Structured observations of hygiene behaviours in Burkina Faso: validity, variability, and utility

V. Curtis,1 S. Cousens,2 T. Mertens,3 E. Traore,4 B. Kanki,4 & I. Diallo6

The use of observation techniques has been promoted for the study of hygiene practices; however, questions still remain about the validity and repeatability of such techniques. In this article we compare data on hygiene behaviours obtained from questionnaires with data obtained using a structured-observation approach and examine the repeatability of structured observations of behaviours and spot observations of environmental conditions.

Poor agreement between questionnaire responses and observations was found for child defecation and stool disposal practices (κ statistic: 0.25 and 0.28, respectively). The use of over-reporting of "good" behaviours (P < 0.0001). Repeated observations of child defecation and stool disposal behaviours showed better agreement (κ statistic: 0.76 and 0.62, respectively) based on small sample sizes. These findings suggest that our questionnaire data are less valid than data obtained by direct observation. However, different approaches to questioning may be less prone to over-reporting of "good" behaviours than our approach. Further research into the validity of different forms of question is warranted.

Behaviours and conditions related to hygiene vary. Observations may be useful in determining the frequency of different behaviours/conditions in the community. However, individual practices may be too variable to assign individuals to exposed and non-exposed groups for the purpose of identifying links with health outcomes. Further studies on the variability of behaviours and the repeatability of observations are therefore needed.

Introduction

In a review of studies of the health impact of water supply and sanitation programmes in developing countries, Cairncross concluded that health benefits stem from changes in hygiene behaviour and that the measurement of such behavioural changes is likely to be easier and more reliable than the direct measurement of health benefits. It was, however, acknowledged that methods for the measurement of behavioural changes need to be developed.

The traditional household questionnaire, used alone, is limited in its efficacy, scope, and accuracy (2, 3, 4). Structured observation of behaviour has been used by psychologists (4), animal behaviourists (5), economists, and anthropologists (6, 7), particularly over the last two decades. This type of observation is now increasingly being used also in investigations of associations between behaviour and health. For example, to measure water contact behaviour in investigations into schistosomiasis and wastewater use (8, 9), to describe water use (<9.9) to describe water utilization practices (10-12), to describe child feeding (13), and to investigate associations between hygiene practices and diarrhoea (14, 15).

A number of questions remain, however, about the validity and repeatability of the structured observation approach. Stanton et al. have compared knowledge-attitude-behaviour questionnaires and 24-hour recall questionnaires with structured observations and found that the responses to questionnaires did not correlate with observed household practices (16). They concluded that such questionnaires should not be used as surrogates for direct observation of hygiene practices. This conclusion was, however, based on a single observation of each household and no data on the repeatability of the observations were presented. Therefore it is not clear whether the concordance between observations conducted on separate occasions would have been greater than the concordance between questionnaires and observations.
We have carried out a study of childhood diarrhea in Bobo-Dioulasso, Burkina Faso, which included the administration of a questionnaire on, and direct observation of, hygiene practices and environmental conditions related to hygiene. About 10% of observations were repeated and a small group of households were observed on six separate occasions. In this article we present our findings on the concordance of responses to questionnaire and direct observations of behaviour, repeated observations of environmental conditions related to hygiene, and repeated observations of hygiene practices.

Methods

A case-control study recruited all children aged \( \leq 36 \) months from the town of Bobo-Dioulasso, Burkina Faso, who had been admitted to Sanou Souro Hospital between 15 January 1990 and 31 March 1991. Following their discharge from hospital, the children were visited at home and each was matched with a neighbourhood control who was selected using a pre-determined set of rules. Five female field-workers conducted detailed interviews with the mothers of both cases and controls and observed environmental conditions in and around the house courtyards. Questions on hygiene behaviours included "Where does your child usually defecate?" and "How do you usually dispose of the stools?". Possible responses were recorded. For example, in answering the question about where the child defecated, the field-worker could choose between "in a pot", "on the ground in the yard", "outside the yard", "in a loincloth or pants", and "other". After the interview and before leaving, the field-worker made spot observations of various environmental conditions in and around the courtyard, including whether or not human faecal material was visible in the courtyard. The range of possible behaviours was defined during a preliminary study to produce a precoded data collection form. For example, there were six numbered options to indicate where the index child's stools were disposed of: "in the latrine"; "buried in the yard"; "thrown in the yard"; "thrown outside the yard"; "not thrown away during visit/child not seen defecate"; and "other". The observer circled the number corresponding to the appropriate response for each behaviour, as observed. If a behaviour was observed several times, only the first occasion was recorded. If the child was seen to defecate, the following were recorded in a similar manner: the site, the disposal, how the child was cleaned afterwards, and how and if the mother cleaned her hands after removing the stools. Most activities such as washing, food preparation, and child care were carried out in the courtyard, which made observation of most behaviours relatively easy. Before leaving the courtyard, spot observations similar to those performed at the interview were made. The observers were residents of Bobo-Dioulasso who spoke the local languages and dressed in the local manner. In view of the repetitive nature of the work, women were chosen who had been educated only to primary-school level, and who had already demonstrated their patience by working as unpaid volunteers in the hospital.

