

DIARRHEA AMONG CHILDREN UNDER FIVE IN MYANMAR: A SYSTEMATIC REVIEW

Kendra J. Kamp

Michigan State University, East Lansing, MI

ABSTRACT:

Eighteen percent of deaths among children under five in Myanmar are due to diarrheal diseases even though diarrheal diseases can be prevented. The purpose of this article is to perform a systematic review of diarrhea prevention and treatment efforts among children under five in Myanmar. A systematic literature review was conducted using the databases of PubMed, CINAHL, and Web of Science. Search terms included: Myanmar, Burma, diarrhea, and children. Articles were limited from 2000 to 2016. Fifteen articles met inclusion criteria and were included in this review. Results indicate that although individuals in Myanmar have high levels of knowledge regarding prevention of diarrheal diseases, social determinants of health and cultural factors encourage the spread of diarrheal diseases. Social determinants of health include disparities due to geography, education, and economics. Cultural factors such as strong allegiances to norms viewing latrines as uncustomary can promote diarrheal diseases. There is a need for interventions designed to address social determinants of health in order to enhance diarrhea prevention and treatment efforts and reduce the under-five mortality in Myanmar.

Keywords: Diarrhea; Children under five; Myanmar; Systematic review

DOI: 10.14456/jhr.2017.10

Received: May 2016; Accepted: July 2016

INTRODUCTION

Each year almost 18% of deaths among children under five in Myanmar (Burma) are due to diarrhea. Diarrhea, as defined by the World Health Organization, is “the passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual)” [1]. Diarrhea is caused by bacteria, viruses, or parasites and reveals an intestinal infection. Although diarrhea can influence all age groups, it is a special concern for children under five in Myanmar. Diarrhea is the second leading cause of mortality due to dehydration and electrolyte loss [2, 3].

Deaths from diarrhea can be prevented. The World Health Organization established a goal “to reduce mortality from diarrhea in children less than five years of age to fewer than 1 per 1000 live births” [4]. Numerous interventions worldwide have sought to protect, prevent and/or treat diarrhea. Protecting against diarrhea involves establishing

good health practices from birth such as exclusive breast feeding (which means feeding infants only breastmilk during the first 4-6 months), adequate complementary feeding, and a breastfeeding promotion program. Efforts to prevent diarrhea include latrine construction, promotion of clean water, latrine use, hygiene, as well as immunizations against rotavirus, measles, and cholera [5, 6]. In order to treat diarrhea, parents/guardians must have access to oral rehydration therapy, healthcare providers, and medications.

In Myanmar, disparities in diarrhea treatment exist based on geographical locations and socioeconomic status. For example, only 28% of children under five in the north (Shan) are treated with oral rehydration therapy as compared to 90% of children in the south (Tanintharyi). In the poorest households, 58% of diarrhea cases are treated with oral rehydration therapy as compared to 79% of children from the richest households. Furthermore, it is estimated that diarrhea episodes could be reduced worldwide through several methods. Improving the water supply would reduce episodes

* Correspondence to: Kendra J. Kamp
E-mail: kendra.kamp@hc.msu.edu

Cite this article as:

Kamp KJ. Diarrhea among children under five in Myanmar: a systematic review. *J Health Res.* 2017; 31(1): 77-84. DOI: 10.14456/jhr.2017.10

by 25%. Sanitary improvements could reduce diarrhea episodes by 32%. The use of household water treatment methods and safe water storage could reduce 39% of episodes. Finally, handwashing could reduce 45% of diarrhea episodes [7].

In order to address prevention and treatment of diarrhea, culturally sensitive interventions are needed. Through the provision of culturally acceptable interventions, healthcare providers and public health practitioners can reduce mortality in children under five. The purpose of this article is to review the literature for diarrheal interventions in Myanmar.

