Validity of clinic-based nutritional surveillance for prevalence estimation of undernutrition


Few studies have been performed to assess the validity of clinic-based nutritional surveillance systems. We compared estimates of the prevalence of underweight (low weight-for-age) obtained from the clinic-based Swaziland surveillance system with estimates obtained from the 1983 National Nutrition Status Survey of Rural Swaziland. The age-adjusted prevalence of underweight among first-time clinic attenders (10.0%) was very similar to that estimated by the national survey (9.4%). However, the prevalence of underweight among children attending two or more times in a year was less than half that of first attenders (4.4%). The regional differences in the prevalence of underweight found in the national survey were not detected by the surveillance system. Surveillance data are useful in describing the nutritional status of children from clinics within the surveillance system. However, surveillance data, particularly from re-attenders, will not necessarily provide a valid estimate of nutritional status within the general population or of differences between regions.

Nutritional surveillance has been defined as "keeping watch over nutrition in order to make decisions that will lead to improvement in nutrition in populations" (1). During the last decade there has been increasing emphasis on using nutritional surveillance systems to improve public health decision-making (1-3). Many types of information can be used for nutritional surveillance including health, agricultural, economic, and meteorological data. For reasons of cost and timeliness, many nutritional surveillance systems use routinely collected data from established reporting units such as maternal and child health (MCH) clinics (1). Obviously the quality of the decisions made from such systems will be closely related to the collected data's accuracy and reliability, as well as to the degree to which the surveillance population is representative of the larger population.

For policy and planning purposes it is often necessary to make inferences from the surveillance population to a larger target population. Yet the issue of the surveillance data's validity as an indicator of population nutritional status has received little study in the nutritional surveillance literature. This is because an independent probability sample that is representative of the population is seldom available for comparison. The 1983 National Nutritional Status Survey of Rural Swaziland (4) provided an opportunity to compare estimates of the prevalence of paediatric malnutrition with those generated by the Swaziland Nutrition Surveillance System during the same period. In this study we compare the results for clinic first attenders and re-attenders with results obtained from the national survey. We examine the surveillance system's ability to identify regional differences. In addition, we try to determine how representative the clinics participating in the surveillance system are of all health clinics in Swaziland, and how representative the children attending these clinics are of all children in Swaziland. To accomplish the latter we compare the nutritional status of clinic attenders and non-attenders within the...
national survey. Finally, we consider a number of methodological issues involved in analysing data obtained from a clinic-based surveillance system.

METHODS

Collection of clinic-based surveillance data

In our study, we used national nutritional surveillance data collected from September to December 1983, the months during which the survey was performed (4). Since 1980, the Swaziland Ministry of Health has collected information on the nutritional status of children attending well-child maternal and child health (MCH) clinics. Children under five years of age are seen routinely in these clinics (primarily for immunizations) where they are weighed, and the weight is plotted on a weight-for-age growth chart. The growth chart is then given to the child’s parent or guardian to keep for the next clinic visit. During the field survey, the clinics were using a growth chart derived from the WHO and National Center for Health Statistics (NCHS) reference, where underweight for both sexes was designated as less than the third centile for girls (5, 6). Children whose weight fell below the line indicating underweight were recorded on a tally sheet as underweight. Children were classified as either first-time attenders or re-attenders. First attendance was defined as the first time the child visited the clinic in each calendar year and/or the first attendance for each year of age; consequently a child could be counted twice as a first-time attender during a calendar year. Clinic nurses completed the tally sheets and sent them to the Ministry of Health headquarters, where they were tabulated, a summary of the information being returned to the clinics.

The facilities reporting surveillance data include hospitals, health centres, and health clinics in both the public and private sector. Reports were received from 155 (59.6%) of the 260 health facilities in 1983. Of the 109 government facilities, 90.8% reported surveillance data. By contrast, 47.1% of the 68 mission facilities, 33.3% of the 30 industrial facilities, and 26.4% of the 53 private facilities reported. Private general practitioners did not report surveillance data; however, private practitioners see only a small proportion of the children in Swaziland.

Collection of national survey data

The national survey of rural Swaziland was conducted between September 1983 and January 1984. This survey was carried out by the Swaziland National Nutrition Council with the assistance of the Swaziland Central Statistics Office, the United States Centers for Disease Control, and the United States Agency for International Development. A two-stage procedure was used to sample the survey population. For the first stage, 125 enumeration areas, defined during the last census, were selected on a population-proportional basis. At each site a group of homesteads was randomly selected. The number of homesteads to be included at each sample site was designed to target 30 preschool children. The number of homesteads to be interviewed was calculated by using population projections from the 1976 census. Survey results were weighted to the 1976 census.