Each observer received supervisory visits once a week. One in ten observations was repeated; exactly which was repeated was decided randomly (17). This takes into account the observer after a delay of 4-60 days (average, 22 days). The observer did not have access to the first observation schedule when filling in the second. In addition, 10 households were observed on six separate occasions to examine the repeatability of the observations in detail. The degree of agreement between the questionnaire responses and direct observation and between repeated observations was assessed using the weighted kappa (W) statistic (17). This takes into account the number of observations expected to be in accord if agreement is random, and is given by the formula:

\[
K = (P(A) - P(E))/ (1 - P(E))
\]

where \( P(A) \) is the proportion of occasions on which agreement occurs and \( P(E) \) is the proportion of occasions on which agreement would be expected to occur by chance alone.

Perfect agreement between observations arises when \( K = 1 \), while \( K = 0 \) indicates that the agreement is no better than that which would arise by chance. By convention, values for \( K \) in the range (0.01-0.39) are taken to indicate poor agreement, those in the range 0.40-0.75 good agreement, and those >0.76 excellent agreement.

The data were also analysed using \( \chi^2 \) tests for general associations and trends and also McNemar's test.

Results

A total of 2775 home interviews were performed with the mothers of hospitalized children and with those of neighbourhood controls (follow-up rate, 70% for the hospitalized children). In addition, 548 of the households were visited for the purpose of direct observation. The follow-up rate for all children who fulfilled the selection criteria for observation was 61%. Of the observation households, 57 (10%) were revisited for a repeat observation, and 10 households were observed on six separate occasions.

Comparison of questionnaire and observation data

Table 1 summarizes the distribution of questionnaire responses to selected questions and of observations on environmental conditions for all the households visited. Shown are the corresponding data from the 549 initial observations. A high proportion of mothers interviewed (75%) reported that their child defecated in a pot, while 66% of the 277 children, when they were observed, actually did so. Similarly, a high proportion of mothers (67%) reported disposal of their child's stools in the latrine, while rather fewer (56%) actually observed to do so. The majority of mothers (78%) reported purging their child's stools (30% every day and 48% for the hospitalized children). In addition, 548 of the households were visited for the purpose of direct observation. The follow-up rate for all children who fulfilled the selection criteria for observation was 61%. Of the observation households, 57 (10%) were revisited for a repeat observation, and 10 households were observed on six separate occasions.

Table 1: Distribution of questionnaire responses to selected questions and of observations on environmental conditions and of hygiene behaviours

<table>
<thead>
<tr>
<th>Questionnaire responses</th>
<th>Observation responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where does the child usually defecate?</td>
<td>Where did the mother dispose of the child's stools?</td>
</tr>
<tr>
<td>Pot</td>
<td>In the latrine</td>
</tr>
<tr>
<td>On the ground</td>
<td>Buried in the yard</td>
</tr>
<tr>
<td>In a loincloth or pants</td>
<td>Thrown in the yard</td>
</tr>
<tr>
<td>Outside the yard</td>
<td>Thrown outside the yard</td>
</tr>
<tr>
<td>Other</td>
<td>Not disposed of</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

Environment control: questionnaire versus spot observation

Were faeces present on the latrine slab?

Yes: 333 (14)
No: 2138 (66)

Were faeces present in the yard?

Yes: 337 (12)
No: 2068 (78)

Were faeces present in the yard slab?

Yes: 307 (40)
No: 2021 (60)

Were faeces present in the yard?

Yes: 351 (13)
No: 2094 (87)

Were faeces present in the latrine?

Yes: 351 (13)
No: 2094 (87)

Were faeces present in the yard?

Yes: 351 (13)
No: 2094 (87)

Was slippah water visible in the yard?

Yes: 351 (13)
No: 2094 (87)

Figures in parentheses are percentages.

The denominator for these observations is 277. Since 277 children were not observed to defecate. 

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defecating in terms of their mother’s response to the question “Where do you dispose of the child’s stools?” (P > 0.5). Among the 277 children for whom a comparison was possible, there was agreement between the questionnaire reply and the observation results for 187 (68%); κ = 0.25 (95% confidence interval: 0.14, 0.35), i.e., agreement between the questionnaire and the observation was poor.

