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ORIGINAL PAPERS

Prevention of Diarrhoea in a Poor District of Santo Domingo, Dominican Republic: Practices, Knowledge, and Barriers

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ABSTRACT

The study, conducted in a poor periurban community of Santo Domingo, Dominican Republic, assessed the practices, knowledge, and barriers relating to prevention of diarrhoea. A total of 582 caregivers of children, aged less than 5 years, were systematically sampled from four barrios. Results of the study showed that 55% of the caregivers did not boil drinking water for children; 38% did not always wash hands of the children prior to meals; 87% of the children did not always wear shoes outside their house; and 54% were breastfed for less than one year. Biomedical knowledge about these practices was high among the caregivers, and was not related to the reported behaviours. However, several barriers were significantly related to practices, including lapse in caregiving, limited resources, erroneous beliefs, and non-compliance by children. Health education, based on a biomedical knowledge-deficit model, may have little impact on improving the diarrhoea-prevention practices in these communities. Greater attention should, therefore, be directed toward the barriers experienced by caregivers of children.

Key words: Diarrhoea, Infantile; Knowledge, attitudes, practice; Health education; Hygiene

INTRODUCTION

Diarrhoea continues to be one of the commonest causes of high morbidity and mortality among young children in many parts of the developing world, including Latin America (1-2). Improved child caregiver practices may significantly reduce the incidence of diarrhoea in children (3-5). Consequently, health education promoting diarrhoea-prevention practices has been embraced as an important intervention by various programmes working in poor communities in developing countries.

Generic education packages have been developed to facilitate its widespread use in poor districts of the developing world. Messages focus on primary and secondary prevention of diarrhoea, such as washing hands before meals, breast-feeding, and use of oral rehydration salts (6-9). These interventions are relatively simple, and health education may seem to be an appropriate intervention. However, critical assumptions are made when health education is chosen as the intervention when a knowledge, attitude and practice study is not first conducted. The first assumption is that high rates of diarrhoea reflect deficiencies in prevention practices of caregivers. The second assumption is that deficits in the prevention practices are a function of deficits in biomedical knowledge (5,10-14). This leads to the use of educational materials based on a knowledge-deficit model even in cases where knowledge had not been assessed.

A number of "health education" interventions have been found to be successful in changing hygiene behaviours (4,15-16). However, baseline knowledge and change in knowledge with the intervention were not assessed in these reports. Even in the few studies that did assess knowledge, practices, and illness, there was a lack of reported assessment of knowledge about specific

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prevention practices, which are the core elements in generic health-education programmes (5,10-11). Other studies have focused on the change in knowledge after a health-education intervention without looking at an associated behaviour change (17-19). Overall, there is a paucity of evidence linking improvements in health knowledge to improvements in health practices for prevention of diarrhoea, and the data that are reported are limited (20).

The first aim of this study was to determine the extent of deficits in the diarrhoea-prevention practices. The second aim was to determine the association of these deficits with deficits in the biomedical knowledge and non-knowledge barriers. The hypothesis was that non-knowledge barriers might be more related to engagement in recommended diarrhoea-prevention practices than basic biomedical knowledge about these practices.

METHODS AND MATERIALS

Setting: The study was conducted in Los Alcarrizos, a predominately poor periurban district of Santo Domingo, the capital of the Dominican Republic. Four poor barrios (locally defined communities or neighbourhoods) of this district were chosen. The barrios were chosen for two reasons: (i) a local child-malnutrition clinic frequently receives referrals from these communities, and (ii) local health-promotion groups had chosen these communities for health-education interventions.

Procedure: Two Dominican research assistants conducted interviews by visiting every fifth house along each road and path in each selected barrio. This sampling frame included all houses within each of the selected barrios, and was used for obtaining a non-biased representative sample. The research assistants explained the nature of the study to an adult in each selected house, and inquired if there was/were one or more children aged 5 years or less who presently lived in the house. If there was, and if a person who provided primary care to the child was available, that person was invited to participate in the interview. If a primary caretaker was not presently available or there was no one at home, the house would be visited up to two further times to conduct an interview. If the primary caretaker had more than one child aged less than 5 years, only one of them was randomly chosen for some specific practice questions, such as duration of breast-feeding. After completing the interview, the research assistants measured the mid-arm circumference of the children using Insertion Tapes from T.A.L.C. (Teaching Aids at Low Cost, School of Hygiene and Tropical Medicine, University of London). They also recorded information about whether the children were barefoot at the time of interview.