METHODS

A systematic literature search was conducted using the databases of PubMed, CINAHL, and Web of Science. Keywords included: Myanmar, Burma, diarrhea, diarrhoea, and child* (which searches for all words with the root of child). Articles were included if they examined diarrhea among individuals living within the country Myanmar or Myanmar citizens who were living in another Southeast Asian country. Both interventions and descriptive studies were included. Articles were excluded if they focused on travelers' diarrhea, and/or had a primary purpose of determining biological causes of diarrhea. Articles were limited to a publication date from 2000 to 2016 and were written in English. A total of 88 articles were found. Fifteen articles met inclusion and exclusion criteria.

RESULTS

Throughout the literature, a reoccurring theme was the importance of collaboration within community-based organizations and non-governmental organizations in order to reduce diarrheal diseases. Myanmar was governed by military regimes for almost 50 years [8]. During this time, conflict caused "widespread internal displacement, erosion of health systems, and limited access to health care and information" [9]. In fact, over 446,000 people were classified as internally displaced persons (individuals who flee their home but are required to remain within the country). The military regime and displaced persons have hindered prevention and treatment efforts as security concerns and conflict prevent access to some villages [9, 10]. The lack of governmental medical infrastructure and health surveillance created an environment in which communities had to rely on the support of community-based and non-

governmental organizations in diarrheal control efforts. These organizations are vital for addressing the prevention and treatment of diarrheal diseases. The findings of this review are organized by surveillance (monitoring for diarrhea), prevention (efforts to avoid diarrhea from occurring), and treatment (methods to remedy diarrhea). Table 1 provides the results of studies included in this systematic review.

Surveillance

Surveillance is used to monitor the amount of children suffering from diarrhea and the types of diarrhea affecting children. Diarrhea was responsible for 18% of admissions in the Yangon Children's Hospital [3]. Researchers determined that the rotavirus was responsible for diarrhea in half of the specimens tested. Rotavirus diarrhea is associated with the cool, dry season of December and January [3, 11]. Rotavirus diarrhea was found to have strains that would be influenced by current vaccines [11]. Among *Escherichia coli*, penicillin G was found to be ineffective in all cases; however, 89% were sensitive to norfloxacin [12]. Therefore, fluoroquinolones are recommended to treat this type of diarrhea.

Prevention

Diarrhea cases can be prevented through proper sanitation techniques such as hand washing, latrine building, the use of clean water, and exclusive breastfeeding. The people of Myanmar have a high knowledge of diarrhea prevention and the importance of sanitation and hygiene [13]. For example, eighty five percent of Myanmar mothers, living in the Mae Sot District, Thailand, were categorized as having a high knowledge of diarrhea prevention [13]. These findings showed weak relationships between knowledge and prevention practices and attitude and prevention implying that an increase in knowledge could lead to an increase in good diarrhea prevention practices.

The lack of latrines and the use of unsanitary water have hindered diarrhea prevention efforts and have promoted the spread of diarrhea in Myanmar [14]. The Myanmar government implemented programs to improve sanitation and hygiene. The Social Mobilization program occurred from 1996 to 2000 and National Sanitation Week began in 1998 and occurs annually. These programs have increased access to sanitary latrines by 18% and handwashing with soap has increased two fold in 5 years. These programs found that printed materials had the

greatest impact on outreach. Interestingly, the Social Mobilization program was more effective among higher educated and higher income groups.

Barriers to program implementation include customs in using paper, twigs, and other material after defecation which may prevent the use of handwashing; individuals believe that handwashing is unnecessary since direct contact with feces has not occurred [14]. Another barrier is the idea that latrines are “not customary” [14]. Latrine construction can be difficult for individuals living in rocky, hilly, or mountainous areas as well as areas which experience flooding such as the delta or coastal areas. However, despite these challenges, the program was able to increase access to sanitary latrines and handwashing with soap.

Oo and colleagues [15] found a relationship between severity of dehydration from diarrhea and handwashing practices. Families who washed hands with water were statistically more likely to have a child with severe diarrhea as compared to families who washed hands with soap and water. This points towards the importance of developing interventions to address handwashing. Yet, disparities exist based on geographical location. Individuals in the north were more likely to obtain water from wells. Individuals living in the south primarily obtained water from lakes, rivers, open ponds, or streams [16].

