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Home-based hand hygiene practices of mothers in relation to infections in their infants

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Abstract*: Background:* Infections are the leading causes of death in children. Most of these infections are transmitted through the hands of mothers, carers and health workers.
Objective: To determine the pattern of home-based hand hygiene practices among mothers of young infants attending a tertiary facility clinic in relation to infections in their infants.
Methods: A cross-sectional study of mothers of infants attending an immunization clinic was conducted using a self-designed, pretested questionnaire.
Results: The mean age of the 203 mothers was 30.3 ±3.8 years. The majority of the mothers received counselling about hand washing as part of antenatal care (79.8%), had access to water at home (94.0%) and always washed hands with water and soap (48.3%). Although 149 (73.4%) knew hand sanitizers, only 28 (13.8%) used it. Close to half of their infants (46.3%) had various infections (diarrhoea, acute respiratory infections, and boils) within a month of the interview. Only counselling was associated with good quality hand washing practices ($p<0.0001$) while the age of child less than 6 months and good quality of hand washing were associated with the absence of infections in the infants ($p = 0.029$ and $p<0.0001$ respectively).
Conclusion: Half of the cohort of mothers practiced good quality hand washing but with poor use of hand sanitizers. With various infections recorded in close to half of their infants, it is important to emphasise better hand washing techniques and improve access to alcohol-based hand sanitizers.

Key words: Alcohol-based Hand sanitizers, Hand hygiene, Hand washing, Infants, Infections, Sagamu.

Introduction

Infections are major causes of infant mortality in the developing parts of the world. Globally, infections contribute to approximately 25% of the 2.8 million neonatal deaths annually; of those deaths, over 95% of sepsis-related neonatal deaths occur in low- and middle-income countries.[1] Important environmental sources of infections for the infant include the hands of the individuals who care for the many needs of the infant, particularly the mothers, other close caregivers and healthcare workers (HCWs).[2, 3] The infections related to hand cleanliness include infections of the gastrointestinal tract, respiratory tract and the skin.[4] Community-based and health facility-based studies have suggested that hand washing may play preventive roles in infant infections in low-, middle-, and high-income countries.[2,5,6] Indeed, this is based on the prospects of hand hygiene to stop the spread of microbes using either soap and water or use of alcohol-based hand-rubs or sanitizers.[4]

Hand hygiene is an inexpensive and cost-effective way of preventing infections, making it a practicable intervention in low- and middle-income settings.[7] Therefore, hand hygiene practices may hold strong prospects for reducing the occurrence of infections and for reducing infection-related infant deaths. A study had reported that houses with soap had less diarrhoea days/100 child-days but with less effect on acute respiratory infections.[8] Infections among infants may lead to life-threatening multi-systemic morbidities, prolonged hospital stay, huge economic burden,[9] and possibly death.

The hands of mothers and other caregivers harbour significant microbial pathogens acquired during contact with patients or environmental surfaces.[10] Contact of caregivers' hands with respiratory secretions, diaper change, and direct skin contacts are often associated with the transmission of infections to the newborn. [11] Therefore, a step in the drive to reduce the contribution of infections to infant death is to improve the chances of hand contamination while caring for the infants. Hand hygiene, in the form of washing with soaps (non-medicated and medicated) and water, detergents and

alcohol hand rubs, is widely recommended, against a wide spectrum of microbes.[12]It remains to be ascertained how well mothers and caregivers of infants practice hand hygiene at home. This may provide the required information which may be used in improving hand hygiene practices among mothers and caregivers, thus reducing the incidence of infections among infants. Although, many studies are available on the pattern of hand hygiene at workplaces, [13] and in the hospital settings,[14, 15] there is a dearth of local studies on home-based practices, particularly considering its relationship with infections in children.

The objective of this study was to determine the pattern of home-based hand hygiene practices among mothers of young infants attending a tertiary facility clinic in relation to infections in their infants.

