

Appendix 3: DIARRHOEA

Acute diarrhoeal diseases (DD) are among the top causes of mortality in early childhood in the world. DD is also a major co-factor in under-nutrition and stunting in under-5s in many parts of the world.

In South Africa, DD is a leading cause of childhood mortality, being responsible for 10% of all causes of death in 2000. HIV infection is responsible for 40% of deaths of children under 5 years of age in SA and DD is the direct cause of death in many of these children. The place of DD in deaths among children in Cape Town shows a similar pattern. The highest numbers of DD death occur among the poorest communities; it is only in these areas that DD appears in the top 10 causes of death in the whole population. Data from the Boland region shows DD to be among the top 10 overall causes of death in all areas.

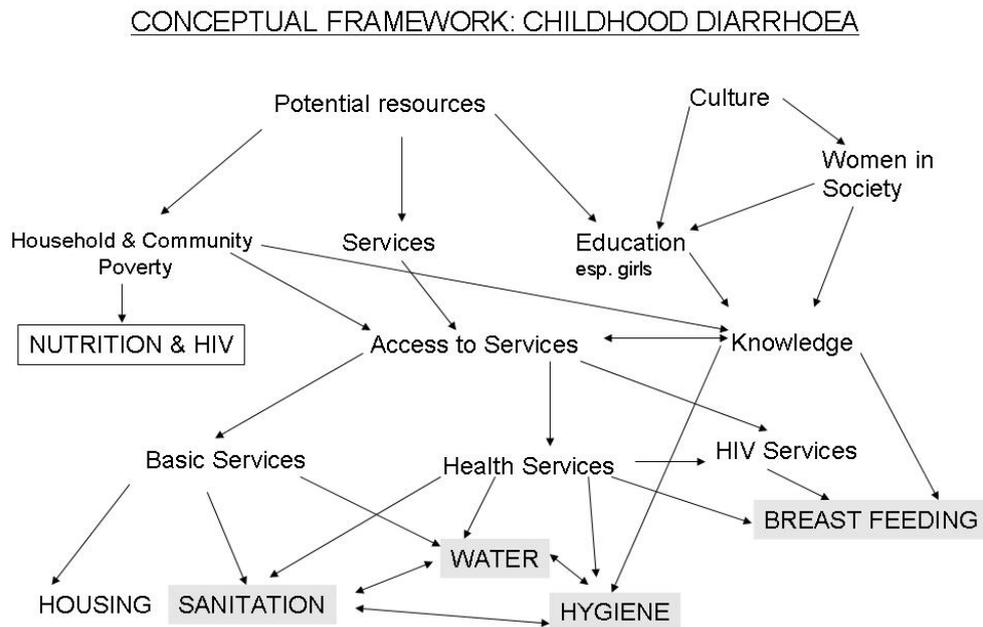
IDENTIFYING INTERVENTIONS TO PREVENT MORTALITY AND MORBIDITY FROM DIARRHOEA

This analysis of interventions that have been shown to have an impact on the burden of childhood disease caused by DD has been based on the conceptual framework in Figure 1. This framework posits 5 levels of determinants of DD, illustrated in the 5 layers in the figure.

Attention will be paid to interventions that mediate their effect on DD through their ability to mitigate the main proximal arbiters of DD incidence and severity shown in grey in the figure i.e. Breast Feeding, Sanitation, Water use and supply, and Hygiene. Nutrition and HIV are shown in the figure as they are very important in the risk profile for childhood diarrhoea. Important arbiters of diarrhoea within these two causes such as weaning foods and risk of HIV infection in childhood will be covered in other papers compiled by the Childhood Diseases group.

Importantly, DD can have significant effects beyond the immediate episode. Nutrition is put at risk by frequent, recurrent episodes of DD; long term cognitive effects of this association have been demonstrated.

Figure 1.



BREAST FEEDING

Experience throughout the world shows that breast-feeding and care-giving practices are important immediate determinants of diarrhoea, while the quality of health services and the overall socioeconomic status are important underlying determinants.