The study was approved by a committee at the Proyecto Ninos/Centro de Salud Clinic in Los Alcarrizos. Verbal consent was obtained from each of the primary caretakers who participated in the interview.

The sampling process resulted in visits to 863 houses. Of these, 597 were eligible as they had a child aged less than 5 years, and an additional 12 were undetermined as no one was encountered on repeated visits. Of those eligible, 15 (2.5%) either refused or had no available primary caretaker to complete the interview, leaving 582 (97.5% of total eligible) who completed the interview.

Measures: The interviews were based on a structured interview protocol. The interview covered the following four prevention behaviours: (i) purification of drinking water, (ii) breast-feeding; (iii) washing of children's hands before a meal; and (iv) use of shoes. (Although going barefoot is not a common cause of diarrhoea, there is a risk of hookworm contamination or injury, and health-education efforts in this region often include this behaviour in general hygiene promotion). In addition, demographic information and history of diarrhoea in children were obtained. For the purposes of this study, diarrhoea was defined as three or more loose stools passed by a child in a day.

The basic structure of the interview was to first ask about engagement in the given prevention practice. Then the respondents were asked an open question as to why the practice was performed by "some people." It was phrased as "some people" rather than for the given respondent as the respondent may not be engaged in the practice but still have an understanding of the purpose for the practice. In addition, we hoped that this would distance the respondent from focusing on justifying their point of view rather than expressing their knowledge of the practice. If the respondent was not presently engaged in the practice, they were asked why not. If they were practising the given behaviour, they were asked as to whether a series of barriers impeded their compliance with the given practice using a closed question format. The specific barrier items were those most frequently reported in a previous study in this same district where barriers had been identified by asking open-ended questions to mothers of young children (21).

For all open questions, the research assistants transcribed all responses given by the caregivers. When a caregiver stopped giving spontaneous responses, she was prompted to give additional responses if she had any more.

Analysis: Associations between variables were assessed using chi-square tests with continuity corrections, Fisher's exact tests, and Spearman's correlations. The

SPSS statistical package (PC version) was used for data analyses.

RESULTS

Demographics: Mothers of the children comprised 84.5% of the 582 respondents who completed interviews, and grandmothers comprised 9.6%. The remaining 5.8% included aunts, fathers, older sisters, and others. Exactly half of the index children were females. Sociodemographic information about the caretakers and the children is presented in Table 1.

Table 1. Sociodemographic data on participants

Variable	Mean (SD)	Range
Age of caregivers (years)	29.5 (10.1)	14-76
Education of caregivers (years)	5.6 (3.6)	0-13*
Age of index children (months)	28.9 (18.2)	0.3-60
No. of people in the house	5.5 (2.1)	2-15
No. of children (aged less than 12 years) in the house	2.7 (1.4)	1-9

*post-secondary education coded as 13 years

Forty-six percent of the caregivers reported that one or more of the children had diarrhoea in the last month, while 77% reported that one or more of the children ever had a problem with diarrhoea. The average mid-arm circumference of the children aged one year or over was 155 mm with 3.6% of these children having measures below 135 mm, a cut-off level for malnutrition.

Purification of water: Purification of drinking water, typically by boiling, is frequently promoted in this district due to the poor quality of drinking water; the district lacks a centralized water treatment system. Fifty-five percent of the caregivers were not presently boiling drinking water for the children. Fifty-three percent of those not presently boiling water reported stopping the boiling of water when the child was aged 12 months or less. Another 28% of this group stopped the boiling of water between 13 and 24 months of age of the children.

All the caregivers were asked the open question "Why do some people boil drinking water?" The most frequent response was to kill "micro-organisms," "parasites," "bacteria," or "germs." A similar pattern of responses was given regardless of whether the caregiver was presently boiling water (Table 2).