Methodology

This was a descriptive, cross-sectional survey conducted at the Child Survival Clinic of the Olabisi Onabanjo University Teaching Hospital, Sagamu. This clinic provides child survival strategy-related services such as oral rehydration therapy, immunization, growth monitoring, food demonstration, and treatment of common ailments in children. The Immunization Clinic runs on Tuesdays under the supervision of senior physicians and senior public health nursing officers.

The participants in this study were mothers of children aged between 0 and 12 months attending the clinic for immunization. Excluded from the study were mothers who were health workers, mothers with cognitive defects and babies who were acutely ill and required immediate medical care.

Purposive sampling method was used to get the sample size of 200 which was derived using the Cochran formula. Using a self-designed mixture of the open-ended and close-ended pre-tested questionnaire, the data recorded for each participant included age, sex of infant and maternal age, parity, education and occupation, religion and place of delivery. The socio-economic classification was determined from the highest educational qualification and present occupation of each parent using the scoring model recommended by Ogunlesi*et al.*[16] The socioeconomic classes were graded from I (highest) to V (least). Classes I and II were re-classified as the upper class, III as middle class and classes IV and V as lower class. Other data included hand hygiene methods at home, types of hand hygiene agents, perception of barriers to hand hygiene and type of infections in the infants in the preceding one month. The self-reported frequencies of hand washing following specific moments were also scored as excellent (5), frequently (4), occasionally (3), rarely (2) and never (1). The scores for each moment of domestic activity (before cooking, after cooking, before breastfeeding, before handling the baby, after cleaning the baby and after using the toilet) were summed and converted to percentages. For each moment, a percentage score of at least 80% defined good hand washing practice while a score of 79% or less defined poor hand washing practices.

Ethical Considerations

Ethical clearance was obtained from the Health Research and Ethics Committee of the Olabisi Onabanjo University Teaching Hospital, Sagamu. Informed consent was also obtained from each participant.

Data Management

This was done with SPSS version 21.0 statistical software. The data were analysed using simple descriptive and inferential statistics. Health facilities were classified as specialists (teaching hospitals and federal medical centres), non-specialist (general hospitals, primary health centres, private clinics) and non-orthodox (churches, traditional birth homes). Continuous and categorical variables were summarised as means (with standard deviation) and proportions respectively. Comparisons of mean values were done using the Student's t -test while proportions were compared using the Chi-Square test with Yate's correction as necessary. Statistical significance was defined as *P* values less than 0.05.

Results

General description of sociodemographics

A total of 203 mothers, aged 22 to 40 years were studied. The mean maternal age was 30.3 ±3.86 years. Eighty-eight (43.3%) and 115 (56.7%) were aged less than 30 years and 30 years or more respectively. The children were aged 7 days to 12 months with the mean age of 3.0±2.6 months. They comprised 93 (45.8%) males and 110 (54.2%) females.

The number of children in the families ranged between 1 and 8; 140 (69.0%) mothers had less than 3 children while 63 (31.0%) mothers had 3 or more children. Fifty-nine (29.1%) and 144 (70.9%) mothers had secondary and tertiary education respectively. Distribution of the respondents according to socioeconomic classification showed that 3 (1.5%), 38 (18.7%), 106 (52.2%), 54 (26.6%) and 2 (1.0%) belonged to classes I, II, III, IV, and V respectively. These were further sub-classified as upper (41; 20.2%), middle (106; 52.2%) and lower classes (56; 27.6%) respectively. Most of the respondents (168; 82.8%) were Christians while 35 (17.2%) were Moslems.

Antenatal care was mostly received in non-specialist facilities (131; 64.5%) while 72 (35.5%) attended specialist centres. The places of birth included specialist facilities (139; 68.5%), non-specialist facilities (58; 28.5%) and non-orthodox facilities (6; 3.0%).

