

(RESEARCH ARTICLE)



Impact of preventive and early treatment of childhood pneumonia and diarrhea in Ethiopia, analysis from Health Management Information System (HMIS) report 2010-2016

Efrem Teferi *, Daniel Gemechu and Ismael Ali

USAID Transform: Primary Health Care project, Ethiopia.

International Journal of Frontline Research in Pharma and Bio Sciences, 2022, 01(01), 027-033

Publication history: Received on 09 February 2022; revised on 29 March 2022; accepted on 31 March 2022

Article DOI: <https://doi.org/10.56355/ijfrpbs.2022.1.1.0003>

Abstract

Background: In Ethiopia mortality in children younger than five years it has dropped from 202 in 1990 to 55 in 2019 (EDHS 2019). Pneumonia and diarrhea are the two leading causes of under-five mortality. They have overlapping risk factors, such as poverty, undernutrition, and poor hygiene. Ethiopia introduced Integrated Community Case management (ICCM) is strategy to treat sick children in communities. Pneumococcal Conjugate vaccine was introduced in 2010, and Rotavirus vaccine was in 2013. This research was conducted to assess the changes in morbidity and mortality in children due to pneumonia and diarrhea based on HMIS data.

Methodology: Diarrhea and pneumonia morbidity, admission, and mortality data of under five children were extracted from 2002/09 EFY to 2008/16 GC, annual Federal Ministry of Health and Health related indicators bulletin. Proportion of morbidity, admission, mortality, and change in percentage analyzed and compared using significant test.

Results: Morbidity due to pneumonia to total under five morbidity increased from 2.6% to 8.7%, and that of diarrhea from 2.3% to 11.8% in six years (2010 to 2016) p-0.000. Admission due to pneumonia decreased from 5% to 4.5%, (10% reduction), p-0.009 and that of diarrhea 3.4%, to 1.3%, (63% reduction), p-0.000. Mortality due pneumonia decreased from 2.7%, to 1.4 %, (48% reduction), p-0.113, that of diarrhea decreased from 1.9% to 0.9%, (53% reduction), p-0.42. The change in morbidity and admission were significant, but that of mortality was not significant.

Conclusion: The increase in morbidity of pneumonia and diarrhea might be due to increase in health service utilization. The decline in admission and mortality of both diseases showed that introduction of new vaccines of, Rota, and early treatment in health posts using ICCM algorithms, have significant contribution. Standard quality treatment, prevention by improving immunization quality and coverage, maximum utilization of health service, is necessary to further decrease, admission and mortality.

Keywords: HMIS; Admission; Mortality; PCV; Rota vaccine

1. Introduction

Global mortality in children younger than five years has fallen substantially in the past two decades from more than 93 to 39/ 1000 live births in 2017, in Ethiopia it has dropped from 202 to 59/ 1000 live births, 55 in 2019 (EDHS 2019). Pneumonia and diarrhea are the two leading causes of death in this age group, and have overlapping risk factors, such as poverty, undernutrition, and poor hygiene. Improvements in socioeconomic development, maternal education, overcrowding and falling fertility rates are important contributors to reduction in child mortality. Interventions with

* Corresponding author: Efrem Teferi
USAID Transform: Primary Health Care project, Ethiopia.

maximum effort include breastfeeding, oral rehydration solution, and community case management. Childhood diarrhea and pneumonia deaths are avoidable and additional interventions, like exclusive breastfeeding for the first 6 months of age, adequate complementary feeding after 6 months of age, vitamin A supplementation, vaccination against measles, pertussis, pneumonia, and diarrhea. Cotrimoxazole prophylaxis for HIV infected, increased quality of water, and improved sanitation delivered, could save significant number of diarrheal and pneumonia deaths (1, 2, 3, 4,5).

Ethiopia is a country situated in the horn of Africa with a total surface area of 1,127,127 square kilometers. Based on the United Nations (UN) estimate the total population of Ethiopia for the year 2020 is expected to be 110 million. Children under five constitute 14% while those under 14 accounts for 47% of the total population.