An ecological study by De Souza and others in State of Ceará, north-east Brazil examined the variations in diarrhoea-specific infant mortality rates among municipalities using data from a community health workers' programme. Diarrhoea is the main cause of postneonatal deaths in Ceará, and diarrhoea mortality rates vary substantially among municipalities, from 7 to 50 per thousand live births.

The study found that the significant determinants of variability in diarrhoea-specific infant mortality between municipalities were

- prevalence of infants exclusively breast-feeding,
- percentage of infants with adequate weight gain,
- percentage of pregnant women with prenatal care up-to-date,
- female illiteracy rate and
- inadequate water supply.

These findings point to important determinants of deaths from DD and suggest that community-based promotion of exclusive breast-feeding in the first 4 months and

care-giving behaviours that prevent weight faltering, including weaning practices and feeding during and following diarrhoea episodes, may further reduce municipality-level diarrhoea-specific mortality.

The study also suggests that primary health care strategies addressing these two immediate (proximate) determinants provide only a partial solution to reducing diarrhoeal disease mortality. Improvements in municipal health services (prenatal care) and socioeconomic status variables, including water supply and maternal education, can also contribute to reduction of infant mortality due to diarrhoea (De Souza, Petersen et al, 2001).

Exclusive breast feeding decreases DD mortality seven fold. It is associated with a 40% reduction in DD in infancy (Kramer MS, Chalmers B et al. 2001), with even greater protection against hospitalisation or persistent diarrhoea. There is evidence of a dose-response relationship with 6 months of exclusive best feeding giving the best protection. The mechanisms by which breast feeding protects against DD are multiple and include the contents of breast milk, the better nutritional status of the child, the low cost and the promotion of the mother-child relationship. (Huttly SR, Morris SS, Pisani V . 1997)

There are no general figures that characterise breast feeding rates in the Western Cape beyond the fact that most women initiate breast feeding in hospital and rates rapidly diminish after that. Exclusive breast feeding is rare in SA: the 2003 Demographic and Health Survey showed a rate of fewer than 12% for infants below 4 months of age. From 4 to 6 months the rate was 1,5%. Most women with HIV infection choose formula feeding when counselled antenatally.

Determinants of breast feeding

The factors that promote or prevent exclusive breast feeding operate at many levels (Figure 1). In terms of interventions that can promote greater rates of breast feeding, many fall largely within the health sector but others operate from the community level to that of international agreements and treaties.

There is good evidence that interventions such as the Baby Friendly Hospital Initiative and breast feeding support for mothers, neither of which have been vigorously implemented in the Western Cape province, are effective in promoting breast feeding rates in general and exclusive breast feeding rates in particular. The latter has been specifically shown to reduce the risk of HIV infection. Given the scope of the Burden of Disease process, interventions through legislation will only be considered if they hold potential for provincial legislation.

The determinants of breast feeding are listed here for completeness as interventions aimed at other factors that promote child survival or well being may have promotion of breast feeding as by-product, but may have been missed in this search. These determinants give a guide to where interventions may have been tried. They are shown in Table 1 (from Yngve A, Sjostrom M. 2001).

Table 2 Determinants for breastfeeding (bf)

Concept	Positive impact	Negative impact
Demographic attributes	High education and age of mother, small family	Low education, young age, single mother, urban, first child, employment
Psychosocial attributes	Supportive family and peers, cultural acceptance, previous successful bf experience, having seen mothers bf	Low maternal confidence, shyness, mother not breastfed herself
Health care attributes and biomedical constraints	Early initiations, prenatal class, participation, skills training, apprenticeship, low birth weight baby, maternal belief regarding bf and health of the baby	Premature birth, difficult labour, use of analgesics, sore nipples, maternity ward use of teats and bottle feeding, distribution of free samples of breast milk substitutes, smoking, baby of male gender
Community attributes	Consensus statements, media advocacy, workplace support, existence and acceptance of peer support groups, high level of community awareness and knowledge regarding bf prevalence and process	Bf considered as indecent exposure, mis-beliefs, low level of community support, low media advocacy
Public policy	Official recommendations, surveillance systems, maternity, benefits including prolonged paid maternity leave, baby-friendly hospitals initiative, inclusion of bf into school curriculum and in health care staff training, code of marketing of breast milk substitutes	Short maternity leave, low priority of bf as a health concern, no supportive structure for bf issues

