

# Impact of Rota virus vaccine on diarrhea among under 5 years children in primary health care centers in left side of Mosul city

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## ABSTRACT

**Background:** Diarrheal disease is the second leading cause of death in children under five years old, and is responsible for killing around 525 000 children every year. Diarrheal disease is a leading cause of child mortality and morbidity in the world, and mostly results from contaminated food and water sources. Rotavirus is the most common cause of severe acute gastroenteritis (AGE) in young children. With the introduction of rotavirus vaccine in routine public health immunization programs, declines in the burden of severe childhood AGE have been documented in early vaccine-introducing countries, such as the United States, Australia, and several countries in South America and Europe.

**Materials and Methods:** A biometric descriptive study was conducted in order to achieve the aim of the present study in which the data was taken from the records present in statistical, integrated management of neonatal and child health and vaccination sections in left primary health care district which responsible for all primary health care and family medicine centers in left side of Mosul city. It depends on number of cases under 5 years who have diarrhea per one year before administration of rotavirus vaccine in primary health care and family medicine centers and number of cases under 5 years who have diarrhea after administration of rotavirus vaccine in the same centers in left side of Mosul city.

**Results:** demonstrated that the number of cases among less than 5 years before administration of rotavirus vaccine in primary health care and family medicine centers in left side of Mosul city was (6630) and this considered as a base line for comparison with diarrheal cases recorded in these centers after administration of rotavirus vaccine which was 5323 ( which represent 80.3% of diarrheal cases before administration of vaccine ), so that there is about 1307 (19.7%) of cases decreased after administration of vaccine per one year in left primary health care district (which responsible on primary health care and family medicine centers in left side of Mosul city) and this reduction was mainly among < 1 year of age which was 1009 (35.7 %) of cases reduced from 2824 before administration of vaccine in these centers and much less among those between age group 1 – 4 years which represent about 7.8% of cases reduced after administration of vaccine and the prevalence of diarrhea was decrease to 2.5 % after administration of vaccine in left primary health care district in Mosul city (was 5.4% in 2009).

**Conclusions:** This study conclude that there is reduction in frequency of diarrheal cases after administration of 2 doses of rotavirus vaccine (Rotarix)

**Key words:** Rotavirus, vaccine, diarrhea, under 5 years.

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## INTRODUCTION

Diarrheal disease is the second leading cause of death in children under five years old, and is responsible for killing around 525 000 children every year. Diarrheal disease is a leading cause of child mortality and morbidity in the world, and mostly results from contaminated food and water sources. Worldwide, 780 million individuals lack access to improved drinking-water and 2.5 billion lack improved sanitation. Diarrhoea due to infection is widespread throughout developing countries <sup>(1)</sup>.

In low-income countries, children under three years old experience on average three episodes of diarrhea every year. Each episode deprives the child of the nutrition necessary for growth. As a result, diarrhea is a major cause of malnutrition, and malnourished children are more likely to fall ill from diarrhea <sup>(1)</sup>.

Despite the improved safety of food, water, and sanitation and the aggressive promotion of noninvasive interventions (e.g., oral rehydration therapy) and prevention strategies (e.g., increased breast-feeding), diarrhea remains the second leading infectious cause of childhood death worldwide, accounting for approximately 1.8 million annual deaths in children under 5 years of age. Rotavirus is the single most important cause of severe childhood diarrhea globally and annually causes more than half a million deaths among children under 5 years of age <sup>(2)</sup>. In developing countries, it is a major cause of under-5 year old mortality, accounting for up to 20% of all childhood deaths in countries with high diarrheal disease burden and first rotavirus infections usually occur between 6-9 months of age, and 80% occur among infants <1 year old <sup>(3)</sup>.

Diarrhea-associated mortality has decreased since 1990 by nearly 65% in part because of improvements in safe water and sanitation and reductions in under nutrition among children younger than 5 years <sup>(4)</sup>. Sustained efforts to scale and implement effective interventions must remain the long-term goal to alleviate the global diarrhea burden. In response to the urgent need to prevent avertable diarrhea episodes and their associated mortality <sup>(5)</sup>, the World Health Organization (WHO) recommended that rotavirus vaccines be included in immunization programs in the European region and the Americas in 2006, a recommendation that was extended to all regions worldwide in 2009.3 In addition, Gavi, the Vaccine Alliance actively supports rotavirus vaccination by subsidizing the cost of vaccination in eligible countries <sup>(6)</sup>.