Hand washing practices

One hundred and sixty-two (79.8%) mothers received counselling on hand washing during antenatal clinic

sessions. Most of the mothers (116; 57.1%) had assisting carers but only 60 (51.7%) taught the assisting carers about hand washing practices. The mothers identified diarrhoea (166; 81.8%), acute respiratory infections (95; 46.8%), skin rash (88; 43.3%), boils (34; 16.7%), eye discharges (18; 8.9%) and ear discharges (15; 7.4%) as infections which children may have as a result of mothers' poor hand washing practices.

The major sources of water at home included boreholes (153; 75.4%), deep wells (23; 11.3%) and public tap (15; 7.4%). The major hand washing facilities included sink basins (121; 59.6%), buckets (58; 28.6%) and the bathroom (24; 11.8%). The major hand washing methods included the use of water and soap always (98; 48.3%), occasional use of water and soap (68; 33.5%) and use of water only (37; 18.2%). The use of water and soap always was regarded as a good hand washing method (98; 48.3%) while the others were regarded as poor hand washing methods (105; 51.7%).These 105 comprised 68 (33.5%) who used water and soap occasionally and 37 (18.2%) who used water only always. Using self-reporting, 165 (81.3%) rated their hand washing practices as satisfactory while house chores (21; 10.3%), lack of water (12; 5.9%) and lack of time (8; 4.0%) were identified as barriers to good hand washing practices at home.

Table 1: Reasons for not using hand sanitizer at home

Reasons	Frequency	Percentage
Do not know what hand sanitizer is	51	25.1
Do not know where to get hand sanitizer	40	19.7
Do not know hand sanitizer is useful	36	17.7
Hand sanitizer may damage the baby's skin	32	15.5
Hand sanitizer is expensive	26	12.8
The use of hand sanitizer wastes time	18	8.9

One hundred and forty-nine (73.4%) mothers knew hand sanitizers but only 28 (13.8%) used hand sanitizers routinely. Difficulty in sourcing hand sanitizers (19.7%), lack of awareness of its usefulness (17.7%) and the fear of possible damage to the baby's skin (15.5%) were the major reasons why mothers did not use hand sanitizers routinely as shown in Table 1.

Table 2 shows that the highest proportions of mothers always washed their hands after visiting the toilet (95.1%) and in relation to cooking (67.5%).Lower proportions of the mothers washed their hands each time they breastfed (53.7%) babies or cleaned up their babies (31.0%).Overall, 166 (81.8%) mothers had good hand washing practices scores while the remaining 37 (18.2%) had poor hand washing practices scores.
Ninety-four (46.3%) of the mothers volunteered that their infants had various infections within the preceding month. These infections included acute respiratory infections (58; 28.6%), diarrhoea (30; 14.8%), boils and skin rash (20; 9.9%) each, eye discharges (12; 5.9%) and ear discharges (6; 3.0%).

Bivariate analyses

Table 3 shows that higher proportions of mothers with good quality of hand washing were aged 30 years or older, were Christians, had additional carers, had less than 3 children at home, had tertiary education and belonged to the middle socioeconomic class but without statistical significance. A significantly higher proportion of mothers who received counselling on hand washing during antenatal clinic sessions had a good quality of hand washing practices ($p<0.0001$).

Table 2: Pattern of the moments and frequencies of hand washing at home

Moments	Always	Frequently	Occasionally	Rarely	Never
Before cooking	137 (67.5)	32 (15.8)	27 (13.3)	3 (1.5)	4 (2.0)
After cooking	132 (65.0)	47 (23.2)	5 (2.5)	11 (5.4)	8 (3.9)
Before breastfeeding baby	109 (53.7)	44 (21.7)	39 (19.2)	3 (1.5)	8 (3.9)
Before handling the baby	63 (31.0)	60 (29.6)	47 (23.2)	20 (9.9)	13 (6.4)
After cleaning up the baby	114 (56.2)	55 (27.1)	14 (6.9)	18 (7.4)	5 (2.5)
After visiting the toilet	193 (95.1)	10 (4.9)	0 (0.0)	0 (0.0)	0 (0.0)