Exclusive breastfeeding is another method used in Myanmar to prevent diarrhea [17]. Research shows that infants who are fed breastmilk exclusively for the first six months have fewer diarrheal and gastrointestinal infections than infants who are not fed breastmilk exclusively [18]. Once a child is sick, breastfeeding can help provide necessary calories and maintain hydration during illness [19]. Thet and colleagues [20] found that women knew the importance of exclusive breastfeeding; however, many barriers prevented behavior change. Beliefs that water or mashed rice (Gazi) are more nutritious than breastmilk have limited the uptake of exclusive breastfeeding [20]. Women reported that needing to work due to poverty and financial concerns limited their ability to exclusively breastfeed. Women also felt that their own poor nutrition led to a decrease in breastmilk production [20]. This qualitative review points toward the need for an intervention to provide continued breastfeeding support especially for working mothers and the provision of information regarding the transition from breastmilk to solid foods.

Treatment

For any diarrheal treatment to be implemented and effective, an individual must recognize the initial danger signs of diarrhea. Danger signs include: bloody stool, lack of urination, sunken eyes, sunken fontanel, and wrinkled skin. In a survey of households, less than 10% correctly identified these danger signs. Thirty-six percent of households could correctly identify listlessness or sleepyness as a danger sign [16]. By improving the ability of households and communities to identify danger signs, children could receive earlier treatment and improved outcomes. No interventions have assisted in training people to identify these signs. This is significant as the majority of households treat diarrhea at home (50.6%) [16].

An intervention in Myanmar used a social franchising program with the goal of increasing the use of Oral Rehydration Solution (ORS). Social franchising is “the application of commercial methods to the delivery of subsidized services with a social benefit goal, such as improving rural health” [21]. To increase use, individuals were selected from several villages to be trained as community health workers (CHWs). The CHWs were taught how to prevent and treat diseases such as diarrhea, pneumonia, tuberculosis, and malaria. Information regarding contraception use was also included. The program was successful in increasing the use of ORS as demonstrated by the intervention group having a statistically significant higher use of ORS than the control group [21]. Also, the program was shown to be cost-effective. With this social franchising program, the CHWs provide ORS to the families. One important omission is that the study does not address whether or not ORS would be utilized without the assistance of a CHW.

Several studies have examined additions to standard diarrhea treatment. By evaluating the use of ORS only versus ORS plus *Saccharomyces boulardii*, a probiotic yeast, on children ages 3 months to 10 years old, it was determined that patients in the ORS plus group experienced a significant decrease in defecation frequency by day 2 as compared to the ORS only group [22]. In addition, by day 3 the ORS plus group experienced more solid stools as compared to the ORS only group. These findings demonstrate the effectiveness of ORS plus therapy in the treatment of diarrhea. Examining an intervention of immunoglobulin Y compared to control as an adjunct to standard supportive therapy showed that individuals in the

treatment group experienced a significantly shorter mean duration of rotavirus diarrhea as compared to the control group [23].

DISCUSSION

This review has provided an overview of the diarrheal surveillance, prevention, and treatment efforts in Myanmar. The majority of studies used community based organizations and non-governmental organizations to assist in reaching remote communities [9, 10, 14, 21]. Social franchising of ORS has shown promising results as individuals have been willing to utilize this model [21] although research has also shown the benefits of adjunctive therapy in addition to ORS [22, 23]. Currently, marketing efforts such as television advertisements are being used to promote ORS [24]. However, prevention efforts are still lagging. As identified in the review, many studies have shown the need to address under 5 mortality related to diarrhea; however, few intervention studies have been performed. There is a need to create and modify interventions aimed at addressing hand hygiene, latrine construction, and exclusive breastfeeding since findings indicate gaps in practice related to these topics. A focus on diarrhea prevention is needed not only to decrease mortality but also prevent the transmission of other diseases.