World Health Organization recommends the inclusion of rotavirus vaccination in all national immunization programs <sup>(6)</sup>. There are 2 licensed oral live attenuated rotavirus vaccines currently available globally: a monovalent human rotavirus vaccine [Rotarix (RV1) GlaxoSmithKline Biologicals, Rixensart, Belgium] and a pentavalent bovine-human reassortant rotavirus vaccine [RotaTeq (RV5), Merck Vaccines, Whitehouse Station, NJ]. RV1 is administered in 2 oral doses at 6 and 10 weeks of age and in United States given at the age of 2, 4 months, and RV5 is administered in 3 oral doses at ages 6, 10 and 14 weeks and in United States given at the age of 2, 4, 6 months <sup>(7, 8)</sup>.

#### Aim of the study:

To evaluate the effect of rotavirus vaccine on reduction of diarrhea among under 5 years in left primary health care centers in Mosul city.

### MATERIALS AND METHODS

**Study setting:** This study was conducted in Mosul city, sample was taken from the left bank of Mosul city to evaluate the effect of rotavirus vaccine on reduction of diarrhea among under 5 years from the visitors of primary health care centers and family medicine centers which belong to the left primary health care district.

**Study design:** A biometric descriptive study was conducted in order to achieve the aim of the present study in which the data was taken from the records present in statistical, integrated management of neonatal and child health and vaccination sections in left primary health care district which responsible for all primary health care and family medicine centers in left side of Mosul city.

**Period of the study and sample size:** The actual period of data collection began from the 1<sup>st</sup> of April 2019 till 15th of May 2019 and the sample size was 11953.

**Tools of data collection:** This study depends on number of cases under 5 years who have diarrhea per one year before administration of rotavirus vaccine in primary health care and family medicine centers and number of cases under 5 years who have diarrhea after administration of rotavirus vaccine in the same centers in left side of Mosul city in addition to (total number of children < 1 year, total number of vaccinated children < 1 year with 2 doses of Rotarix vaccine at the age of 2, 4 months, measuring the coverage rate of vaccine during one year, 2018 by dividing the total No. of vaccinated children < 1 year over the total No. of children <1 year eligible to take vaccine and total number of children < 5 years with total number of cases with diarrhea < 5 years before and after vaccination to measure the prevalence of diarrhea which calculated by dividing the No. of old and new cases over total No. of population at risk here they include <5 years children it express as a fraction as a percentage or the number of cases per 10000 or 100000 <sup>(9)</sup>, before and after vaccine to compare between them).

**Ethical acceptability:** The protocol was approved by Ethical and Scientific Committee in Nineveh health sector; an agreement was also signed by the guardian of the children and by the places where research was done.

### RESULTS

This study shows that the number of diarrheal cases before administration of rotavirus vaccine was (6630) per year which distributed according to age and sex as shown in (Table 1) which revealed that the number of diarrheal cases below 1 year of age per year was 2824 and about 1337 (47.3%) out of them was male and 1487 (52.7%) was female, while those between 1 – 4 years old was 3806 divided as 1823 (47.9%) male and 1983 (52.1%) female.

**Table 1: distribution of diarrheal case according to age and sex before administration of rotavirus vaccine**

Diarrhea	Male		Female		Total
	No.	%	No.	%	
< 1 year	1337	47.3	1487	52.7	2824
1 – 4 years	1823	47.9	1983	52.1	3806
					6630

(Table 2) clarify that the number of diarrheal cases after administration of rotavirus vaccine was( 5323) per year , 1815 out of them was < 1 year age and 3508 was between 1 – 4 years old .

From 1815 of < 1 year old , 828 (45.6 %) of them was male and 987 (54.4%) was female . In relation to those 3508 between 1 – 4 years old there was 1716 (48.9%) male and 1792 (51.1%) was female .

**Table 2: distribution of diarrheal case according to age and sex after administration of rotavirus vaccine**

Diarrhea	Male		Female		Total
	No.	%	No.	%	
< 1 year	828	45.6	987	54.4	1815
1 – 4 years	1716	48.9	1792	51.1	3508
					5323

Regarding reduction of number of diarrheal cases (Table 3) demonstrated that the number of cases among less than 5 years before administration of rotavirus vaccine in primary health care and family medicine centers in left side of Mosul city was (6630) and this considered as a base line for comparison with diarrheal cases recorded in these centers after administration of rotavirus vaccine which was 5323 ( which represent 80.3% of diarrheal cases before administration of vaccine ) , so that there is about 1307 (19.7%) of cases decreased after administration of vaccine per one year in left primary health care district (which responsible on primary health care and family medicine centers in left side of Mosul city) and this reduction was mainly among < 1 year of age which was 1009 (35.7 %) of cases reduced from 2824 before administration of vaccine in these centers and much less among those between age group 1 – 4 years which represent about 7.8% of cases reduced after administration of vaccine