Table 3: Factors associated with the quality of hand washing practices at home

Characteristics	Good quality (n = 98)	Poor quality (n = 105)	Statistics
Maternal age (years)			
<30	40 (64.3)	68 (64.8)	$\chi2 = 0.495$; p = 0.482
>30	35 (35.7)	37 (35.2)	
Number of children			
<2	71 (72.4)	69 (65.7)	$\chi2 = 1.074$; p = 0.300
>2	27 (27.6)	36 (34.3)	
Maternal education			
Secondary	32 (32.7)	27 (25.7)	$\chi2 = 1.184$; p = 0.277
Tertiary	66 (67.3)	78 (74.3)	
*SEC**			
Upper	17 (17.3)	24 (22.9)	$\chi2 = 2.704$; p = 0.259
Middle	49 (50.0)	57 (54.3)	
Lower	32 (32.7)	24 (22.8)	
Religion			
Christianity	83 (84.7)	85 (80.9)	$\chi2 = 0.497$; p = 0.481
Islam	15 (15.3)	20 (19.1)	
Antenatal care			
Specialist	63 (64.3)	68 (64.8)	$\chi2 = 0.005$; p = 0.944
Non-specialist	35 (35.7)	37 (35.2)	
*Counselling***			
Received	91 (92.8)	71 (67.6)	$\chi2 = 20.032$; p<0.0001
Not received	7 (7.2)	34 (32.4)	
*Carer****			
Mother only	47 (47.9)	40 (38.1)	$\chi2 = 2.014$; p = 0.156
Mother with a helper	51 (52.1)	65 (61.9)	

*Socioeconomic Classes; ****Counselling on hand washing during antenatal care; ***Assisting carer

In Table 4, the use of hand sanitizers at home was statistically significantly associated with the number of children less than three (p = 0.028), maternal tertiary education (p = 0.013) and upper socioeconomic status (p<0.0001). Maternal age, use of an additional carer, religion, place of antenatal care and counselling on hand washing were not significantly associated with the use of hand sanitizers at home.

Only infant age less than 6 months (p = 0.029) and good quality of hand washing practices (p = 0.008) were significantly associated with the absence of infections in the infants in the preceding one month as shown in Table V. Infant's sex, maternal age, number of children at home, maternal education, family's socioeconomic status and the use of hand sanitizers were not associated with the presence or absence of infections in the infants.

Table 4: Factors associated with the use of hand sanitizer at home

Characteristics	Use (n = 28)	Non-use (n = 175)	Statistics
Maternal age (years)			
<30	12 (42.9)	76 (43.4)	$\chi2 = 0.03314$; p = 0.955
>30	16 (57.1)	99 (56.6)	
Number of children			
<2	24 (85.7)	116 (66.3)	$\chi2 = 4.808$; p = 0.028*
>2	4 (14.3)	59 (33.7)	
Maternal education			
Secondary	3 (10.7)	56 (32.0)	$\chi2 = 6.234$; p = 0.013*
Tertiary	25 (89.3)	119 (68.0)	
SEC#			
Upper	14 (50.0)	27 (15.4)	$\chi2 = 18.114$; p<0.0001*
Middle	12 (42.9)	94 (53.7)	
Lower	2 (7.1)	54 (30.9)	
Religion			
Christianity	23 (82.1)	145 (82.9)	$\chi2 = 0.009$; p = 0.926
Islam	5 (17.9)	30 (17.1)	
Antenatal care			
Specialist	21 (75.0)	110 (62.9)	$\chi2 = 1.555$; p = 0.212
Non-specialist	7 (25.0)	65 (37.1)	
*Counselling***			
Received	24 (85.7)	138 (78.9)	$\chi2 = 0.756$; p = 0.385
Not received	4 (14.3)	37 (21.1)	
*Carer****			
Mother only	14 (50.0)	73 (41.7)	$\chi2 = 0.677$; p = 0.411
Mother with a helper	14 (50.0)	102 (58.3)	

*Yate's correction applied; **Counselling on hand washing during antenatal care; ***Assisting carer

Table 5: Factors associated with infections in the preceding month in the infants