These determinants can be considered in the following non-health service domains from distal to proximal:

- Formula marketing vs Breast feeding promotion at International level
- Maternity/Paternity Leave Laws and other Labour legislation
- Normalising breast feeding / social attitudes
- Education of girls
- Life-orientation education for all children
- Local formula marketing
- Maternal employment, workplace practices, informal employment, law enforcement

Interventions to promote breast feeding¹

An extensive 185 page systematic review of the effectiveness of interventions to promote *initiation of breast feeding* was published in Health Technology Assessment in 2000 (Fairbank L, O'Meara S et al. 2000).

Most of the interventions described occurred within the health sector (antenatal health education, institutional changes, health professional training, social support from health professionals, peer support and combinations of these). The exceptions cited were ten studies (two RCTs) of the US Department of Agriculture's Special Supplemental Nutrition Program for Women, Infants and Children (WIC). The equivalent interventions in SA would be carried out within the Department of Health using the Integrated Nutrition and Food Security Programme. None of the studies

¹ Search Strategy

Local review articles were collated and references obtained. Pubmed and Google were searched on line using combinations of the following keywords: diarrhoea, breast feeding, promotion, intervention study, community mobilisation, programme, community intervention, health policy, maternity leave, rates. The Cochrane database was searched for article on interventions to promote breast feeding. Review articles and those that studied determinants of breast feeding choices and rates were searched for references that described interventions.

explored the effect on outcomes such as protection against diarrhoea. Two studies of media campaigns were less than ideal methodologically and occurred in industrialised countries. The better conducted of the two studies did not show a benefit in the intervention group from a TV campaign.

Multifaceted campaigns that combined health service, support and media interventions are also described in this paper. One randomised study in Mexico compared a number of individual interventions at different sites with a site at which there was no intervention. Breast feeding rates at 1, 5 and 6 months improved though statistical significance was not achieved.

Perhaps the most valuable multi-faceted intervention study in terms of the Western Cape comes from Brazil (Rea MF, Berquo ES. 1990).

Here a sustained campaign (over 6 years) in two metropolitan areas included:

- Radio and television, press and promotional material
- Training of health professionals
- Orientation of non-professional health workers
- BFHI
- Inclusion of breast feeding in primary school and teacher training curricula
- Developing a Marketing Code on Breast Feeding substitutes in accordance with the WHO Code
- Implementing legislation for working mothers
- Peer support groups
- Disseminating breast feeding information to relevant authorities
- Informing mothers about breast feeding

Achievements included:

- The average duration of breastfeeding increased from 89 to 127 days in Sao Paulo and from 66 to 104 days in Recife
- Exclusive breast feeding increased by 1.5 times in Sao Paulo and 2.2 times in Recife
- The experience has been used in the rest of the country and recent data (1999) shows that one in two Brazilian women breast fed for 10 months.

Another relevant large scale intervention was implemented in Madagascar in 1999. This programme integrated many nutritional health messages using breast feeding as the entry point. It was based on formative research that indicated which health messages were most likely to initiate change of behaviour. Existing community activities and health programmes such as IMCI were integrated into the programme that had activities spread from antenatal visits to immunisation and sick child visits over many months. Home visits, women's groups and drama formed the backbone of the programme. 'Workers' included lay, health and women's groups representatives. Media were also employed to deliver key messages. Progressive increases in exclusive breast feeding rates in children under 6 months of age compared to control populations were recorded (48% to 79% over 3 years). Initiation of breastfeeding also demonstrated major increases. A direct nearly four-fold reduction in diarrhoea incidence was noted.

A similar intervention in Haryana in India is described by Bhandari.