Each survey child aged 3 to 59 months was weighed and measured using a hanging spring-scale and a standard portable measuring board. Age data for survey children were determined from birth dates on the clinic and immunization card, if available, or from parents’ declarations. For survey children whose exact birth dates could not be correctly established, a historical calendar of local events was used to determine the age. In addition, each survey child’s mother or guardian was asked whether the child had ever attended a well-child MCH clinic. If the child had attended such a clinic, the guardian was asked to produce the growth chart as documentation of attendance.

Analysis

The prevalence of underweight was tabulated for the surveillance data and the national survey in the same rural areas and in the same four-month period in which the survey was conducted. Analysis was limited to the rural areas because representative survey data were not available for urban areas. To provide comparability with surveillance data, children less than the third centile for girls on the WHO/NCHS reference were defined as underweight (5, 6). Because the age distributions in the survey and surveillance populations were different, the tabulations for surveillance data have been age-adjusted using the weighted survey population as the standard. In the under-12-month age category the field survey included only children three months of age and older, whereas the surveillance system included children from birth.

SESUDAAN, a computer package for analysing data from surveys with complex cluster designs, was used to calculate appropriate confidence intervals around the weighted estimates for survey data. Because the surveillance data were not defined from a sample, confidence intervals were not calculated.

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*a Research Triangle Institute, Research Triangle Park, NC 27709, USA*
Table 1. Low weight-for-age<sup>a</sup> national nutrition survey data compared with clinic-based surveillance data, by age for children aged <59 months, Swaziland, 1983

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Percentage from survey data&lt;sup&gt;a&lt;/sup&gt; (n = 4130)</th>
<th>First attenders&lt;sup&gt;b&lt;/sup&gt; (n = 19 459)</th>
<th>Re-attenders&lt;sup&gt;c&lt;/sup&gt; (n = 64 637)</th>
<th>Percentage from surveillance data&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12</td>
<td>5.3 (3.2-7.4)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>7.6</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>12-23</td>
<td>10.6 (8.5-12.7)</td>
<td>10.0</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>24-59</td>
<td>10.1 (8.8-11.4)</td>
<td>10.7</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9.4 (8.3-10.5)</td>
<td>10.0&lt;sup&gt;d&lt;/sup&gt;</td>
<td>4.4&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Low weight-for-age is defined as less than the 3rd centile for girls of the WHO/NCHS reference population.
<sup>b</sup> Children aged 3-11 months only.
<sup>c</sup> Survey percentages are weighted on the basis of population proportions, 95% confidence intervals are given in parentheses.
<sup>d</sup> Age-adjusted to the survey population.

RESULTS

The analysis was based on 4130 children in the national survey and 84 096 children from clinic-based surveillance (19 459 first attenders and 66 247 re-attenders). Overall, the prevalence of underweight children detected in the national survey was very similar to that among first-time attenders in the clinic-based surveillance system (9.4% vs. 10.0%) (Table 1). However, the prevalence of underweight was lower for clinic re-attenders (4.4%). The prevalence of underweight in relation to age was similar for the national survey and the surveillance system with the lowest prevalence of underweight occurring in the under-12-month age category for both field survey and surveillance data.

The patterns of underweight by administrative region were not similar, however. In the national survey, the Manzini region had the lowest rate of underweight, but in the surveillance system, the Lubombo region had the lowest rate (Table 2).

From the survey data, it appeared that the prevalence of underweight was consistently lower among children who had a history of attending a MCH clinic than for those who did not (8.8% vs. 11.5%, respectively) (Table 3). This was true for all age groups studied.

Table 2. Low weight-for-age<sup>a</sup> national nutrition survey data compared with clinic-based surveillance data, by administrative district for children aged <59 months, Swaziland, 1983

<table>
<thead>
<tr>
<th>Administrative district</th>
<th>Percentage from survey data (n = 4130)</th>
<th>Percentage from surveillance data&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lubombo</td>
<td>9.9 (7.9-11.9)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.3</td>
</tr>
<tr>
<td>Manzini</td>
<td>6.7 (5.0-8.4)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.2</td>
</tr>
<tr>
<td>Shiselweni</td>
<td>10.7 (8.6-12.8)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>12.1</td>
</tr>
<tr>
<td>Hhohho</td>
<td>10.2 (7.8-12.6)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>9.1</td>
</tr>
</tbody>
</table>

<sup>a</sup> Low weight-for-age is defined as less than the 3rd centile for girls of the WHO/NCHS reference population.
<sup>c</sup> Children aged 3-11 months only. Age-adjusted to the survey population.
<sup>d</sup> Survey percentages are weighted on the basis of population proportions, 95% confidence intervals are given in parentheses.

