P < 0.05$). There was a 1.4-fold increase in the proportion of infants with birthweight >4000 g, but this was not statistically significant ($\chi^2 = 5.35$; 2 degrees of freedom; $P > 0.05$). A similar increase in birthweight resulted when the data were stratified by sex, the mean birthweight of males increasing from 3125 ± 374 g (1973) to 3235 ± 557 g (1983) and that of females from 3019 ± 570 g to 3125 ± 418 g (Table 1).

The stillbirth rate for deliveries within the formal health-care system decreased from 51.5 per 1000 births (1973) to 34.1 per 1000 births (1982). However, statistically significant differences in the distribution of birthweight for stillbirths were observed only for the birthweight ranges 3000–3499 g ($\chi^2 = 8.88$; 1 degree of freedom; $P < 0.0005$) and 3500–3999 g ($\chi^2 = 7.25$; 1 degree of freedom; $P > 0.01$). Nevertheless, comparison of the overall distribution of stillbirths in 1973 and 1982 using the Mantel-Haenszel procedure indicated that the difference was highly significant ($\chi^2 = 23.75$; 1 degree of freedom; $P < 0.0005$). Tests for homogeneity among the birthweight intervals were not statistically significant ($\chi^2 = 1.73$; 9 degrees of freedom; $P < 0.05$).

**DISCUSSION**

Analysis of the changes in birthweight distribution in 1973 and 1982 in Addis Ababa indicates a significant shift to higher birthweights. This occurred uniformly over all birthweight intervals, but is statistically significant only for infants of low birthweight; the rate of such births decreasing from 13% to 8% over this period. The distribution of birthweight is essentially linear except for the low birthweight extremity. This implies that for babies of birthweight >2500 g the distribution is essentially Gaussian, whereas for birthweights less than this there is a non-Gaussian residual component; this is similar to previous reports of birthweight distribution (4). The low birthweight rate in Addis Ababa compares favourably with that in other regions of Ethiopia (5) and in Nigeria and Tanzania, where values as high as 15% have been reported (6, 7).

The observed shift in birthweight distribution may have arisen because of either demographic changes in the population of Addis Ababa or the medical interventions. Demographic data for the city are scanty, but in 1972 the estimated population of Addis Ababa was 912 000 (8) and this increased to 1 167 315 by 1978, with an estimated annual growth rate of 5% (9). From 1967 to 1976, the proportion of females aged 15–45 years remained approximately constant at 27%; however, 28.3% of women in 1967 were unmarried compared to 40.3% in 1976 (9). There was also a marked increase in the overall literacy rate in Addis Ababa from 43% in 1967 to 92% in 1982. Trend analysis of the age-specific rates

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a The City Council, Program of strengthening the implementation of primary health care in Addis Ababa, 1984–1987 Addis Ababa, 1983
of the economically active population indicates an overall decline in this population from 47% in 1967 to 45% in 1976; nevertheless, stratification by sex reveals that this was predominantly caused by a decline in male employment from 71% in 1967 to 61% in 1976. In contrast, female employment increased from 24% to 32% over the same period. At the same time there was a steady decline in the crude birth rate from 43 per 1000 population in 1967 (8) to 32.3 per 1000 in 1978 (11), and the estimated rate for 1982 was 26.1 per 1000 (12). Although accurate data on per capita income are difficult to obtain, in 1975 the estimated income for Addis Ababa was US$ 37 per month. In 1981 it was estimated that 57% of the population earned less than $37 per month, while 34% earned $37–193 per month.\(^{c}\)

From 1967 to 1982, demographic changes in the population of Addis Ababa may therefore explain the observed shift in birthweight distribution reported here. Although during this period no specific health interventions were introduced in Addis Ababa, subtle changes not identified in this study may have occurred. This may be further illustrated by the observed decrease in the stillbirth rate, particularly in the term newborn, which may indicate either that women arrive at the health-care facility earlier or that there has been improvement in intrapartum care. Although statistical significance was only demonstrated in the birthweight range 3000–4000 g, the Mantel-Haenszel statistic shows that there may be an overall trend in the reduction of fetal mortality.