Health Extension Program (HEP), launched in Ethiopia 2004 to develop a community-based accelerated expansion of health services, and achieve universal coverage of primary health care. Two HEWs are assigned to one health post to serve a population ranging from 3,000 to 5,000 in a village “kebele”. The HEP is fully integrated into the broader health system and is part and parcel of the Primary Health Care Unit structure. The program delivers 16 clearly defined packages of preventive, promotive, and basic curative services. All services delivered under the program are free and available to everyone. HEWs are all female, 10th grade high school graduates, recruited from the community with the active participation of the community. They were trained for one full year and then deployed back into their community to promote health and provide services at the village level (6,7).

Based on growing demand of Ethiopian rural communities, local studies on feasibility of pneumonia management of by HEWs, the Health Sector Development Plan III (HSDP III) midterm review and joint review meeting recommendation, FMOH decided to introduce Integrated Community Case Management of childhood illnesses (ICCM) in 2010, ensure greatest possible reduction of mortality in children less than five years of age to achieve Millennium Development Goal (MDG) 4 by 2015. used amoxicillin to treat pneumonia, ORS and zinc to treat diarrhea (8).

Expanded program of Immunization (EPI), was launched in Ethiopia in 1980 against six killer diseases, Polio, Diphtheria, Tuberculosis, Pertussis, Measles and Tetanus, later new vaccines such as Hepatitis B, Hemophilus influenza, Pneumococcal Conjugate Vaccine (PCV), and Rota vaccine were included later. Vaccination was provided to children and women in hospitals, HCs and HPs, free according to the schedule set by FMOH. Pneumococcal Conjugate vaccine was introduced in 2011 and Rotavirus vaccine in 2013 (9,10).

The country achieved Millennium Development Goal 4, 3 years before the 2015 deadline. The under-5 mortality decreased by 69%, from 205 deaths per 1000 livebirths in 1990 to 64 deaths per 1000 livebirths in 2013. Half of deaths averted in children younger than 5 years were with reduced stunting from 58-38% (EDHS 2006). Vaccination programs accounted for 23% of deaths averted, treatment of childhood diarrhea for 9%, pneumonia for 5%, improved water and sanitation for 6%, and insecticide-treated bed nets for malaria prevention for 3%. SDG goal 3 calls for an end to preventable deaths of newborn and children under five years of age and specifies all countries should aim to reduce under-five mortality to 25 or less and newborn mortality to 12 or less per 1000 live births by 2030 (11).

This research was conducted to assess the changes in morbidity and mortality in children due to child survival interventions.

2. Methodology

Ethiopia has a three-tier health care system organized as primary, secondary, and tertiary level health care. The primary level health care is comprised of five satellite health posts, one health center and primary hospital. The secondary and tertiary level cares are comprised of general and specialized hospitals respectively. In seven years the number of health posts increased from 14,192 to 16,547, health centers from 2822 to 3962, and hospitals from 116 to 290.

The Health Management Information System (HMIS) in Ethiopia is designed to capture and provide essential core data for planning and monitoring health system’s performance in the country. Monthly reports from health facilities (health center and health posts) submitted to the Woreda Health Offices, council where they are aggregated and submitted to zonal health departments. Zonal Health Department (ZHD) in turn aggregates and submits to Reginal Health Bureau (RHB), then RHB to Federal Ministry of health (FMOH).

Some of child survival interventions, the related HMIS indicators are ; Number of treatments for children provided by health facility like, diarrhea, pneumonia, measles, malaria, contraceptive acceptance rate, antenatal coverage, deliveries attained by skilled birth attendance, and live births.

At each administrative unit, the HMIS Focal Person maintains a registry of receipt and transmission of the monthly report from and to the respective level/health unit. The Lot Quality Assessment Sampling (LQAS) method was used to check data accuracy at each level. LQAS enables quantitative comparison of reported data to recount data and helps to assess if intermediate aggregation sites are collecting and reporting data accurately. It provides the Verification Factor (i.e. level of under- or over-reporting, if any) for the HMIS data items studied.

Diarrhea and pneumonia morbidity, admission, and mortality data of under five children were related indicators in the bulletin. The dates overlap with initiation of ICCM and introduction of PCV and Rota vaccines to see the relation.