Table 3 shows a paired comparison of the mother’s response to the question “Where do you dispose of the child’s stools?” with the direct observation of the same children. Among the 277 children for whom a comparison was possible, there was agreement between the questionnaires and the observation results for 187 (68%): K = 0.25 (95% confidence interval: 0.14, 0.35), indicating poor repeatability. Better agreement was obtained between two observations of the mother and how the latrine hole was covered (κ statistic = 0.59: 95% CI: 0.39, 0.80).

Comparison of two consecutive observations

Table 5 summarizes the comparisons of consecutive observations of behaviours related to hygiene, ranked in order of decreasing κ statistics. Because not all behaviours were observed at all visits, the effective sample size for each behaviour varies. For some of the behaviours the sample size was very small, and thus the results should be interpreted cautiously. The place where the child defecated, how the stools were disposed of, and whether or not the child ate earth, all had higher κ statistics than for the comparison between the questionnaire and observation data. Observations of other behaviours showed moderate-to-good repeatability, except for the mother’s action after going to the latrine, for which the agreement was no better than chance. This finding is, however, based on a very small sample size. In addition, the observer could not record whether the mother went to the latrine to defecate or urinate, and part of the variability in the mother’s behaviour may have arisen because of this.

The inter-observation agreement for various environmental conditions, recorded at successive observation visits, was generally poor; whether the yard had been swept, whether meal plates had been washed, how food was covered, and how drinking-water was stored each had κ statistics < 0.1, indicating poor repeatability. Better agreement was obtained between two observations of whether and how the latrine hole was covered (κ statistic = 0.59: 95% CI: 0.39, 0.80).

Comparison of six consecutive observations

In 10 households the observation schedule was repeated on six separate occasions. Three children behaved consistently, using a pot only on at least four occasions. Four children were not observed defecating more than once, and thus contributed no information about behaviour variability. The behaviour of the remaining three children varied: two used a pot on early visits but defecated on the ground at later visits. Such a pattern is consistent with the concept of “reactivity”; at first the mother makes an effort to appear hygienic in front of the observer but as she becomes used to the observer’s presence she reverts to her normal behaviour. The manner in which the mother disposed of the child’s stools was fairly consistent. For only one mother were two different methods of stool disposal observed. Four mothers consistently threw stools in the latrine, while the stool disposal practices of the remaining mothers were observed at most once.

Analysis of the results for these 10 households revealed a pattern of repeatability consistent with that suggested by a comparison of two observations. The presence of stools on the latrine slab was rare and occurred at random. For four of the households faeces were never observed on the latrine slab, while for another four the faeces were observed only

Table 4: Comparison of spot observations of environmental conditions recorded at the time of the questionnaire interview and at the time of the observation

| Environmental Condition | Questionnaire | Observation | Table 5 summarizes the comparisons of consecutive observations of behaviours related to hygiene, ranked in order of decreasing κ statistics. Because not all behaviours were observed at all visits, the effective sample size for each behaviour varies. For some of the behaviours the sample size was very small, and thus the results should be interpreted cautiously. The place where the child defecated, how the stools were disposed of, and whether or not the child ate earth, all had higher κ statistics than for the comparison between the questionnaire and observation data. Observations of other behaviours showed moderate-to-good repeatability, except for the mother’s action after going to the latrine, for which the agreement was no better than chance. This finding is, however, based on a very small sample size. In addition, the observer could not record whether the mother went to the latrine to defecate or urinate, and part of the variability in the mother’s behaviour may have arisen because of this.

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<thead>
<tr>
<th>Environmental Condition</th>
<th>Questionnaire</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excreta on the slab of the latrine</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>15</td>
<td>41</td>
</tr>
<tr>
<td>No</td>
<td>78</td>
<td>351</td>
</tr>
<tr>
<td>Statistic</td>
<td>0.07</td>
<td>(-0.03, 0.18)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sugarcane in the yard</th>
<th>Questionnaire</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>142</td>
<td>90</td>
</tr>
<tr>
<td>No</td>
<td>17</td>
<td>27</td>
</tr>
<tr>
<td>Statistic</td>
<td>0.46</td>
<td>(0.38, 0.52)</td>
</tr>
</tbody>
</table>

* Figures in parentheses are the 95% confidence intervals.
one of the six visits. In one household, faeces were observed on the latrine slab twice, while in the remaining household they were observed three times. The presence of faecal material in the yard was much more common: for six households such material was observed every visit; for two households, on five of six visits; and for two households, on only one visit. The presence of stagnant water in the yard did not vary at all over six visits: for three households stagnant water was always observed, while for the other seven it was never observed.