In South Africa, an intervention in Cato Manor in KwaZulu Natal aimed to increase exclusive breast feeding rates (Bentley J, Coutsooudis A, Kagoro H, Newell M-A. undated).

The intervention included the selection and training of 12 peer counsellors, who were responsible primarily for visiting women in their homes before and shortly after delivery to encourage, and support exclusive breastfeeding. Posters, a pamphlet, and articles for the local newspaper were developed, and widely distributed in the intervention site. Role-plays, drama, songs and competitions were specially devised. Prizes were awarded for correctly completed competitions. There was a modest increase in exclusive breast feeding rates at the intervention site 17 months later (13.6% to 21.5%). Coincident changes in policies for HIV-infected mothers undid some of the effect of the intervention. In this context, DD incidence was notably lower in the exclusively breast fed babies.

Ashworth evaluated mass media campaigns promoting breast feeding in which effect on DD was an outcome. Her analysis was that “mass media can play a useful role helping to change group norms, but only if part of a long-range promotion strategy”.

Role of Fathers: There is very little literature on interventions that improve breast feeding rates through targeting fathers. Only one small study has been performed in which 59 fathers were randomised to receive classes on breast feeding or general childcare classes antenatally. Improvements in breast feeding rates were seen where fathers had the intervention.

Maternal employment

Having to return to work in the first few months after a baby is born is a significant factor leading to attrition in exclusive breast feeding rates among women in the Western Cape. Day care itself is associated with higher rates of illness (including diarrhoea) in small children. Studies of interventions in this area were hard to find. The little research there is describes programmes in the work place or compares parental leave arrangements in different countries and their effect on child health. What little evidence there is (and it almost exclusively relates to formal employment) is summarised in the following paragraphs:

- Parental leave
 - Longer parental leave promotes breast feeding duration
 - Paternal leave is effective in supporting breast feeding
 - Paternal leave can reduce gender discrimination by employers
- Lactation support in the work place
 - Legislation at state level mandating lactation support in the work place has increased breast feeding rates in the USA
 - Peer and supervisor support in the workplace is helpful in supporting women who are breast feeding
 - Job flexibility including fewer hours on return to work is helpful
- Child care
 - Child care on the site of employment reduces the number of illnesses the infant contracts and reduces maternal absenteeism

Note PGWC as large employer in the Western Cape. Capacity to put own house in order.

Beware of discriminating against the poorer employees with policies that are more accessible to the well off.

SA has not legislated the Code on Breast Milk Substitutes. Could the W Cape do it?

Paragraph about HIV and breast feeding as confounders/confusers re promotion of BF among poor communities. Also what is the relative role of those outside the health sector when the health sector can make the biggest difference through its proven `breast feeding-promotive interventions.

WATER, SANITATION & HYGIENE²

Although discrete variables, these three factors are considered together as many research papers and interventions report aspects of each.

Water

“The human right to water entitles everyone to sufficient, safe, acceptable and physically accessible, affordable water for personal and domestic uses.” UN Committee on Social, Cultural and Economic Rights.

Water supply and use are fundamental to the prevention and amelioration of DD. It is necessary for the best sanitation and personal hygiene, two major co-factors in the causation of DD (Figure 1). Access to clean water is considered to be a fundamental human right.

Water supply includes the following aspects:

- Quantity
- Quality (at source, after collection, and storage in the household)
- Accessibility

The WHO states that the minimum daily supply a human being requires is 20 litres. Many dispute this with Glieck providing evidence that 50 litres per day (i.e. 1500 litres per person per month) is a more realistic figure if water for drinking, sanitation, hygiene and food preparation are to be covered. South Africa’s 2004 Reconstruction

² Search Strategy

Local review articles were collated and references obtained. Pubmed and Google were searched on line using combinations of the following keywords: diarrhoea, water, water supply, sanitation, hygiene, hand washing, provision, promotion, intervention study, community mobilisation, programme, community intervention, health policy, rates. The Cochrane database was searched for article on interventions on water supply, sanitation and hygiene/hand washing.