3. Results

Morbidity due to pneumonia to total under five morbidity increased from 2.6% to 8.7%, and that of diarrhea from 2.3% to 11.8% in six years (2010 to 2016) p-0.000. Admission due to pneumonia decreased from 5% to 4.5%, (10% reduction), p-0.009 and that of diarrhea 3.4%, to 1.3%, (63% reduction), p-0.000. Mortality due to pneumonia decreased from 2.7% to 1.4 %, (48% reduction), p-0.113, that of diarrhea decreased from 1.9% to 0.9%, (53% reduction), p-0.42.

SN	Year	Total < 5 population	Pneumonia morbidity	% of morbidity	Admission	% of admission	Mortality	% of mortality
1	2002/10	11664641	308,901	2.6	15514	5.0	425	2.7
2	2003/11	11959017	453369	3.8	16150	3.6	704	4.4
3	2004/12	12310864	668836	5.4	24659	3.7	686	2.8
4	2005/13	12516434	792157	6.3	33006	4.2	775	2.3
5	2006/14	12848000	862602	6.7	32775	3.8	709	2.2
6	2007/15	13151098	1260430	9.6	61448	4.9	1019	1.7
7	2008/16	13462077	1164896	8.7	52700	4.5	759	1.4
SN	Year	Total < 5 population	Diarrhea morbidity	% of morbidity	Admission	% of admission	Mortality	% of mortality
1	2002/10	11664641	272968	2.3	9323	3.4	174	1.9
2	2003/11	11959017	641064	5.4	7763	1.2	126	1.6
3	2004/12	12310864	784022	6.4	11706	1.5	235	2.0
4	2005/13	12516434	1071205	8.6	17720	1.7	235	1.3
5	2006/14	12848000	1001712	7.8	14168	1.4	161	1.1
6	2007/15	13151098	1629673	12.4	24960	1.5	190	0.8
7	2008/16	13462077	1593658	11.8	20370	1.3	184	0.9