Table 3. Low weight-for-age<sup>a</sup> national nutrition survey data, by attendance at maternal and child health clinic and by age of child

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Percentage with a history of attendance (n = 3200)</th>
<th>Percentage with no history (n = 838)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-11</td>
<td>4.4 (3.5-6.3)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.2 (2.9-13.5)</td>
</tr>
<tr>
<td>12-23</td>
<td>9.9 (7.6-12.2)</td>
<td>14.5 (8.9-20.1)</td>
</tr>
<tr>
<td>24-59</td>
<td>9.5 (8.1-10.9)</td>
<td>11.5 (8.3-14.7)</td>
</tr>
<tr>
<td>Total</td>
<td>8.8 (7.7-9.8)</td>
<td>11.5 (8.8-14.2)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Low weight-for-age is defined as less than the 3rd centile for girls of the WHO/NCHS reference population.
<sup>b</sup> Percentages are weighted on the basis of population proportions, 95% confidence intervals are given in parentheses.

DISCUSSION

For planning and decision-making, data are needed to accomplish the following: (1) assess the prevalence of nutrition problems and identify high-risk groups, (2) monitor trends, and (3) evaluate the programme’s impact. One approach to obtaining data is a series of surveys on a representative sample of children: a baseline survey and periodic repeat surveys. However, this approach is complex and expensive. A more practical approach may be surveillance using existing data from health services or other established sources. Despite the potential importance of nutritional surveillance to programme planning, few studies have evaluated surveillance data in terms of validity, representativeness, reliability, and usefulness.
One of the key issues addressed in this study was representativeness, that is, the extent to which the nutritional status of clinic attenders, whose measurements comprise the surveillance data base, are representative of the nutritional status of children in the general population. Only a few studies have evaluated the validity of the prevalence estimates generated by surveillance systems (7). One such study in El Salvador found that the prevalence of underweight in preschool children, as estimated by a clinic-based surveillance system, was about twice that measured by a concurrent probability sample survey (8). This difference in prevalence was attributed to the fact that most children seen in the clinics were attending because of illness. By contrast, the estimated prevalence of underweight among first attenders in the Swaziland Surveillance System was very similar to that measured by the national survey. This was perhaps because the Swaziland Surveillance System is composed predominantly of children attending well-child clinics rather than children attending because of illness.

Prevalence estimates of underweight among re-attenders in the Swaziland Surveillance System (those attending more than once in the same year) were less than half the estimates from the national survey, possibly indicating a self-selection bias of children from wealthier families. In addition, easier access to the clinics may have encouraged return for follow-up visits. The lower rate of underweight among re-attenders is also consistent with the better preventive health care they would have received.

The better nutritional status of children who use clinic services is further illustrated by the observation that survey children with a history of clinic attendance had a lower prevalence of malnutrition than children without a history of clinic attendance (Table 3). Fortunately, almost 80% of children in the Swaziland nutritional survey did utilize clinic services. But the poorer nutritional status of non-attenders and one-time attenders compared with re-attenders suggests the continuing need for health services to reach the non-attenders and encourage regular attendance.

In the El Salvador study cited earlier, the surveillance data successfully detected regional differences in surveillance data that corresponded to field survey results (8). In Swaziland, although differences in prevalence rates between regions were observed in the surveillance data, these did not correspond to the pattern of high and low prevalence as determined by the national survey. Thus the surveillance data did not appear to accurately reflect regional prevalence differences. This may be because the differences in rates of underweight between regions in Swaziland, as estimated by the national survey, were small but statistically significant. There may be different proportions of government, mission, or industrial clinics in different regions. These regional differences in the source of surveillance data could also obscure actual differences in nutritional status.