**Table 3: comparison between diarrheal cases according to age before and after administration of rotavirus vaccine and frequency of reduction in cases**

Diarrhea	Before rotavirus vaccine		After rotavirus vaccine		Reduction in diarrhea	
	No./ year	%	No./ year	%	No.	%
< 5 years						
	6630	100 %	5323	80.3 %	1307	19.7 %
Diarrhea	No.	%	No.	%	No.	%
< 1 year	2824	42.6%	1815	34.1%	1009	35.7%
1 – 4 years	3806	57.4 %	3508	65.9 %	298	7.8%

Regarding the coverage rate of Rotavirus vaccine ( Figure 1) demonstrates that the number of vaccinated children < 1 year is (31139) and the total number of children < 1 year in all primary health care centers is (32544) , so that the coverage rate was 95.7% in 2018 ,so that Figure 2 reveals that the prevalence of diarrhea before administration of vaccine (2009) was 5.4% (by dividing No. of new and old cases on total population at risk during certain period of

time per 100 or 1000) which decrease to 2.5 % after administration of vaccine in left primary health care district in Mosul city and (Figure 3) determine that the total number of <5 years children before administration of vaccine(2009) was (121992) and the number of cases with diarrhea was (66300) on the other hand the total number of <5 years children after administration of vaccine(2018) was (212790) and the number of cases with diarrhea was (5323) which mean there is a reduction in cases of diarrhea in spite of increase total numbers of <5 years children after administration of vaccine but there is reduction in cases of diarrhea which is clear from prevalence of diarrhea in (Figure2).

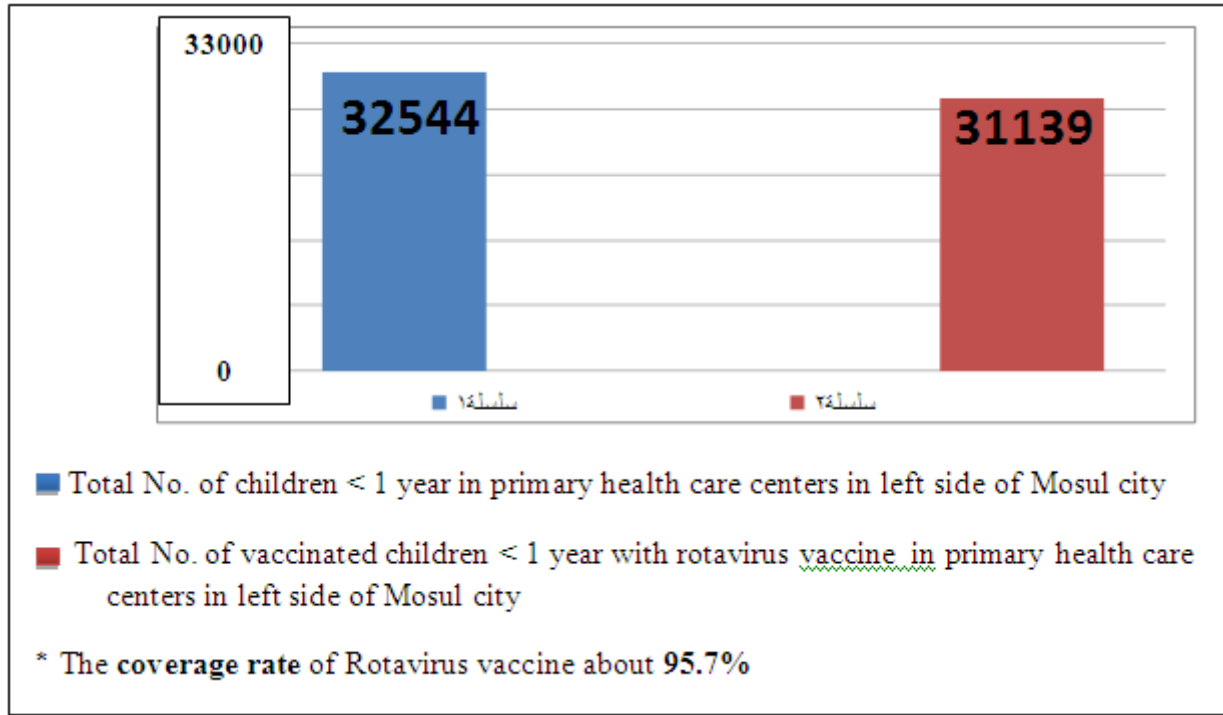


Figure 1: Coverage rate of Rotavirus vaccine 2018 in PHC in left side of Mosul city