Table 2. Frequency distribution of reasons for boiling drinking water

	Boils water now			
	Yes		No	
Reason	No.	%	No.	%
Kills micro-organisms/parasites/bacteria/germs*	215	83.3	248	78.2
Water is contaminated/dirty/full of garbage	45	17.4	47	14.8
Prevents illness or damage	10	3.9	19	6.0
Prevents diarrhoea or vomiting	4	1.6	2	0.6
Miscellaneous	3	1.2	12	3.7

*no significant difference in frequency of response for this item (c^2=2.108)

Table 3. Frequency distribution of reasons given for no longer boiling drinking water

Reason	No.	%
Child can get sick if he/she returns to drinking purified water after drinking untreated water	142	44.2
Use other purification methods (filtration, chlorination, bottled, tablets)	40	12.5
For no specific reason or "descuida"*	36	11.2
Child drinks "agua cruda"† elsewhere	31	9.7
Drinking "agua cruda" does not cause any problems	31	9.7
Child is big enough to drink "agua cruda"	24	7.5
Lack resources (cannot buy enough fuel, no stove, no appropriate pots)	16	5.0
Does not drink water yet	6	1.9
Miscellaneous	23	7.8

*The word "descuida" is roughly equivalent to "neglectfulness
†"agua cruda" is untreated water

Twenty-seven percent reported that they chlorinated water. Seventy-four percent reported on an open question that the reason that people chlorinated drinking water was to kill "germs," "bacteria," "parasites," or "micro-organisms." Nineteen percent reported that chlorine was used for "disinfecting," "purifying," or "decontaminating" water. Only 3% stated that they did not know why water was chlorinated. There was no significant difference in the frequency of the most common reason given between those who used or who did not use chlorine (c^2=0.430).

Those who did not use chlorine for purifying water were asked an open question as to why not. Twenty-four percent reported that there was no particular reason to explain why they did not use it. The next most common reason they

Table 4. Endorsement of obstacles to washing hands of children before meals by frequency of hand-washing*

	Frequency of hand-washing							
	Almost always		Sometimes or usually		Almost never		Total	
Obstacle	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Forgets†	104	29.1	130	70.7	33	82.5	267	45.9
"Descuida"†	89	24.9	111	60.3	37	92.5	247	42.4
Not enough time†	91	25.4	110	59.8	18	45.0	219	37.6
Not always that dirty†	91	25.4	95	51.6	27	67.5	213	36.6
Children do not want to‡	53	14.8	53	28.8	7	17.5	113	19.4
Not always sufficient water†	35	9.8	39	21.2	9	22.5	83	14.3
Total no.	358	61.5	184	31.6	40	6.9	582	100.0

* "sometimes/usually" collapsed with "almost never" to facilitate 2x2 c^2 analysis; † $p< 0.0005$; ‡ $p<0.005$

mentioned was that they did not like the taste of chlorinated water (18%). Those who did report using chlorine endorsed several obstacles that prevented them from always using chlorine, including running out of chlorine, not having money to buy it, and forgetting to use it.

Hand-washing: The caregivers were asked to rate the frequency that the children's hands were washed prior to eating. Sixty-two percent reported that the hands of children were "almost always" washed before meals, while 31.6% reported "usually" or "sometimes," and 6.9% reported that they were "rarely" washed before meals.

To an open question, 83% of the caregivers reported that contamination with "micro-organisms," "parasites," or "germs" was the reason to wash the hands of children. Other reasons included that the food would become contaminated, that it was a way to maintain health, and that it was part of good hygiene to do so. Only two caretakers (0.1%) were not aware of any reason for hand-washing. There was no significant difference in the frequency of the most common reason given between those who reported "always" washing the hands of children versus those reporting "usually, sometimes, or rarely" ($c^2=0.811$).

To assess barriers to washing the hands of children all the time, the caregivers were asked about 6 possible barriers (Table 4). "Forgetfulness" and "descuida" (the word "descuida" is roughly translated as "neglectfulness") were the most frequently-endorsed obstacles, and most discriminated the "almost always" hand-washing group from the other groups. Those reporting that they did not always wash the hands of children prior to meals endorsed all the proposed obstacles at a higher rate than those reporting that they almost always washed the hands of children.

Wearing shoes: The caregivers were asked to rate the frequency that the children went barefoot outside. Twenty percent reported that the children "almost always went barefoot," 67% reported "usually" or "sometimes," and 13% reported that the children "almost never went barefoot" (Table 5). The reported frequency of barefootedness was significantly related to whether the children were barefoot at the time of interview ($c^2=40.6$, df=2, $p<0.0001$).