Review articles on water and sanitation provision and hygiene were searched for references that described interventions with health outcomes.

and Development Programme set 50 litres per person per day as the standard for water supply (see below for discussion of current lower standard).

Interventions

A recent meta-analysis of the effect of water supply interventions on diarrhoea incidence suggested 25% reduction in illness. This confirms the effect noted in observational studies in the 1970s and 1980s. There is evidence that the supply of ample clean water is especially effective at preventing *Shigella* infections (through better hygiene). *Shigella* requires one of the lowest inocula to cause disease and is often responsible for severe bloody diarrhoea (dysentery).

Water quantity is more important than quality. 'Sufficient' water can allow the cleanliness and sanitation that can mitigate the effect of a contaminated supply. However 'safe' water, either at the point of supply or through good household water treatment and/or storage practices, protects against DD (Cochrane).

Accessibility to water is a further aspect that promotes or inhibits the protective effect of water supply. While not a linear relationship, the closer the water source is to the home, the greater is the protection against DD. Research based on several African studies suggests that a water source within one kilometre roughly approximates a thirty-minute round trip. At distances less than that, the amount of water collected plateaus at around 15 litres per person per day. This consumption level can only be improved by introducing water supply within the household. This would have the potential to double or treble the amount of water consumed per person per day. (Loughborough). South Africa's Department of Water and Forestry (DWAF) has set a minimum standard of no dwelling being more than 200m from a standpipe.

Community-based water supply: what the community wants and what they are prepared to pay. Efficacy is dictated in part by levels of social capital in the communities. Indonesia, India, Bangladesh.

Household storage and treatment of water where quality is suspect at point of source are associated with a 39% reduction in diarrhoea incidence. Measures include the use of spigots (preventing hands or utensils being put into the water), solar heating or UV treatment, chemical treatment (e.g. with sodium hypochlorite), flocculants and filtration. A Cochrane review on the subject concluded: '*Interventions to improve water quality are generally effective in preventing diarrhoea, and interventions to improve water quality at the household level are more effective than those at the source. Significant heterogeneity among the trials suggests that the actual level of effectiveness may depend on a variety of conditions that research to date cannot fully explain. Rigorous, blinded, multi-arm randomized controlled trials conducted over a longer duration in a variety of settings may help clarify the potential effectiveness.*' (Clasen T, Roberts I, et al. 2007)

A World Bank study in 2000 suggested that the cost per DALY saved through supplying water in rural areas is US\$35. The equivalent cost of hygiene interventions is US\$20.

A comprehensive review of water supply in Durban has been undertaken. Durban led the way in South Africa in water supply to a large urban community. Apart from pioneering the six free kilolitres of water per household that is now the national norm, various types of water supply depending on household type and ability to pay were introduced. Access to water has gone up throughout Durban, but for the poorest households use has often gone down or the cost has been too much leading to disconnections. Accessibility may be reduced by tariffs that exceed ability to pay for more than 6kl per household per day. Many poor households contain more than the 8 persons this water volume is predicated upon, leading to concerns that insufficient water for safe existence is occurring in these households as families attempt to live within the 6kl limit. [Hooper MC, 2003]

A study undertaken in Johannesburg under the DWAF's WASH programme demonstrated significant differences in water use depending on whether a flat rate or consumption-based tariff was being paid. Hygiene was worse in the dwellings paying a consumption-based rate for water.

Sanitation

Sanitation interventions produce a 32% reduction in diarrhoea incidence [Fewtrell et al, 2005]. Children are at particular risk where stool is disposed of at ground level (50% increase of diarrhoea) Child mortality is decreased to the presence of latrines in poor communities. [Traore E, et al.]

Hygiene

The extra risk for diarrhoea of unhygienic practices is estimated by the WHO to be 23% [WHO 2004]. Unhygienic practices in respect of DD includes lack of handwashing in relation to defaecation and food and water handling, and inadequate disposal of children's faeces.

There is good evidence however of an effect of interventions that promote hygiene that is independent of the presence of sufficient water or safe sanitation.