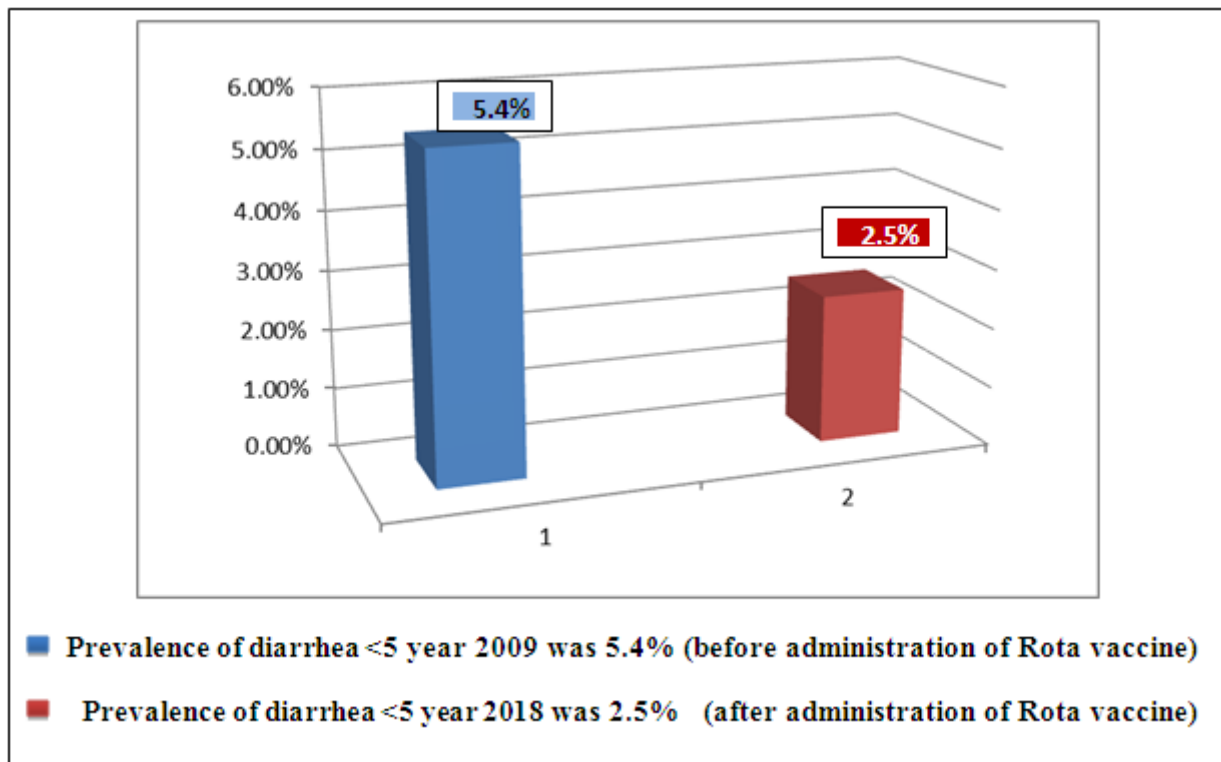
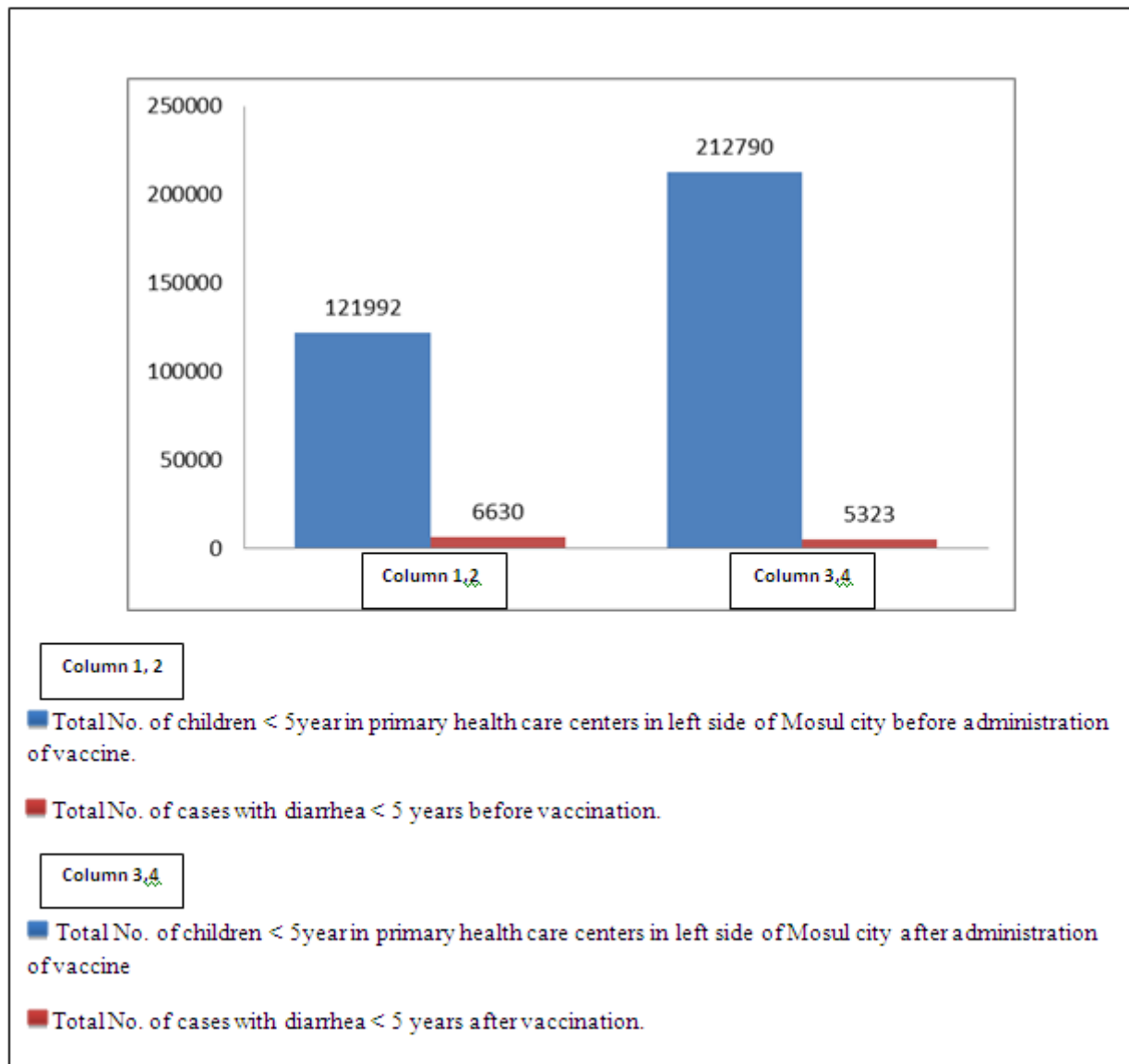