Future interventions to address diarrheal disease among children under five should seek to address disparities influenced by geography, education, and income. These social determinants of health influence the prevention and treatment of diarrhea. Previous programs have used educational brochures which may further enhance disparities based on education by creating an intervention in

which individuals need to read to understand. In addition, economic and political factors lead to displaced families and forced labor families to have higher rates of under 5 mortality due to diarrhea than families without these challenges. Interventions should incorporate cultural beliefs, values, and practices to ensure the intervention addresses the community needs in an appropriate manner. Programs such as the SuperAmma handwashing campaign [25] which was developed for rural villages in India could be adapted to address handwashing in Myanmar. The SuperAmma campaign uses an animated film in which a mother teaches her son to use soap for handwashing whereas a male character is contrasted with having disgusting habits. This intervention is based on the theory that emotional behaviors influence health behaviors more than rational health beliefs [26].

A limitation of this review is due to the lack of research on diarrheal treatment and prevention in Myanmar. Most concepts such as ORT or breastfeeding only had a few articles. In order to understand the current state of affairs and understand the cultural influences, more research is needed to support or refute the previous findings. The lack of research limits the generalizability of these findings.

Future research and interventions should use an interdisciplinary approach. Engineers could partner with practitioners to create culturally-appropriate latrine building methods to address geographical constraints and challenges in building latrines. By working together, community partners, researchers, and practitioners can help reduce diarrheal diseases by addressing social determinants of health.

Table 1 Results of systematic review

No.	Author	Type of study	Sample size	Location	Theme	Results
1	Moe et al., 2005 [3]	Quantitative: cross sectional	30869 children	Yangon Children's Hospital in Yangon, Myanmar	Surveillance	- Diarrhea responsible for 18% of admissions - Rotavirus identified in 53% of specimens tested (not all patients had specimens) - Rotavirus had a seasonal pattern - Most common age group was 7-12 months old
2	Parmar et al., 2014 [9]	Quantitative: cross sectional	5592 adults	Community sample	Surveillance	- Diarrhea was the second leading cause of death in children under 5

Table 1 Results of systematic review (Cont.)

No.	Author	Type of study	Sample size	Location	Theme	Results
						- Households which experienced forced labor had statistically higher rates of under 5 mortality as compared to households that did not experience forced labor - Prevalence of diarrhea among children under 5 was higher among individuals who were displaced as compared to individuals who were not displaced
3	Moe et al., 2009 [11]	Quantitative: cross sectional	2179 children	Yangon Children's Hospital in Yangon, Myanmar	Surveillance	- Rotavirus is associated with cool, dry seasons - Most common among children 6-17 months old
4	Takahashi et al., 2008 [12]	Quantitative: Cross sectional	217 children	Yangon Children's Hospital in Yangon, Myanmar	Surveillance	- Most prevalent <i>Escherichia coli</i> diarrhea was the EAEC category - All specimens were resistant to penicillin G - Most specimens were resistant to erythromycin, tetracycline, and streptomycin - Recommend the use of norfloxacin (89.4% were sensitive to this)
5	Hoehn and Hoppenz, 2009 [27]	Review	NA	Myanmar	Surveillance	- Geographic distribution of mortality: 83% of deaths occurred in rural areas, only 17% in urban areas - 73% of deaths occurred between ages of 0-11 months
6	Oo et al., 2000 [15]	Quantitative: cross sectional	100 children	Yangon Children's Hospital in Yangon, Myanmar	Prevention	- The association between severity of dehydration with types of feedings was not significant (although small sample size could influence these findings) - Severity of dehydration in washing with water only was higher than individuals washing with soap and water
7	Thet et al., 2016 [20]	Qualitative: semi-structured interviews	44 adults	Community sample: Laputta, Myanmar (Ayeyarwady region)	Prevention	- Mothers and grandmothers had a high knowledge of the benefits of breastfeeding - There was a disconnect between knowledge and practice with families introducing water and rice before 6 months - Barriers to breastfeeding include being busy and health factors
8	Myat and Taneepanichskul, 2014 [13]	Quantitative: cross sectional	112 mothers	Myanmar migrants living in Mae Sot district, Tak Province, Thailand	Prevention	- 85.7% of mothers had high knowledge regarding prevention of diarrhea - 61.6% had moderate practice scores - Marital status, education, and income impacted practice scores

Table 1 Results of systematic review (Cont.)