Characteristics	Infections absent (n = 109)	Infections present (n = 94)	Statistics
Infants' age (months)			
<6	97 (89.0)	73 (77.7)	$\chi^2 = 4.760$; p = 0.029
≥6	12 (11.0)	21 (22.3)	
Infants' sex			
Male	59 (54.1)	51 (54.2)	$\chi^2 = 0.001$; p = 0.986
Female	50 (45.9)	43 (45.7)	
Maternal age (years)			
<30	49 (45.0)	39 (41.5)	$\chi^2 = 0.248$; p = 0.619
≥30	60 (55.0)	55 (58.5)	
Number of children			
≤2	75 (68.8)	65 (69.1)	$\chi^2 = 0.003$; p = 0.958
>2	34 (31.2)	29 (30.9)	
Maternal education			
Secondary	36 (33.0)	23 (24.5)	$\chi^2 = 1.794$; p = 0.181
Tertiary	73 (67.0)	71 (76.5)	
*SEC**			
Upper	24 (22.0)	17 (18.1)	$\chi^2 = 0.526$; p = 0.769
Middle	55 (50.5)	51 (54.3)	
Lower	30 (27.5)	26 (27.6)	
Quality of hand washing			
Good	62 (56.9)	36 (38.3)	$\chi^2 = 6.980$; p = 0.008
Poor	47 (43.1)	58 (61.7)	
Hand sanitizer use			
Yes	17 (15.6)	11 (11.7)	$\chi^2 = 0.644$; p = 0.422
No	92 (84.4)	83 (88.3)	
*Practice score***			
High	90 (82.6)	76 (80.9)	$\chi^2 = 0.100$; p = 0.752
Low	19 (17.4)	18 (19.1)	

*Socioeconomic classes; **High – 80% and above, Low -79% or less

Discussion

The mean age of the respondents in this study (30.3 years) is similar to 27.9 years previously reported from a similar study at Uyo, Akwa-Ibom State, southern Nigeria.[17] However, 97.1% of the mothers in the present study delivered their infants at orthodox health facilities (specialist and non-specialist) similar to 72.6% of the Uyo group.[17]This comparison shows similar background characteristics of the two comparative studies. Close to half (48.3%) of the respondents in the present study always washed their hands with soap and water while a third washed their hands with water and soap occasionally. The proportion that always washed hands with soap and water was regarded as the population with good quality of hand washing practices. This is remarkably high compared to 27.9% reported in Uyo, Nigeria.[17] However, the definition of good hand washing per study varies and this may limit interpretation and generalisation of the recorded data. Nevertheless, the use of soap and clean water at every hand washing moment typifies good hand washing practices. This applies irrespective of the standard of living of the family. Other studies also related good hand washing practices to the availability of soap and a fixed washing point in the house. [18]In the present study, attention was also paid to the source of water and the facility available for hand washing. Ninety -four percent of the respondents had access to water but three-quarters used water drawn from household or neighbourhood water boreholes unlike 52.5%, [17] in the Uyo report. The widespread use of water boreholes may be one of the factors facilitating hand washing practices in the present study since it is less laborious to access water from borehole compared to deep wells and water from the former is remarkably safer, in terms of cleanliness than the latter.

More than half of the respondents in the present study washed hands at the sinks (washbasins) and close to third used buckets which need to be emptied following use. This may also contribute to the high level of hand washing practices as previously observed in Vietnam.[18]Interestingly, none of the socio-demographic parameters tested showed statistically significant association with good hand washing practice although it appeared the higher the mother's age, the lesser the number of children, the lesser the level of maternal education, the poorer the quality of hand washing practices, though without statistical significance. Nevertheless, prior counselling on hand washing during antenatal care was remarkably associated with good quality hand washing practices. This finding reinforces the benefits of providing health education on important health issues when expectant mothers attend antenatal clinics. The point of birth may not be the best to counsel on hand washing because of the anxiety and discomfort occurring in the labour room.