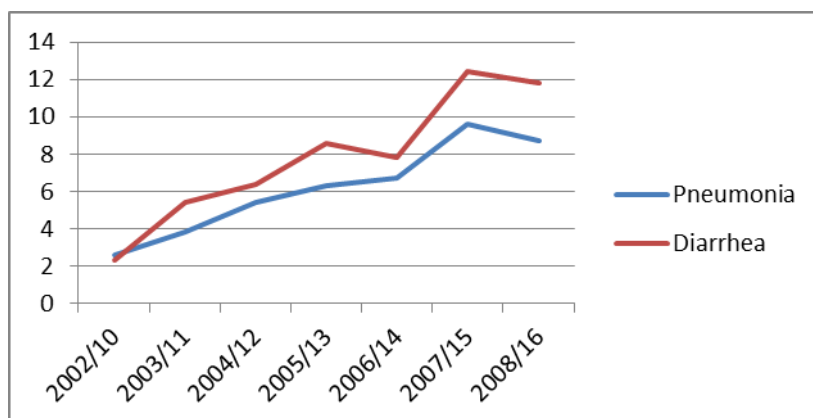


Figure 1 Trend in proportion of morbidity due to pneumonia and diarrhea

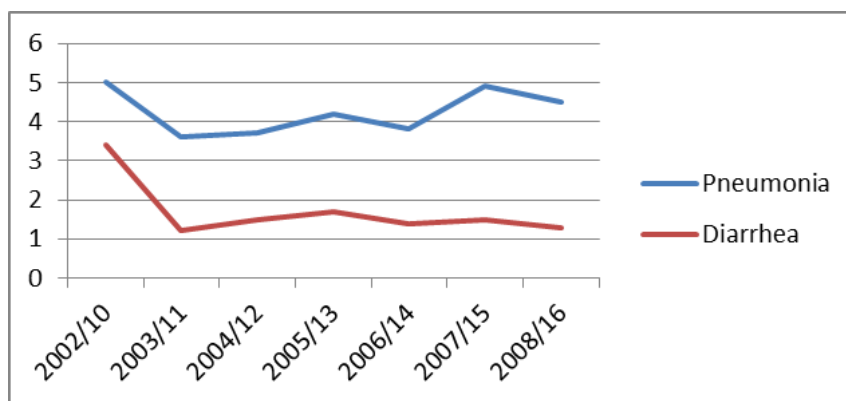


Figure 2 Trend in proportion of admission due to pneumonia and diarrhea

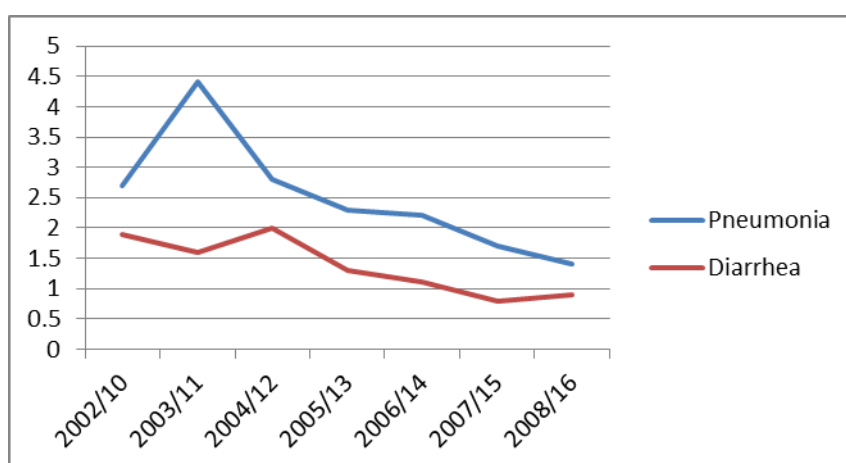


Figure 3 Trend in proportion of mortality, due to pneumonia and diarrhea

4. Discussion

Diarrhea and pneumonia morbidity to overall under five morbidity increased from 2.6% to 8.7% and 2.3% to 11.8% respectively in six years (2010 to 2016). The increase in morbidity was not due to increase in incidence, but increase in health service utilization, but still low compared to expected cases in both diseases, global estimate 0.23, and 2.9 episodes for pneumonia and diarrhea respectively (2). The study is complemented by research done in 300 woredas, after initiation of ICCM, the number of children seen in HCs did not decrease but increased (12). Construction of many health centers and health posts increased access to health facilities. There was significant drop in proportion of admission of both diarrhea, and pneumonia cases (3.4% to 1.3%, 63% reduction), $p=0.000$, and (5% to 4.5%, 10% reduction) respectively, $p=0.009$. There was decrease in proportion of mortality of pneumonia, 2.7% to 1.4% (48% reduction), $p=0.113$ and for diarrhea 1.9% to 0.9%, (53% reduction), $p=0.419$, but the decrease was not significant. The decrease in proportion of admission may be the effect of prevention and early treatment, overlaps with initiation of PCV in 2011, Rota vaccine in 2013, and ICCM in 2010. According to EDHS 2019, percentage of children 12-23 months vaccinated with third dose of pentavalent vaccine was 61%, PCV 60% and Rotavirus vaccine 67%.

Significant decrease in hospitalization of pneumonia cases was seen post PCV introduction in Rwanda, 53%, Brazil, 26%, and Sweden 19%. The Brazil study showed that, in areas where PCV coverage was low (<80%), the decrease in admission was not significant (13, 14, 15). In Ethiopia, it was 10%, with PCV3 coverage 61%, significant but low.

In Europe, America, and Australia, after introduction of Rota virus vaccine 49-89% decline in laboratory confirmed rotavirus hospitalization, and 17% to 55% decline in all causes of gastroenteritis in children aged less than 5 years. An expected efficacy of Rotavirus vaccine was lower in Africa 50% to 64% in preventing severe rotavirus gastroenteritis, compared to 85% to 98% in America and Europe, due to possible interference by concurrent infections, and