No.	Author	Type of study	Sample size	Location	Theme	Results
9	Bajracharya, 2003 [14]	Review	NA	Myanmar	Prevention	- High association between knowledge, practice, and attitude. - Printed materials had the highest reach for creating awareness about the situation - Intervention was more effective among more educated and higher income group - 33% stated building a latrine was not customary (this was 70% in the Rakhine state) - Difficulty in digging latrines due to geographical constraints
10	Hlaing et al., 2016 [17]	Quantitative: Cross sectional survey	106 mother-child pairs	Ayeyarwady Region	Prevention	- 45.4% of children had been exclusively breastfed until 6 months of age - Bothers believe that vegetables and beans cause diarrhea in children - Almost 70% of mothers used unboiled water from a river or well
11	Aung et al., 2013 [16]	quantitative: cross sectional	2033 adults	Community sample from townships of: Wakhema, Ta Dar Oo, and Myit Thar	Prevention and Treatment	- Half of households treated diarrhea at home - Only 24% of households provided their child with appropriate ORS in composition and concentration - Drinking water in the south was primarily open ponds, lakes, rivers, springs, or streams - Drinking water in the north was primarily wells - Living in the north, higher socioeconomic status, and a caregiver aged 30 or older were associated with a lower incidence of pediatric diarrhea
12	Aung et al., 2014 [21]	Quantitative: Community-level randomized control trial	81 village tracts	Community sample	Treatment	- Participants were assigned to standard ORS plus zinc or a social franchise program training community educators to supply ORS plus zinc - Intervention group was more likely to use ORS - 3 month prevalence of diarrhea did not differ between control and intervention at the post-intervention survey
13	Htwe et al., 2008 [22]	Quantitative: Randomized Controlled Trial	100 children	Pediatric ward of the North Okkalapa General Hospital in Yangon, Myanmar	Treatment	- Participants were randomly assigned into ORS alone or ORS plus <i>Saccharomyces boulardii</i>, a probiotic yeast - Individuals in the ORS plus group had decreased defecation frequency by day 2, and more solid stools by day 3

Table 1 Results of systematic review (Cont.)

No.	Author	Type of study	Sample size	Location	Theme	Results
14	Rahman et al., 2012 [23]	Quantitative: Randomized Controlled Trial	52 children	Pediatric Infectious Disease Wards of the Defense Services Obstetrics, Gynaecology, and Children's Hospital	Treatment	- Participants were randomly assigned into treatment with immunoglobulin Y or control - Participants in the test group experienced a statistically lower mean duration of diarrhea as compared to the control group - On day 1, intervention patients experience significantly less IV fluid administration than control participants - Those in the intervention had statistically less rotavirus shedding as compared to the control group - The intervention group did not experience any adverse clinical events
15	Bishai et al., 2015 [28]	Review	NA	Myanmar	Treatment	- ORS using a social franchise network is cost effective - Total cost of ORASEL kit is 78 cents - The median incremental cost per child death averted from a medical perspective is \$8,980

CONCLUSION

Diarrhea-related deaths should not be the second cause of death among children under five in Myanmar since many treatment and prevention methods exist. This review has shown that the primary intervention related to diarrhea treatment in Myanmar is the use of ORS; yet, this treatment is limited by families and communities who are unable to identify the danger signs of diarrhea. There is a need to develop programs not only to treat but also to prevent diarrhea through handwashing campaigns and latrine construction. Working as interdisciplinary teams can help address some of the current research challenges. Addressing public health factors related to diarrhea will reduce the number of deaths due to diarrhea among children under five.