Inter-observer variation

Inter-observer variation was difficult to assess since the allocation of observers to households was not random but was based largely on the geographical location of the households. Thus, differences between observers could have arisen because of socio-economic and cultural variations between different areas of the town. Comparison of the initial observations made by each of the three observers indicated that there were no differences for reports about the child's defection site (P = 0.08), with one observer (A) reporting twice as often as the other observers (B and C) that children ate outside. Observer B saw the mother disposing of the child's stools in the latrine or outside the courtyard more often than observers A or C, and in the courtyard less often than A or B (P = 0.01). Observer A reported excreta on the latrine slab more often than observers B or C (P = 0.001), while observers A and C reported excreta in the courtyard and stagnant water in the yard more often than observer B (P < 0.0001 in both cases).

Discussion

Health researchers may be interested in studying behaviours for several reasons. They may wish to understand and describe what occurs within a particular community, and what they may wish to understand the links between these behaviours and health, and to plot changes in behaviours over time. Among the technical assessment results. However, because for this purpose are the following: participant observation, focus group discussions, key informant interviews, structured interviews of a sample of the population, and structured observation of a sample of the population. Each technique can contribute to an understanding of behaviour but all have shortcomings in identifying and quantifying what occurs in practice. Two areas of difficulty can be identified: the validity of the method of measurement and the variability of the behaviour itself.

Problems of validity arise when study techniques do not represent accurately actual behaviours. This is particularly likely when the behaviour being investigated is socially sensitive, e.g., sexual behaviour. Some techniques may reflect more accurately than others what actually happens; for example, in a study of sexual habits in the Gambia, Pickering concluded that structured interviews with prostitutes produced less valid data than those obtained from key informant interviews (75). Although the social sensitivity of different behaviours varies from society to society, in most cultures defecation behaviour is probably less socially sensitive than sexual behaviour. Women in Burkina Faso appear, in general, to be less reluctant about revealing personal habits than women in some Asian societies, although certain ethnic groups in West Africa, such as the Peulh and the Dogon, have particular social codes that forbid the behaviour itself.

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Our findings suggest that hygiene behaviours and environmental conditions in Burkina Faso lie somewhere between the two extreme outcomes above. There appears to be some consistency in most of the observed behaviours and conditions but it is clearly not absolute, and the degree of consistency may vary substantially from behaviour to behaviour and from condition to condition.

The potential effect of this variability is considerable. For example, consider 2000 courtyards which can be divided into "clean" and "dirty" groups (1000 each). Suppose that in the 1000 "clean" courtyards faecal matter is only rarely present (and observed) on 20% of days and that in the 1000 "dirty" courtyards faecal matter is commonly present on 80% of days. If all the courtyards are visited on two separate occasions and we record whether faecal material is present, the expected value of the K statistic for the two observations would be 0.36—higher than the value we obtained in our study.

Now suppose that on days when there is no faecal material in the courtyard a child has a 2% risk of developing diarrhoea, and on days when there is faecal material the risk is 6%, i.e., the presence of faecal material is associated with a risk ratio of 3.0. On any given day we then expect 28 children from clean households ((1000 x 0.8 x 0.02) + (1000 x 0.2 x 0.06)) and 52 children from dirty households ((1000 x 0.2 x 0.02) + (1000 x 0.8 x 0.06)) to develop diarrhoea. If these 80 children are observed on another day, we would expect to classify 20 (52 x 0.2) + (52 x 0.8)) as living in dirty courtyards and 32.8 as living in clean court-yards. Thus the expectation of the risk ratio estimated from a study based on a single observation on any given day other than this on which transmission occurred is 12.22 (47.2/3.8), which is substantially less than the true risk ratio (3.0). Hence, even a slight degree of variability in the behaviours and conditions being measured can result in a serious bias towards unity in the estimate of the risk ratio.

The measurement of behaviour is a subject for much debate among epidemiologists and public health specialists who are attempting to improve health promotion activities. Structured observations have been promoted as one of the methods by which this variability can be monitored. Some quantitative interview methods have been promoted as one of these methods. However, the reliability and consistency of different observations performed this task is if structured observations can perform this task, are they the best way to do it?

The results of our study provide tentative answers to some of these questions. Behaviours and conditions related to hygiene, such as faeces disposal, vary both within and between individuals, and the between-individual variability may be substantial. In some circumstances, measurements of certain behaviours and conditions may be useful for certain purposes, but not others. For example, measurement may be useful to determine the incidence/prevalence of different behaviours/conditions in the community. Investigations designed to monitor changes in hygiene behaviours, perhaps by means of an education programme, could then use a series of cross-sectional studies to do so. Individual hygiene practices may, however, be too variable to assign individuals to either exposed or non-exposed groups for identifying links with health outcomes. Further studies on the variability of behaviours and on the repeatability of structured observations with larger sample sizes and in other settings are necessary before any firm conclusions can be drawn.

