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Hygiene behaviour practises as discriminants for the occurrence of childhood diarrhoea

OYENIKE OYEJIDE,* DIMEJI OLADEPO* and EZEKIEL OKE**

Department of Preventive & Social Medicine, University College Hospital,* *Department of Sociology, University of Ibadan, Ibadan, Nigeria.*

Summary

Structured observations of events during food preparation, feeding and defecation management were conducted in four rural Nigerian communities as part of a longitudinal study aimed at identifying environmental and behavioural risk factors for diarrhoea. A discriminant analysis model was developed for distinguishing between children who had no diarrhoea and those who had diarrhoea during the study period. The behavioural practises associated with occurrence of diarrhoea included disposal of faeces around the house; careless handling of cleaning material; use of feeding bottles; purchase of cooked food from food vendors; and the presence of domestic animals in food preparation places. Using age and defecation scores as discriminants, the sensitivity of the discriminant model was 73% its specificity 68%, while 71% of cases were correctly classified.

Resume

Nous avons observé dans quatre communautés rurales du Nigéria la succession des opérations menant de la préparation de la nourriture et de son ingestion au traitement des matières fécales; ceci fait partie d'une étude approfondie destinée à identifier les facteurs de risque responsables de l'apparition de la diarrhée, en fonction de l'environnement et du comportement. Nous avons développé un modèle d'analyse discriminante, pour distinguer entre les enfants ayant souffert de diarrhée et ceux n'en ayant pas souffert pendant la durée de cette étude. Les comportements associés à une manifestation de diarrhée comprennent: le dépôt des matières fécales autour de la maison, la manipulation sans précaution des instruments ménagers, l'usage de biberons,

l'achat de nourriture toute préparée à l'extérieur de la maison et la présence d'animaux domestiques dans les cuisines. En utilisant comme discriminants l'âge et les paramètres liés à la défécation, la sensibilité du dit modèle est de 73%, sa spécificité de 68% et nous avons trouvé que 71% des cas sont classés correctement.

Introduction

Diarrhoea diseases constitute major causes of morbidity and mortality among children of developing countries[1-5] where about a third of the childhood deaths are associated with diarrhoea. In the last decade, a major impact has been made through appropriate case management of diarrhoea with a resultant decrease in mortality rates among cases of acute diarrhoea that get to the health centres. Because many cases of diarrhoea occurring in the rural communities do not get to health centres and may not have the benefit of receiving oral rehydration solution, and also because a small but significant proportion of these diarrhoeas are persistent; there is the need to find effective ways of preventing diarrhoea especially in such rural settings. This need has been clearly argued for by previous authors[1] who advocated a multifaceted approach to diarrhoea disease control. The various approaches advocated have included improving water supplies and excreta disposal, chemoprophylaxis, measles immunization, and promotion of supplementary feeding[6- 11]. Our study contributes to those which have been conducted in the past decade[12-15] that have attempted to describe the determinants of hygiene behaviour and to quantify the effect of personal and domestic hygiene on childhood diarrhoea.

* Correspondence: Dr C.O. Oyejide, Department of Preventive & Social Medicine, University College Hospital, Ibadan, Nigeria.

Methodology

This study was carried out in four village clusters of Oluyole local government area of Oyo State, Nigeria. These village clusters were Badeku, Jago, Ajia and Ojoku. In three of the villages, water was obtained from shallow wells and streams for household use. In Badeku, communal taps were available in a few locations in the village, but villagers still used surface water when the taps went dry. In all villages, household water was stored in either clay pots or plastic pots often left uncovered. Domestic animals notably goats, chickens and pigs freely roamed in and out of the homes; and animal droppings were often seen present in the children's playing and feeding areas. Disposal of faecal matter was done indiscriminately.

The study aimed at identifying environmental and behavioural risk factors associated with childhood diarrhoeal diseases, with the ultimate aim of using the information gathered to develop and implement an educational intervention programme for the control of diarrhoea in the rural communities. In order to ensure community participation, informed consent was obtained first from the community leaders. Following this, a series of meetings was held with the women of the villages during which the objective of the study and the need for field workers to spend some time in their homes were explained to

them. All children under the age of four years, a total of 420, were recruited into the study. The subsequent methodology employed included an ethnographic study, weekly diarrhoea surveillance over a six month period, and structured observation of food preparation, feeding, and defecation behaviours on study children on two different occasions during the study period.