malnutrition in Africa. In Rwanda 61% to 70% reduction in rotavirus attributed hospitalization was observed following introduction of RV5, but in Ethiopia 63% reduction in all causes of diarrhea. Other interventions like improved clean water utilization might have contributed. Nationwide diarrhea mortality in Mexican children has been reduced by half following rotavirus vaccine implementation, similar to Ethiopia 53% (16, 17). In China the decrease in overall proportion of pneumonia deaths was 44% in 17 years, higher than in Ethiopia, 10% in 6 years. Ethiopian Demographic Health Survey (EDHS) which was done every five years from 2000 to 2016 showed decrease in incidence of diarrhea (24, 18, 13, and 12 %), and pneumonia (25, 13, 7, and 7 %) (19). MELA (Monitoring Evaluation, Learning, and Adapting), baseline survey, May 2018, showed 10.9% children had diarrhea and 6.6 % had pneumonia (20). The results are similar to EDHS, and our results 11.8% had diarrhea and 8.7% pneumonia. Random follow up which was done in 300 districts in 2018, four agrarian regions showed 14% of children had diarrhea and 26% pneumonia, diarrhea prevalence with the previous two findings, but pneumonia is more than two times higher, may be due difference in socioeconomic, seasonal variation, health service coverage and quality (21). These figures did not show seasonal variation, they show the incidence at the time of surveys, but HMIS data is from the number of children seen in health facilities the whole year, and seasonal variation is captured, and difficult to compare the results. The decrease in cases of diarrhea and pneumonia done at the same time of the year may indicate preventive measures like immunization, and initiation of early treatment in HPs, have brought change in morbidity, and mortality. Researches conducted in 2014-2017, in different parts of the country showed prevalence of pneumonia 16-33% (22, 23, 24), and diarrhea 15-31% (25, 26, 27). The associated factors for pneumonia were, absence of separate kitchen, and animals, vaccination, crowded house, vitamin A supplementation problem, mixed breast feeding, moderate acute malnutrition, and for diarrhea lack of water, and hand washing were risks for diarrhea. The results are much higher than HMIS finding, because it only includes those who come to health facilities, but surveys include community cases, different risk factors covered by the studies. Associated risk factors mentioned need to be improved to decrease pneumonia and diarrhea morbidity. Childhood diarrhea deaths in seven low- and middle-income countries, in Ethiopia 2000- 2012, were 8.8 %, in Ghana 8.5%, Tanzania 2.1%, Uganda 18.2%, and Pakistan 22.3% It was population based verbal autopsy data. The population covered in each country ranged from 60,000 to 600,000. In Ethiopia it was collected only from only ten villages in two districts, which may not be representative, and the population covered in all countries is not the same, which makes comparison difficult (28). WHO CHERG (Child Health Epidemiology Reference Group) data shows 9% of under-five deaths are due to diarrhea, and 18% due to pneumonia. This is much higher than our finding, 1.4% and 0.9% for pneumonia and diarrhea respectively, because HMIS includes only facility deaths.

5. Conclusion

There was increase in morbidity of pneumonia and diarrhea was associated with improvement in health service utilization. The decline admission and mortality were, due to both diseases showed that introduction of new vaccines of, Rota, and early treatment in health posts using ICCM algorithms, might have contributed a lot to decrease admission and mortality. Standard quality treatment, prevention by improving immunization quality and coverage, maximum utilization of health service, is necessary to further decrease, admission and mortality. There is a need to improve associated factors such as separate kitchen, home based water treatment, exclusive breast feeding in the first six months in addition to early treatment, vaccination and vitamin A supplementation.

Limitation

There is lack of reporting from some health facilities especially from private ones. Quality of reporting was not optimum. It was not possible to separately see the effect of associated factors of pneumonia and diarrhea.

Compliance with ethical standards

Disclosure of conflict of interest

All authors declare that they have no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