Our findings are consistent with, but do not prove, the hypothesis that, in Burkina Faso, data collected through direct observation of hygiene-related behaviours have greater validity than those obtained through questionnaire interviews. However, the variability of the data collected through direct observation of hygiene-related behaviours may, in some cases, make it difficult to arrive at any firm conclusions.

Studies whose aim is to describe the range and relative frequencies of different hygiene-related behaviours in Burkina Faso may be based on direct observation rather than on questionnaires. Structured observations are, however, expensive. In our study, households were observed for a total of about 1400 hours and data were gathered on child defecation behaviours on 277 occasions. Thus, approximately 5 hours were required to observe each event. Our questionnaire related to what "usually" happened. A different approach to questioning, e.g., "What did you do the last time...?" may be better in some cases. However, even less variability of the data obtained from structured observations results in good behaviour. Further research into the validity of different forms of questionnaires is warranted.

Acknowledgements
The study was a collaboration between the Ministére de la Santé et de l'Action Sociale du Burkina Faso, the London School of Hygiene and Tropical Medicine, England, Centre Murzak (POCU), Burkina Faso, and the University of Bordeaux II, France. We particularly thank Dr F.R. Tall, Dr A. Traore and Dr B. Naoro, Service de Médecine, Saoou Sourou Hospital, Bobo-Dioulasso, without whose contribution this study could not have been started, and Mme Baro, Mme Lumala, Mme Percom, Mme Sainou, Mme Simma, Mme Tianou, and Mme Tiendrebeogo.

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References
A vaccination survey using the EPI methodology to evaluate the impact of a child health outreach programme in an urban area of South Africa

D.J. Coetzee, P. Ferrinho & S.G. Reinach

A community-based survey of the vaccination status of children aged 12–23 months was conducted to evaluate the impact of a child health outreach programme on vaccination coverage in Alexandra township, South Africa. The EPI cluster sampling technique was adapted for this purpose. The sample size, including the number of clusters and the number of units per cluster, was increased to permit stratification of the data and comparison of the results with those obtained in a study conducted prior to the introduction of the outreach services in 1988.

At the time of the survey interview, 67% of the children were fully vaccinated (78% against measles) and by 1 year of age, 58% were fully vaccinated (89% against measles). The increase in coverage since the introduction of the programme was statistically significant only for measles (Student's t-test, P <0.01). A total of 75% of children living in informal dwellings, compared with 51% living in formal dwellings, were fully vaccinated by interview (Fisher's exact test, two tailed, P <0.001). Mothers from informal dwellings had a 1.88 times greater chance of not knowing about the outreach services (P <0.001). Children whose mothers knew where vaccinations were given, attended postnatal clinics, used the outreach services, possessed a road-to-health card from the Alexandra Health Centre, and who resided in a formal dwelling all had a higher chance of being vaccinated.

Introduction

Alexandra township is situated 15 km from the centre of Johannesburg. Estimates of its current population range from 150 000 to 250 000, a three-fold increase since the census of 1965 (1). Approximately 33% of the population live in informal dwellings or shelters, 15% in new developments, 8% in three large single-sex hostels, and the remainder in old homes. The already poor socioeconomic conditions have been aggravated by rapid urbanization and its associated problems, unemployment, and the 3-year state of emergency in South Africa. Inadequately maintained sewage, sporadic refuse removal, the absence of storm-water drainage, and overcrowding in the township are predisposing factors for infectious disease and concomitant poor nutritional status.

Most of the health services for the community are provided by the Alexandra Health Centre and University Clinic (AHC), a privately funded facility. In its efforts to provide comprehensive health care to all the people, AHC is attempting to create a model for health care for the urban poor (2). Curative services, including 24-hour emergency and maternity services, and preventive and promotive services are provided. An outreach service is also operated by AHC. A total of 17 general practitioners provide primary curative care, a number of traditional healers are active in the area, and a state clinic provides services to deal with tuberculosis, chronic psychiatric problems, and some vaccinations.

Vaccination is provided by both AHC and the state health clinic according to the following schedule: BCG and monovalent oral poliovirus vaccine at birth, diphtheria-pertussis-tetanus (DPT) and oral trivalent poliovirus vaccine, at 3, 4, and 6 months of age, respectively; and measles vaccine at 9 months of age. Administration of monovalent