Descriptive analysis of the diarrhoea morbidity and structured observation data was done using BMDP 2D and 4D on the VAX II/750 MINI COMPUTER.

Behaviour scores were generated for each child, for each of the three observation data sheets. Stepwise discriminant analysis was used with Program BMDP 7M [16], in an attempt to distinguish between children who had no diarrhoea and those who had one or more episodes of diarrhoea.

Data obtained from the structured observation from all the children were used for descriptive analysis, but only those with records of food preparation, feeding and defecation were used for discriminant analysis.

Results

The variables in each observation data sheet are presented in Table 1.

Table 1

Variables in food preparation data sheet included:

- Cleanliness of food preparation area.
- Presence of flies, domestic animals.
- Methods of washing hands before food preparation.
- Storage of prepared food.

Variables in feeding data sheet included:

- Cleanliness of feeding area — Cleanliness of feeder's hands.
- Mode of feeding the child.
- Feeding of fresh or left over food — Handwashing rates.
- Feeding of foods purchased from food vendors.

Variables in defecation data sheet

- Methods of cleaning defecation place.
 - Methods of cleaning the child.
 - Methods of disposal of childhood faeces.
 - Methods of cleaning caretaker's hands.
-

The key findings of the observational study are summarised in Table 2.

Table 2: Results of structured observation

Methods of cleaning defecation place	<ol style="list-style-type: none"> 1. Soap 7.3% and water 2. Water 34% only 3. Cloth 35.6% 4. Leaves 3.3%
Methods of cleaning the child after defecation	<ol style="list-style-type: none"> 1. Water 79.5% 2. Leaves 8% 3. Soap 0.5% and water
Methods of disposal of child's faeces	<ol style="list-style-type: none"> 1. Thrown into nearby bush 25.9% 2. Thrown in front or back of house (within the compound) 11.3% 3. Thrown into a dust bin 0.5% 4. Cleaned by dogs 15.8%
Method of disposal of cleaning material	<ol style="list-style-type: none"> 1. Bush 31.8% 2. Left around 31.6% 3. Thrown in front or back of house 21.7% 4. Thrown in a dust bin 2.8%
Methods of cleaning caretaker's hands	<ol style="list-style-type: none"> 1. Did not wash or wipe 43.6% 2. Water 41.5% only 3. Wipe with cloth or dress 12% 4. Soap & water 1.4% 5. Leaves 0.5%

Descriptive analysis of the morbidity data showed that the highest diarrhoea rates were recorded in the age groups 6-11 months and 12-23 months. Thereafter incidence of diarrhoea decreased.

Stepwise discriminant analysis was first conducted using two levels of diarrhoea (no diarrhoea/had at least one episode) as the dependent variable; and using age, sex, village code and defecation scores as the discriminating variables. The procedure of variable selection was completed after five steps. Table 3 shows that the variables selected as discriminating between the two groups of children were age, disposal of faeces around the house, the practise of using diapers and leaving them lying around, using leaves to clean the child, and the village code. The sensitivity of the discriminant function was 73%, its specificity was 68.2%, while 71% of the cases were correctly classified. The overall F statistic 9.4, df 5,193 was statistically significant ($p < 0.01$).

After adjusting for the effect of age and sex, the variables selected were disposal of faeces around the house, and the village. The sensitivity of the

discriminant function became 66.7%, its specificity 61.4%, while 64.3% of the cases were correctly classified. (Table 3). The overall F statistic 8.1, df 3, 195 was statistically significant ($p < 0.01$).

Table 4 shows a summary of the discriminant model using age and the feeding scores as discriminating variables. Age and the use of feedings bottles were the selected variables. After adjusting for the effect of age and sex, the practise of feeding food purchased from the food vendors was the only discriminant variable. Using the food preparation variables as discriminants, none of them was selected. Table 5 shows that when all the observation variables (food preparation, feeding and defecation variables) were used as discriminating variables, those selected were age, disposal of faeces around the house and the practise of using leaves as cleaning materials. After adjusting for age, sex and village, the variables selected in the full discriminant model were disposal of faeces around the house, use of leaves and the presence of domestic animals in feeding areas.