To an open question, 87% of the group reported that the reason for wearing shoes was to protect the children from "micro-organisms," "parasites," or "germs." The other commonest reasons were to prevent cuts on or contamination of feet and to prevent illness. Only two caregivers (0.1%) reported that they did not know why it was important to have the children wear shoes all the time. There was no significant difference in the frequency of the most common reason given between those reporting that they "almost always used shoes" versus the other categories collapsed ($c^2=0.028$). The caregivers whose children went barefoot more frequently were more likely to endorse 4 of the 6 barriers (Table 5).

Breast-feeding and non-breast-milk: Ninety-four percent of the children had been breastfed in infancy. Seventy-eight of those who were initially breastfed were not presently breastfeeding. For the children aged one year or over, 45.9% were breastfed for one year or more.

Only 3 caregivers (0.5%) reported that infant formula was better than breast-milk. Eighty-seven percent reported that they were aware of the recommendation to breastfeed for at least one year. However, those caregivers of children, aged over one year, who were aware of this recommendation were less likely to breastfeed for one year or more compared to those who were not aware of the recommendation (Table 6).

Of the 6% who had never breastfed, the most common reasons were that the children did not want it and that the mothers did not produce milk. The most common reason for terminating breast-feeding before

Table 5. Endorsement of obstacles to having children wear shoes by frequency of barefootedness*†

	Barefoot frequency							
	Almost always		Sometimes or usually		Almost never		Total	
Obstacle	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Child takes them off‡	105	98.1	343	95.3	51	72.9	499	92.9
Child does not want them‡	87	81.3	223	61.9	16	22.9	326	60.7
Not enough money to buy	46	43.0	104	28.9	14	20.0	164	30.5
Yard not that dirty¶	27	25.2	70	19.4	4	5.7	101	18.8
Caregiver forgets§	15	14.0	61	16.9	2	2.9	78	14.5
Not necessary all the time	5	4.7	29	8.1	4	5.7	38	7.1
Total no.	107	19.9	360	67.0	70	13.0	537	100.0

* "sometimes/usually" collapsed with "almost always " to facilitate 2x2 c^2 or Fisher's exact test analysis;
† does not include those whose children were not walking yet (n=45); ‡ p< 0.0005; ¶ p<0.005; § p<0.05

Table 6. Duration of breast-feeding versus knowledge of recommendation to breastfeed*†

	Knew recommendation to breastfeed for a minimum of one year				
	Yes		No		
	No.	**%**	**No.**	**%**	**Total**
Breastfed >=1 year	170	41.7	46	73.0	216
Breastfed <1 year	238	58.3	17	27.0	255
Total	408	100	63	100	471

* Does not include children aged less than one year (105) and 6 with missing data for the age of stopping breast-feeding; † p<0.0001

Table 7. Reasons for stopping breast-feeding before one year of age*

Reason	**No.**	**%**
Children no longer wanted to breastfeed	94	38.4
Breast-milk dried up	54	22.0
Mothers became pregnant	26	10.6
Mothers were ill or too thin	22	9.0
Mothers were working outside the home	13	5.3
Mothers felt they did not produce enough milk	10	4.1
Miscellaneous	26	10.6

* n=245; does not include those still breastfeeding (119), those who never breastfed (32), those breastfeeding for 12 months or longer (175), and those missing this data point (11)

one year was that the children did not want breast-milk (Table 7).

DISCUSSION

This study identified substantial deficits in the engagement in diarrhoea-prevention practices by the caregivers of young children, and hence there is support for the first assumption of health educators, that is, that the high rates of diarrhoea seen in this population may be related to deficits in prevention practices. However, despite these deficits, there was a high level of biomedical knowledge about the reasons behind the given practices, particularly with regard to the concern over microbial contamination. This biomedical knowledge did not appear to be related to the report of engaging in the given prevention practices. This questions the second assumption, that is, that deficits in biomedical knowledge underlie poor engagement in practice. In contrast, several non-knowledge barriers did demonstrate a relationship to the reported practice.

The findings on barriers may be instructive for health-education efforts. The most frequently-endorsed barriers could be clustered into several groups: lapse in caregiving, resource limitations, erroneous beliefs, and non-compliance by children. Although some of this clustering is likely a function of the restricted range of barriers inquired about under a closed question format, the inclusion of these specific items was based on the open-ended responses obtained in an earlier study of caregivers of children treated at a local realimentation clinic (21).

