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Performance of surrogate markers of low birth weight at community level in rural India

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Low birth weight (LBW) is the most important determinant of infant mortality rate (IMR).[1] In India, the current IMR is around 72 per 1000 live births and prematurity and LBW account for 49.6% of infant mortality as reported by the government of India in 1990.[2 3] To reduce the IMR, early identification, prompt referral and management of low birthweight babies is essential. In India, 80% to 90% of the roughly 20 million births in rural areas, occur at home and are conducted by illiterate and often untrained traditional birth attendants (TBAs). Provision of valid weighing scales at domiciliary level poses logistic (carrying a heavy scale), as well as, operational problems (inability of TBAs to read). Also, because of sociocultural reasons, parents are reluctant to get their children weighed immediately after birth.

To overcome these problems. various surrogate measures like mid-arm circumference (MAC), chest circumference (CC), etc, have been assessed for appropriateness of use to detect LBW newborns.[4] In an earlier paper, we had identified cut off points for CC and MAC in hospital births to detect low birthweight newborns.[5] Here, we describe the feasibility and validity of the two indicators in identifying low birthweight babies under field situations using health workers.

Methods

The study was conducted in four villages under the Primary Health Centre (PHC) Dayalpur, in Ballabgarh block of District Faridabad in Haryana state of northern India. For full details about the working of the area, please see our earlier paper.[6] The total population of the four villages was around 10 000. The data were collected for a period of two years from January 1991 to December 1992. Two female health workers and one female health assistant were trained in taking these measurements at the hospital at Ballabgarh. Birth weight was recorded in the field using a Salter scale with a minimum reading of 100 grams. The MAC and CC were measured as described in our previous paper.

The data collection for this study was added to the existing work load of the selected female workers. The data were entered into Dbase and analysed using EPIINFO package. Sensitivity, specificity and predictive values were calculated for the surrogate measures using birth weight as the reference method.

Results

During the study period of two years, there were 660 births in the four villages. The measurements were available for 614 newborns (93.3%). The main reason for not being able to measure was because these mothers had gone outside the study area for delivery. The mean birthweight was 2846 grams (SD = 378 grams). A total of 54 newborns had low birth weight (< 2500 grams) in the study area, giving a prevalence of 8.8% (95%CI 6.7%, 11.2%) with only two (0.3%) of the newborns having a birth weight of < 1800 grams. There were a total of 56 (9.1%) preterm (< 37 weeks of gestation) deliveries .

For identifying newborns below 2500 grams, a MAC of 8 cm gave a sensitivity of 81.5% and specificity of 67% (table 1). Further reduction in MAC made the sensitivity unacceptable. For the CC, a cut off point of 32.5 cm gave the best trade off between sensitivity and specificity in identifying LBW babies. When used in series (MAC of 8 cm and CC of 32.5 cm for birth weight below 2.5 kg), the sensitivity was 79.6% (95%CI 66.1%, 88.9%) and a specificity of 87.1% (95% CI 84.0%, 89.0%).

It was also seen that, against the real prevalence (8.8%) of LBW, the identified best cut off points would result in labelling of 29% to 37.2% of the newborns as LBW. The positive predictive values were consistently low and negative predictive values were high. This was attributable to relatively high sensitivity and moderate specificity coupled with low prevalence of LBW.

Discussion

The surrogate measures of birth weight, if found valid, could have multiple uses. They

Table 1 Performance of mid-arm circumference and chest circumference in identifying low birthweight newborns (<2500 g)

Indicator	*Cut off point (cm)*	*% Below cut off point*	*Sensitivity*	*Specificity*	*Positive predictive value*	*Negative predictive value*
MAC	8.5	51	81.5 (68.1, 90.3)	52.0 (47.7, 56.2)	14.1 (10.5, 18.5)	96.7 (93.8, 98.3)
	8.0	37.2	81.5 (68.1, 90.3)	67.0 (62.9, 70.8)	19.2 (14.4, 25.0)	97.4 (95.1, 98.7)
	7.5	10.7	63.0 (48.7, 75.4)	94.3 (91.9, 96.0)	51.5 (39.0, 63.9)	96.4 (94.3, 97.7)
	7.0	9.8	63.0 (48.7, 75.4)	95.4 (93.2, 96.9)	56.7 (43.3, 69.2)	96.4 (94.4, 97.7)
CC	32.5	29	87 (74.9, 94.2)	76.7 (72.8, 80.0)	26.4 (20.2, 33.6)	98.4 (96.6, 99.3)
	31.5	12.4	59.3 (45.1, 72.1)	92.1 (89.5, 94.2)	42.1 (31.0, 54.0)	95.9 (93.8, 97.4)
	30.5	11.2	59.3 (45.1, 72.1)	93.4 (90.9, 95.2)	46.4 (34.4, 58.7)	96.0 (93.9, 97.4)
	29.5	2.8	13 (5.8, 25.5)	98.2 (96.7, 99.1)	41.2 (19.4, 66.5)	92.2 (89.7, 94.2)

95% Confidence intervals shown in parentheses.

could be used for (1) identifying and management of LBW babies, (2) measuring the prevalence of LBW and monitoring its trend and; finally (3) in the absence of birthweight data, future studies linking birth weight to diseases in adulthood may consider using the surrogate measures for this purpose.

In our early hospital based study, we had found that CC performs better than MAC.[5] The cut off point identified for CC was 29.5 cm for newborns below 2500 grams and for MAC this was 8.5 cm. However, when tested in the field, MAC performed better than CC. The cut off points for MAC were 0.5 cm lower, while for CC, the difference was 3 cm. This probably reflects the difficulty in measuring CC in field situations. Relatives may not allow the workers to remove clothes of the newborns, thus, increasing the measurement. Also, they may not be able to strictly follow the guidelines for CC measurement. While measuring MAC, the child need not be lifted from the bed. But for measuring birth weight and CC, the child needs to be handled more. Workers are likely to be a bit hesitant in handling newborns.

It seems from this study, that the surrogate measures used alone give only modest results.

The indicators that seemed to give satisfactory results for validity did not estimate the prevalence rightly and vice versa. The results also do not seem to justify their use for studies linking birth weight to diseases in adulthood. The poor performance could be either attributable to inadequate training or because of problems in the field hindering the translation of the skills learnt into practice. Given the fact that these health workers are also expected to do other jobs like immunisation, antenatal care, they may not have adequate time and inclination to do this additional work.

There is a need to look for other easily identifiable criteria that can be used in conjunction with these measures to improve their performance. However, all efforts must be made to measuring birth weight at field level. We fully realise that this is a difficult task, but at least a beginning has to be made, especially in areas that have better health facilities, like the field practice area of medical colleges.

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