Table 3: Results of discriminant analysis using as dependent variable : 2 levels of diarrhoea

Discriminant Variables : Defecation scores	
With age and sex in model	
Variables selected	1. Age 2. Disposal of faeces around the house 3. Use of leaves 4. Village code
Sensitivity:	73%
Specificity:	68.2%
% Correctly classified:	71%
Adjusted for age and sex	
Variables selected:	1. Disposal around the house 2. Village code
Sensitivity:	66.7%
Specificity:	61.4%
% Correctly classified:	64.3%

Table 4: Results of discriminant model using as dependent variable : 2 levels of diarrhoea. Discriminant variables: feeding scores

With age and sex in the model	
Variables Selected:	1. Age 2. Use of feeding bottle
Sensitivity:	69.8%
Specificity:	52.8%
% Correctly classified:	62%
Adjustng for age and sex	
Variables : Selected :	1. Feeding food purchased From food vendors.
Sensitivity:	68.9%
Specificity:	48.3%

Table 5: Results of discriminant model using as dependent variable : 2 Levels of diarrhoea

Discriminant variables : Food preparation feeding, and defeacation scores	
With age and sex in the model	
Variables selected :	1. Age 2. Disposal of faeces around the house 3. Use of leaves.
Sensitivity:	70%
Specificity:	60%
% Correctly classified:	66.2%

Discussion

Multivariate techniques have been widely applied in epidemiology for various purposes including quantifying the role of risk factors, computing the probability of disease occurrence, or predicting the occurrence of disease [18-24]. This study applies the multivariate techniques of discriminant analysis to structured observation data of hygiene behaviour.

The results provide relevant information that will be useful for planning diarrhoea control programmes targetted at reducing the development of new cases of diarrhoea in rural settings. In addition, it also quantifies the role of events related to the feeding of young children and to the management of defeacation by their caretakers, in diarrhoea disease occurrence.

The discriminant model developed in this study has identified specific risk factors that should be highlighted in a diarrhoea disease control programme for these Nigerian rural communities. This information will be useful in the overall efforts of improving child survival in such rural settings. The fact that the model using only defeacation scores had the highest sensitivity and the highest percent of cases correctly classified, shows that this was the best discriminant model. The results of this study highlight specific events at defeacation as being most closely associated with diarrhoea. Similar findings have been found by previous authors [13].

The presence of animals in the food preparation areas being another useful discriminant variable identified, highlights the role of domestic animals in contributing to the incidence of diarrhoea; possibly by carrying diarrhoea causing pathogens on their feet into the house thereby contaminating the children's play area; or by bacterial pathogens in the animals

droppings contaminating the hands of children playing in and around the house.

One of the defeacation management practises identified as promoting occurrence of diarrhoea was the use of leaves to clean the child after defeacation. This might be related to the lack of handwashing after such a behaviour, and to the fact that such leaves are thrown around the house indiscriminately where flies have access to them.

The fact that the village score was a discriminant factor highlights the differences in the rates of occurrence of diarrhoea in the three villages without tap water; and the only village (Badeku) with communal tap water. The lowest incidence rate of diarrhoea was observed in Badeku [17]. This again highlights the positive role of availability of adequate quantities of water in a community.

Of the feeding variables observed, the use of feeding bottles and the practise of buying cooked food from food vendors turned out to be the useful discriminating feeding variables. Mothers especially in such rural settings where bottles can easily be contaminated should be encouraged to exclusively breastfeed their infants. Hygienic conditions under which food is stored, prepared and sold by food vendors needs further investigation; and suggestions for improvements should be incorporated into future diarrhoea control programmes.

In practical terms therefore, health workers planning preventive measures for the control of diarrhoea diseases in such rural settings need to pay particular attention to strategies which will encourage more positive hygiene behaviours; especially those that relate to the management of childhood defeacation. Caretakers of children need to be made to understand the dangers that could arise from

indiscriminate disposal of faeces in the yard, with leaving materials used for cleaning faeces lying around the house, and allowing domestic animals to roam freely in the house after stepping on faeces thrown in the yard. In addition, more attention needs to be paid to the food preparation and food storage behaviours of food vendors, since a large proportion of these village children are fed food prepared by food vendors. Higher breastfeeding rates need to be encouraged for infants; and the use of feeding bottles in such rural settings where mothers often prepare the milk overdiluted with contaminated water must be discouraged.

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