ACKNOWLEDGEMENT

The author would like to acknowledge Dr. Connie Currier, CrPH, MPH (Michigan State University) for her passion for culture and health which is evident through her teaching.

REFERENCES

1. World Health Organization [WHO]. Diarrhoeal disease. [updated 2013 April]. Available from: <http://www.who.int/mediacentre/factsheets/fs330/en/>
2. Ministry of Health, UNICEF. Overall and cause-specific under-five mortality survey, Yangon 2002-2003. [Yangon: Ministry of Health]; 2003.
3. Moe K, Hummelman EG, Oo WM, Lwin T, Htwe TT. Hospital-based surveillance for rotavirus diarrhea in children in Yangon, Myanmar. *J Infect Dis.* 2005 Sep; 192(Suppl 1): S111-3. doi: 10.1086/431509
4. World Health Organization [WHO], The United Nations Children's Fund [UNICEF]. Ending preventable child deaths from pneumonia and diarrhoea by 2025: the integrated global action plan for pneumonia and diarrhoea. Geneva: WHO; 2013.
5. Waddington H, Snilstveit B. Effectiveness and sustainability of water, sanitation, and hygiene interventions in combating diarrhoea. *Journal of Development Effectiveness.* 2009; 1(3): 295-335. doi: 10.1080/19439340903141175
6. Ministry of Immigration and Population, United Nations Population Fund. Country report on 2007 fertility and reproductive health survey, Yangon, 2009. [Yangon: Ministry of Immigration and Population]; 2009.
7. Fewtrell L, Kaufmann RB, Kay D, Enanoria W, Haller L, Colford JM, Jr. Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *Lancet Infect Dis.* 2005 Jan; 5(1): 42-52. doi: 10.1016/S1473-3099(04)01253-8
8. U.S. Campaign for Burma. Politics. U.S. campaign for Burma; 2012.