In their meta-analysis of hygiene interventions [Fewtrell L, Kaufmann R, Kay D, Enanoria W, Haller L, Colford J. Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *Lancet Infect Dis* 2005;5:42-52), Fewtrell et al showed a 45% overall protective effect. Handwashing reduced risk of DD by 54% and health education by 28%. These outcomes exceed those for water or sanitation.

In a systematic review of the use of soap when washing hands in preventing diarrhoea, Curtis and Cairncross [Curtis V, Cairncross S. 2003] a 38% to 42% reduction in risk was demonstrated. Handwashing was particularly protective against severe diarrhoea (48%) and Shigellosis (59%).

A cost-effectiveness study in Burkino Faso [Borghi J, et al, 2002] estimated that hand washing promotion (including the formative research that underpinned it) was likely to be very good value for not a lot of money. The programme targeted mothers, maids and primary school children using community workers, plays, media messages and

the school curriculum. While little change took place in faeces disposal, hand-washing with soap after cleaning a child's bottom rose from 13% to 31%. The proportion of mothers who washed their hands with soap after using the latrine increased from 1% to 17% [Curtis et al 2001]. The estimated cost over a 3 year intervention was less than 1% of the Health budget and less than 2% of the household budget. Given that hand washing also reduces acute respiratory infections and this study only looked at the prevention of cases of diarrhoea, hand washing promotion must be considered to be a highly cost-effective intervention for preventing childhood disease. Indeed, it is likely to be more cost effective than immunisation and should perhaps be considered to be a form of immunisation!

Behaviour change interventions suggest that hand washing rates are increased more effectively using social marketing of soap rather (lather?) than health messages. To be clean and to be able to get rid of smells is viewed as more important than the prevention of infection by people in many varied settings [Curtis V, 2003]. The following quotation from experience in Peru illustrates this point:

With respect to the sensation of cleanliness, mothers reported that they prefer to feel clean, fresh, agile, alert and happy as opposed to restless, uncomfortable, distressed, sticky and tired, which is how they feel when they are dirty. They generally wash their hands to keep them clean, avoid germs and remove dirt. Soap is used to kill germs, but above all to keep the hands soft and clean smelling.
(<http://www.globalhandwashing.org/Country%20act/Peru.htm>
accessed 8th January 2007)

A handbook on how to promote hand washing at local, regional or national level, based on international experience and using a private-public partnership model, has been produced by the World Bank (The Handwashing Handbook. The World Bank Group. Washington. Available at http://www.globalhandwashing.org/Publications/Handwashing_Handbook.pdf).

Interventions aimed at improving the disposal of children's faeces have proved more difficult than hand washing. This is partly owing to little information being available on household practices in this area. It is particularly difficult to analyse these practices as questionnaires are likely to produce answers that gild the lily and observational studies intrinsically alter behaviours in this area (Hawthorn effect). In Lima, Peru an intervention after considerable planning and formative research was unable convincingly to prove efficacy owing to multiple impediments to optimal implementation in routine health services [Yeager et al 2002].

Multiple interventions

Multiple interventions involving water supply, sanitation and hygiene produce an average reduction in diarrhoea incidence of 30%, with greater effects on children over 5 years of age.

Notably many successful interventions have taken place as part of general community-based (social) programmes where the community themselves have

prioritised issues of water/sanitation/hygiene. The World Bank has noted this in a review of its work. More success is likely to be obtained through this route than through the technical approach involving e.g. the DWAF or health campaigns. Importantly in the Western Cape context, this should link with the municipal planning of IDPs.

BRAC – effect of women-focussed development on child mortality. While not focussed on diarrhoea, the women-focussed development programmes (women’s groups including education and micro-lending) in Matlab, Bangladesh under the auspices of the International Centre for Diarrhoeal Research and the Bangladesh Rural Advancement Committee (BRAC) demonstrated a 52% relative reduction in child death rates (many of those prevented will have been children who would have died of diarrhoea) compared to a 31% reduction in non-intervention areas. [Bhuiya A et al, 2002]

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