"Lapse in caregiving" was reflected in the endorsement of the barriers of "descuida" or "forgetfulness." These were frequently endorsed as reasons for not washing the hands of children. They may be a function of a lack of conviction about the effectiveness of hand-washing in preventing disease or they may be a manifestation of neglectful childcare. The former interpretation may suggest a potential focus point for health education. The latter interpretation, that is, neglectful childcare, does not suggest any simple or obvious approach for health education.

Resource limitation was reflected in the endorsements of lack of money to buy shoes for the

children or the lack of time to wash the hands of children before each meal. There may be a role here for health-education efforts as far as the promotion of efficient use of limited finances and improving time-management skills. However, it would be important to identify whether there are deficits in these skills first. Alternatively, these barriers may not primarily be relative but more absolute, suggesting that there is a need to look at more systemic problems that lead to limited resources. Whether this is an appropriate role of a health educator may be debatable; however, if such efforts ultimately lead to improved health practices, this might strengthen the argument justifying such a role.

Some erroneous beliefs identified in this study may be a function of deficits of biomedical knowledge. For example, the most frequent reason given for terminating the boiling of drinking water was that the children might get sick if they returned to drinking purified water after drinking non-purified water. This may represent a failure to understand a dose-response relationship, and represent an "all-or-nothing" belief versus attempting to minimize adverse exposure. Preliminary discussions of a dose-response illustration have been well received in focus-group discussions with the caregivers and health promoters in the study district.

Finally, the caregivers endorsed child-based barriers for some practices, such as the children taking their own shoes off, the children no longer being interested in breast-milk, and the children not wanting to wash their hands. This may suggest that health educators should consider work on parental management of non-compliance by children. Though again, there is a need to assess whether there are, in fact, skill deficits in this area.

Although the barriers described above did demonstrate a relationship with practices, knowledge measures did not. The lack of the latter's relationship has been found for other prevention behaviours, e.g. condom use (22). Perhaps what is more striking than this lack of relationship is the persistence in the dependence on a biomedical knowledge-deficit model approach in health education. This may be particularly true for poor communities of developing countries where there may be a presumption that the relatively low mean levels of formal education are equivalent to ignorance of preventive health practices. However, this presumption would seem unjustified for our sample.

There are, however, some limitations of this study. One important limitation is the dependence on the reported behaviours of caregivers without corresponding observational measures to validate these reports. However, the barefootedness observation was related to the corresponding reported behaviour. In addition, we were impressed by the number of caregivers who reported deficient practices despite the potential for a social desirability bias, particularly given the high levels of biomedical knowledge. A second limitation to the estimate of practices is that we did not collect more detailed information on the quality of the caregivers' practices, e.g. duration of boiling of water, use of soap in hand-washing, etc. In support of this concern is a finding from a subsequent study we have done in this district in which only a minority of the caregivers, using purified drinking water, indicated that the children received this exclusively (23). Hence, the extent of strict adherence to effective prevention practices is probably even lower than the values we are reporting here.

An additional limitation is the crude measures we used for assessing knowledge. These may have been responsible for the lack of variance within the sample, and may obscure possible significant relationships between knowledge and practices. However, health-education messages are often basic and simple, and do not attempt to present complex concepts. Hence, measurements of more refined knowledge may not have been useful for the purpose of this study or its implications.

A further limitation is the exclusive reliance on a survey instrument. A multi-method approach, particularly with the complementary use of qualitative methods, would have allowed for some validation of the findings as well as provided a richer understanding of adherence to the prevention practices and the nature of the barriers. However, the survey instrument was informed by input from the local health promoters, the author's extended community and clinic experience in the area, and a previous interview study that relied heavily on open-ended questions. In addition, we included a number of open-ended questions in this interview to capture variables that were not covered in the closed-ended questions of this survey. Although open-ended questions do not substitute for good qualitative investigations, they do address some of the limitations on a completely closed-ended structured questionnaire. However, further investigations, using multi-method approaches, would still be valuable in confirming these results and in developing culturally valid interventions.

We cannot say that basic knowledge about prevention of diarrhoea was not essential for those engaged in prevention practices given the high levels of knowledge in this sample. However, this basic level of knowledge is not sufficient to engage a large percentage of caregivers

in prevention behaviours. In the case of these communities, provision of basic health-education messages would be unlikely to make a significant impact on the present practice deficits. There appears to be a need to move beyond a simplistic biomedical knowledge-deficit model. One approach may be to consider the barriers identified in this study in more depth.

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