Only 67.5% and 53.7% of the respondents always washed their hands before cooking and before breastfeeding their infants compared to 61.2% and 25.6% reported in Uyo. [17]The major difference in this comparison has to do with hand washing before breastfeeding. Although this is essential in the prevention of faeco-oral transmission of infections, it is largely taken for granted given the high frequency at which infants seek breastfeeding. Worse still, only 56.2% of the mothers in the present study always washed their hands after cleaning up their infants compared to 51.6% in Uyo. These rates are considered low because cleaning up infants is supposed to be a compulsory basic personal hygiene measure to avoid the soiling of clothing and prevent faeco-oral transmission of microbes. Unfortunately, it appears mothers traditionally but erroneously regard the stools of infants as less likely to be contaminated hence less of a danger, in terms of causing infections. This becomes more obvious when 84.1% of the Uyo group and 95.1% of the Sagamu group would always wash their own hands after using the toilet, probably considering their stools more dangerous. This traditional belief needs to be changed using efficient health education interventions. Mothers need to know that every faecal matter is heavily contaminated hence the need for good hand washing practices after handling faeces irrespective of age.

Although the Uyo study[17] did not assess the use of hand sanitizers, close to three-quarters of the Sagamu cohort knew hand sanitizers only 13.8% actually used it. While a quarter did not even know what hand sanitizers are, 19.7% did not know where to get it, 17.7% did not know it is useful while 15.5% erroneously believed it could damage the infant skin. Efforts should be made to initiate mothers to routine use of hand sanitizers right from every contact they make with the health facility. Just as this method has helped with the use of insecticide-treated bed nets, [19]free provisions of hand sanitizers at antenatal clinics along with health education on its usefulness, may encourage mothers to use it at home, especially, in situations where frequent hand washing with soap and water may be difficult.

Further analysis in the present study showed hand sanitizer use was significantly associated with the fewer number of children, tertiary maternal education and upper socioeconomic status while counselling on hand washing during antenatal remarkably lacked any association with hand sanitizer use. This may imply that health education offered during antenatal clinics may be devoid of information on other methods of hand hygiene aside from hand washing. Therefore, the use of alcohol-based hand rubs may need to be incorporated into the existing modules of health education during antenatal clinics at all levels.

Although the present study was not designed to establish a causal relationship between mothers' hand washing practices and frequency of infections in their infants, it is important to note that the mothers identified diarrhoea, acute respiratory infections, skin rash and boils as common illnesses which poor hand washing may cause in their infants. This could serve as a proxy for their knowledge of the causal relationship between hand cleanliness and infections. Indeed, close to half of the

respondents volunteered that their infants had had various infections within the month preceding the study. Infants age less than 6 months and good quality of hand washing practices were strongly associated with the absence of infections. While the former point is probably based on the protective role of maternally-acquired antibodies, the latter point raises the prospects of good hand washing practices in the prevention of infections as previously reported in various studies.[20,21]The lack of a definite role for hand sanitizers in the present study may be related to the low proportion of the mothers who used hand sanitizers in the first place.

The cross-sectional design of this study limits the causal relationships which may be derived from these data. The respondents were not required to demonstrate hand washing hence, it is difficult to be certain that they were doing it right at home. A larger study to link the frequency and scope of infections among infants in relation to the hand hygiene practices of their mothers is desired. It will be interesting to know if the use of hand sanitizers upon hand washing with soap and water confers any advantage, in the prevention of childhood infections.

Conclusion

In a population where access to water is not significantly restricted, half of a cohort of mothers practiced good quality hand washing but with poor use of hand sanitizers. With various infections recorded in close to half of their infants, it is important to emphasise better hand washing techniques and improve access to alcohol-based hand sanitizers. Health education on hand hygiene practices should be strengthened using the platform of antenatal and immunization clinics.

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Authors' Contributions
OOB and OTA conceived and designed the study. OOO participated in data collection and analysis. All the authors interpreted the data, drafted the manuscript and approved the final version of the manuscript.
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