Another key issue in evaluating a surveillance system is data quality, especially the reliability of the surveillance data. Data quality could only be evaluated indirectly in this study. However, data collection procedures were observed by a supervisory field team during site visits, at which time several problems were identified including inadequate training of health personnel in data collection procedures, defective or unstandardized weighing scales (including some using measurements in pounds when the system was based on metric weights), procedural inconsistencies (not taking or not charting the weights), and confusion regarding the definition of first attendance. To a varying extent, many of these problems are common to most clinic-based surveillance systems where staff have multiple responsibilities and budgets are low (7). In general, surveillance data are collected in settings where the quality of data cannot be well controlled. Thus, periodic evaluation of clinic procedures is important to identify problems and solutions. Without such periodic evaluation, the credibility of surveillance data may be so compromised that the results cannot be trusted for decision-making.

The most important issue, ultimately, is the usefulness of surveillance data for planning and decision-making. Surveillance data alone may be useful in describing the nutritional status of children within the surveillance system and in demonstrating broad trends over time. But surveillance data will not necessarily provide a valid estimate of the nutritional status within the general population or of differences between regions. The above limitations in the validity and reliability of surveillance data indicate the need for caution in using such data for programme planning and evaluation. By validating surveillance data with a national survey, it was possible in Swaziland to demonstrate that the nutritional status of first attenders provided a close approximation of the prevalence of undernutrition in the Swazi child population as a whole. However, the prevalence of undernutrition among re-attenders was significantly different, and regional differences could not be defined by the surveillance data. Thus caution must be used when extrapolating surveillance findings to the general population.

It would be even more hazardous to extrapolate the demonstrated relationship between survey and surveillance data in one country to populations outside that country. Each country's nutritional surveillance system must be evaluated based on its unique characteristics. Periodic review of the sources
from which surveillance data are derived and the quality of the data collected will help determine how useful the data may be for decision-making. Finally, independent evaluation of the surveillance results through comparison with field survey data is a useful undertaking for assessing the validity of the surveillance data. More studies are needed for a better understanding of both the usefulness and the limitations of surveillance data for programme planning and evaluation.

ACKNOWLEDGEMENTS

We thank D. M. Gama, P. F. Kuruene, and R. E. Peck, who worked on the surveys, and D. Lukhele and C. Motsa for their support during the surveys.

RÉSUMÉ

VALIDITÉ DE LA SURVEILLANCE NUTRITIONNELLE BASÉE SUR LES DONNÉES DES DISPENSAIRES POUR L’ESTIMATION DE LA PRÉVALENCE DE LA SOUS-ALIMENTATION

Etant donné l’importance de la surveillance de l’état nutritionnel d’une population, on s’est soigneusement attaché à élaborer des systèmes de surveillance valables pour de vastes populations. Toutefois, on n’a que peu étudié la validité des données de surveillance elles-mêmes car il est rare de disposer d’une source indépendante de données sûres. Une enquête nationale sur l’état nutritionnel au Swaziland a fourni l’occasion de comparer la prévalence de la sous-alimentation dans une population, telle qu’elle est mesurée par une enquête de probabilité, avec la prévalence mesurée par un système de surveillance. Les estimations de l’insuffisance pondérale (faible poids pour l’âge) obtenues à partir du système de surveillance mis en place au Swaziland et fondé sur les données fournies par les dispensaires ont été comparées avec les estimations obtenues lors de l’enquête nationale sur l’état nutritionnel dans le Swaziland rural conduite en 1983. La prévalence, corrigée de l’âge, de l’insuffisance pondérale parmi les enfants conduits pour la première fois au dispensaire était analogue à celle obtenue lors de l’enquête nationale (10,0% contre 9,4%). Toutefois, parmi les enfants ayant consulté deux fois ou plus dans l’année, la prévalence de l’insuffisance pondérale était plus de deux fois plus faible que celle observée chez les sujets se présentant pour la première fois (4,4%). Les différences régionales de la prévalence de l’insuffisance pondérale mises en évidence lors de l’enquête nationale n’ont pas été décelées par le système de surveillance. Les données de surveillance à elles seules peuvent être utiles pour décrire l’état nutritionnel des enfants dans le cadre du système de surveillance et pour mettre en évidence des tendances générales, mais elles ne fourniront pas nécessairement une estimation valable de l’état nutritionnel dans la population générale et ne feront pas apparaître les différences régionales. Des enquêtes indépendantes peuvent aider à évaluer la validité des données de surveillance issues des registres des dispensaires. En l’absence de telles enquêtes, un examen des sources et de la qualité des données de surveillance aidera à évaluer la validité et la fiabilité de ces données en vue de la prise de décisions.

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