- [1] Walker CL, Igor R, Liu L, Nair H, Theodoratou E, et al. Global burden of childhood diarrhea and pneumonia. April 2013.
- [2] Bhutta ZA, Das KJ, Walker N, Rizvi A, Campbell H, Rudan I, et al. Interventions to address deaths from childhood pneumonia and diarrhea equitably. April 2013.
- [3] IMNCI –WHO report November. 2016.
- [4] Pinto CB, Labadie G, Dilip TR, Oliphant N, Dalglish SL, et al. Global implementation Survey of Integrated Management of Childhood Illness (IMCI): 20 years on. October 2018.
- [5] Levels and trends in child mortality, report of interagency group for child mortality. 2018.
- [6] Damtew ZA, Chekagn CT, Moges AS. The Health Extension Program of Ethiopia Strengthening the Community Health System, Harvard Policy Review, 30 December 2016.
- [7] Center for national Health Development in Ethiopia, Colombia university, Health Extension Program Evaluation rural Ethiopia, Household survey. 2005-2010.
- [8] Federal Ministry of Health, National implementation plan for Community Case Management of Common Childhood Illnesses. February 2010.
- [9] Federal Ministry of health, Introduction of Pneumococcal Conjugate vaccine in Ethiopia. June 2011.
- [10] Federal Ministry of health, Introduction of Rotavirus vaccine in Ethiopia. June August 2013.
- [11] Ruducha J, Mann C, Singh NS, Gemebo TD, Tessema NS, et al. How Ethiopia achieved Millennium Development Goal 4 through Multisectoral interventions: a Countdown to 2015, case study. November 2017; 5.
- [12] Teferi E, Teno D, Ali I, Alemu H, Bulto T. Quality of IMNCI services at health center under five clinics after introduction of ICCM, in three regions of Ethiopia, Ethiopia, Ethiopian Medical Journal. October 2014; 52(3).
- [13] Alfonso T, Minamisava R, Bierrenbach AL, Escalante JJC, Alencar AP, et al. Effect of 10 valent Pneumococcal vaccine on pneumonia among children. 4 April 2013; 19(4).
- [14] Pediatrics, Journal of American academy of pediatrics, Unit of Infectious Diseases, Karolinska Institute, Karolinska, Solana, Sweden.
- [15] Rurangwa J, Rujeni N. Decline in hospitalization and mortality after introduction of 7-Valent PCV in Rwanda, American Journal of Medical Hygiene, 2016, Jul 1824. Workie N, Roman G, UNICO studies series 10, The Health extension program in Ethiopia, the World Bank, Washington DC. January 2013.
- [16] Bennet A, Bar-Zeev NA. Cunliffe, Measuring indirect effect of Rotavirus vaccine in low income countries.
- [17] Parashar UD, Johnson H, Steele D, Tate JE. Health impact of Rotavirus vaccination in developing countries: progress and way forward.
- [18] He C, Kang I, Miao L, Li Q, Wang Y, et al. Pneumonia mortality Among children under five in China from 1996 to 2013; An analysis from national surveillance system. PLoS one. Jul 2015; 10(7): 0133620 .
- [19] Ethiopian Demographic Health Survey (EDHS). 2000-2016.
- [20] MELA. (Monitoring, Evaluation, Learning and Adapting), TRANSFORM program baseline survey report. May 2018.
- [21] Transform: Primary Health Care project, random follow up. 2018.
- [22] Lemma KT, Murugan R, Tachbele E, Negussie BB. Prevalence and associated factors of pneumonia among under five children at public hospitals in Jimma zone, South West of Ethiopia, Ethiopia. 2018; 1.
- [23] Abeje GF, Wubshet MT, Asres GA. Prevalence of pneumonia among under five children in Este town and the surrounding rural kebeles, Northwest Ethiopia; A community based cross sectional study. 24 April 2014.
- [24] Abuka T. Prevalence of pneumonia and factors associated among children 2-59 months old in Wondo Genet district, Sidama zone, SNNPR, Ethiopia ,published online, www.currentpediatrics.com. 2017; 21(1): 19-25.
- [25] Bizuneh H, Getnet F, Meresa B, Tegene Y, Worku G. Factors associated with diarrheal morbidity among under five children in Jigjiga town, Somali region, Eastern Ethiopia: A cross-sectional study. 2017; 17: 182.

- [26] Mohammed S, Tameru D. The Burden of Diarrheal Diseases among children under five years of age in Arba Minch District, Southern Ethiopia, and associated risk factors: A cross-sectional study.
- [27] Beyene SG, Melaku AT. Prevalence of diarrhea and associated factors among under five years children in Harena Buluk woreda, Oromia region, South East Ethiopia. 2018; 1(2).
- [28] Rahman AE, Moinuddin Md, Molla M, Worku A, Hurt L. Childhood diarrheal diseases in Seven low- and middle-income countries, Bulletin of World Health Organization. 23 June 2014.