This study, in common with reports from other developing countries, relied on retrospective data from health-care facilities. Between 1973 and 1982, 40–60% of deliveries in Addis Ababa probably took place within the formal health-care system, and this has recently been corroborated by a community-based survey, which reported that 54.2% of all deliveries were in a health institution (12). It has also been shown that high-risk mothers from low socioeconomic groups may or may not receive antenatal care at a mother-child health centre, and that the majority of these deliver at home (13). In order to plan effective and appropriate health intervention programmes, there is therefore urgent need for further community-based studies of birthweight distribution trends to identify the determinants of low birthweight.

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\(^{c}\) See footnote \(b\) on p. 712

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**RÉSUMÉ**

**CHANGEMENTS DANS LA DISTRIBUTION DES POIDS DE NAISSANCE DE 1973 À 1982 À ADDIS ABEBA**

Le poids à la naissance est un facteur prédictif de l'évolution néonatale et le reflet de l'état sanitaire et nutritionnel de la mère. La fréquence de faibles poids de naissance est généralement utilisée comme indicateur de la santé générale d'une communauté et l'OMS a estimé que le taux mondial était de 17–18%. Cette fréquence est plus élevée dans les pays en développement où sa valeur estimative va de 10% à 30%; toutefois, les données en provenance de ces pays sont peu nombreuses et la variation de la distribution des poids de naissance avec le temps n'a pas été étudiée. Des enquêtes antérieures ont montré que les plus grandes différences dans la mortalité perinatale sont attribuables à des différences dans la distribution des poids de naissance plutôt qu'à des interventions médicales particulières. Dans le présent travail, les changements dans la distribution des poids de naissance entre 1973 et 1982 à Addis Ababa (Ethiopie) sont étudiés.

Les poids de naissance de 29 586 nourrissons nés en 1973 et en 1982 dans six centres de soins de santé dépendant de l'Université d'Addis Ababa ont servi de données de base pour cette étude. Le rapport de masculinité des naissances était de 1,1-1,0 pour l'une et l'autre année, et la fréquence des grossesses multiples a été de 4,3% en 1973 et de 3,3% en 1982. Il y a eu une augmentation de 22,6% du nombre total d'accouchements dans le cadre du système de soins de santé au cours de ces dix ans et la proportion d'accouchements à l'hôpital est passée de 70,4% en 1973 à 76,2% en 1982.

Le poids de naissance moyen a augmenté de 107 g, passant de 3073 ± 585 g en 1973 à 3181 ± 550 g en 1982. Cette modification s'observait uniformément pour tous les intervalles de poids de naissance, mais elle n'était statistiquement significative que pour les nourrissons ayant un faible poids de naissance, dont la proportion a diminué de 13% en 1973 à 8% en 1982. Un changement similaire des
poids de naissance était mis en évidence lorsque les données étaient stratifiées en fonction du sexe. Dans le cadre du système formel de soins de santé, le taux de mortalité est passé de 51,1 pour 1000 naissances en 1973 à 34,1 pour 1000 naissances en 1982; toutefois, le changement dans la mortalité fœtale n'était statistiquement significatif que pour l'intervalle de poids de naissance 3000–4000 g.

D'après les résultats de cette étude, il y a eu une modification positive significative dans la distribution des poids de naissance à Addis Ababa au cours de la période 1973–82. Le taux des faibles poids de naissance est plutôt moins élevé à Addis Ababa que dans les autres parties de l’Éthiopie et d’autres pays d’Afrique. La modification observée peut résulter de changements dans les caractéristiques démographiques de la population: l’âge des femmes au moment du mariage a augmenté, alors que le taux des naissances s’est abaissé; en outre, il y a eu de 1973 à 1982 une augmentation globale du taux d’alphabétisation ainsi que du nombre de femmes en âge de procréer qui occupaient un emploi. Il n y a eu aucune intervention sanitaire particulière pendant cette période, mais des changements plus subtils dans la pratique médicale sont intervenus. L’abaissement du taux de mortalité par rapport aux naissances vivantes indique soit que les femmes parvenaient aux centres de soins de santé à un stade plus précoce du travail, soit qu’il y a eu une amélioration des soins au cours de l’accouchement.

Afin de planifier des programmes d’intervention sanitaire appropriés et efficaces, il est nécessaire de déterminer sans délai la variation de la distribution des poids de naissance dans le temps, d’évaluer cette distribution par des études axées sur la communauté et de poursuivre des enquêtes sur les déterminants du faible poids de naissance.

REFERENCES