9. Parmar PK, Benjamin-Chung J, Smith LS, Htoo SN, Laeng S, Lwin A, et al. Health and human rights in eastern Myanmar prior to political transition: a population-based assessment using multistaged household cluster sampling. *BMC Int Health Hum Rights*. 2014; 14: 15. doi: 10.1186/1472-698X-14-15
10. Parmar PK, Barina CC, Low S, Tun KT, Otterness C, Mhote PP, et al. Health and human rights in eastern Myanmar after the political transition: a population-based assessment using multistaged household cluster sampling. *PLoS One*. 2015; 10(5): e0121212. doi: 10.1371/journal.pone.0121212
11. Moe K, Thu HM, Oo WM, Aye KM, Shwe TT, Mar W, et al. Genotyping of rotavirus isolates collected from children less than 5 years of age admitted for diarrhoea at the Yangon Children's Hospital, Myanmar. *Vaccine*. 2009 Nov; 27(Suppl 5): F89-92. doi: 10.1016/j.vaccine.2009.08.068
12. Takahashi E, Sultan Z, Shimada S, Aung WW, Nyein MM, Oo KN, et al. Studies on diarrheagenic *Escherichia coli* isolated from children with diarrhea in Myanmar. *Microbiol Immunol*. 2008 Jan; 52(1): 2-8. doi: 10.1111/j.1348-0421.2008.00001.x
13. Myat K, Taneepanichskul N. Maternal knowledge, attitude, and practice of preventing diarrhea among children under five in migrants in Mae Sot district, Tak province, Thailand. *J Health Res*. 2014; 28(Suppl.): S63-S8.
14. Bajracharya D. Myanmar experiences in sanitation and hygiene promotion: lessons learned and future directions. *Int J Environ Health Res*. 2003 Jun; 13(Suppl 1): S141-52. doi: 10.1080/0960312031000102903
15. Oo KN, Aung WW, Thida M, Toe MM, Lwin HH, Khin EE. Relationship of breast-feeding and hand-washing with dehydration in infants with diarrhoea due to *Escherichia coli*. *J Health Popul Nutr*. 2000 Sep; 18(2): 93-6.
16. Aung T, McFarland W, Khin HS, Montagu D. Incidence of pediatric diarrhea and public-private preferences for treatment in rural Myanmar: a randomized cluster survey. *J Trop Pediatr*. 2013 Feb; 59(1): 10-6. doi: 10.1093/tropej/fms033
17. Hlaing LM, Fahmida U, Htet MK, Utomo B, Firmansyah A, Ferguson EL. Local food-based complementary feeding recommendations developed by the linear programming approach to improve the intake of problem nutrients among 12-23-month-old Myanmar children. *Br J Nutr*. 2016 Jul; 116(Suppl 1): S16-26. doi: 10.1017/S000711451500481X
18. Duijts L, Jaddoe VW, Hofman A, Moll HA. Prolonged and exclusive breastfeeding reduces the risk of infectious diseases in infancy. *Pediatrics*. 2010 Jul; 126(1): e18-25. doi: 10.1542/peds.2008-3256
19. Huffman SL, Combest C. Role of breast-feeding in the prevention and treatment of diarrhoea. *J Diarrhoeal Dis Res*. 1990 Sep; 8(3): 68-81.
20. Thet MM, Khaing EE, Diamond-Smith N, Sudhinaraset M, Oo S, Aung T. Barriers to exclusive breastfeeding in the Ayeyarwaddy Region in Myanmar: qualitative findings from mothers, grandmothers, and husbands. *Appetite*. 2016 Jan; 96: 62-9. doi: 10.1016/j.appet.2015.08.044
21. Aung T, Montagu D, Su Su Khin H, Win Z, San AK, McFarland W, et al. Impact of a social franchising program on uptake of oral rehydration solution plus zinc for childhood diarrhea in Myanmar: a community-level randomized controlled trial. *J Trop Pediatr*. 2014 Jun; 60(3): 189-97. doi: 10.1093/tropej/fmt108
22. Htwe K, Yee KS, Tin M, Vandenplas Y. Effect of *Saccharomyces boulardii* in the treatment of acute watery diarrhea in Myanmar children: a randomized controlled study. *Am J Trop Med Hyg*. 2008 Feb; 78(2): 214-6.
23. Rahman S, Higo-Moriguchi K, Htun KW, Taniguchi K, Icatlo FC, Jr., Tsuji T, et al. Randomized placebo-controlled clinical trial of immunoglobulin Y as adjunct to standard supportive therapy for rotavirus-associated diarrhea among pediatric patients. *Vaccine*. 2012 Jun 29; 30(31): 4661-9. doi: 10.1016/j.vaccine.2012.04.091
24. Population Services International. Ad for PSI/Myanmar's Orasel Kit with mother bird. [Update 2014] Available from: <http://www.psi.org/publication/ad-for-psimyanmars-orasel-kit-with-mother-bird/>
25. Biran A, Schmidt WP, Varadharajan KS, Rajaraman D, Kumar R, Greenland K, et al. Effect of a behaviour-change intervention on handwashing with soap in India (SuperAmma): a cluster-randomised trial. *Lancet Glob Health*. 2014 Mar; 2(3): e145-54. doi: 10.1016/S2214-109X(13)70160-8
26. Curtis VA, Danquah LO, Aunger RV. Planned, motivated and habitual hygiene behaviour: an eleven country review. *Health Educ Res*. 2009 Aug; 24(4): 655-73. doi: 10.1093/her/cyp002
27. Hoehn T, Hoppenz M. Neonatal and childhood mortality rates in Myanmar. *Klin Padiatr*. 2009 Jul-Aug; 221(4): 266-8. doi: 10.1055/s-0029-1220904
28. Bishai D, Sachathep K, LeFevre A, Thant HN, Zaw M, Aung T, et al. Cost-effectiveness of using a social franchise network to increase uptake of oral rehydration salts and zinc for childhood diarrhea in rural Myanmar. *Cost Eff Resour Alloc*. 2015; 13: 3. doi: 10.1186/s12962-015-0030-3