Figure 2: Comparison of prevalence rate of diarrhea < 5 years before and after administration of Rotavirus vaccine



**Figure 3: Comparison between total number of <5 years children and number of diarrheal cases before and after administration of Rotavirus vaccine**

## DISCUSSION

Rotavirus is the most common cause of severe acute gastroenteritis (AGE) in young children. With the introduction of rotavirus vaccine in routine public health immunization programs, declines in the burden of severe childhood AGE have been documented in early vaccine-introducing countries, such as the United States, Australia, and several countries in South America and Europe. Rotavirus vaccines are expected to have the highest impact on acute gastroenteritis morbidity and mortality in Africa, where the burden of disease is the greatest, but data from African countries on vaccine impact are sparse given the more recent introduction of vaccines in the region. Given the lower efficacy of rotavirus vaccines in developing countries compared with developed countries in clinical trials, assessing impact of routine rotavirus vaccination in developing settings is important<sup>(9)</sup>.

This study depends on the data from statistical and vaccination records of the all primary health care and family medicine centers in left side of Mosul city during one year before administration of rotavirus vaccine (2009) and on year after administration of rotavirus vaccine (2018) which introduced to routine national vaccination program in Iraq at 2011 and it revealed that the number of cases with diarrhea before vaccine was (6630) and (5323) of cases after administration of vaccine, so the reduction in diarrheal cases after receiving two doses of Rotarix vaccine which is available at 2018 was 19.7 % among < 5 years old children and the vaccine is considered one of the most important measures to prevent or decrease diarrhea in addition to good sanitation and safe water supply etc. but these measures except vaccine was not so available in left side of Mosul city mainly after war which extended from 2016 up to 2017 in spite of increase in total number of children < 5 years (2018 was 212790) in comparison to 2009 (was 121992). This reduction in frequency of diarrhea was mainly among < 1 year of age (35.7%) while among children 1 – 4 years was

(7.8%) and these results was similar to other study done in Lusaka, Zambia that observed a significant reduction in acute gastroenteritis -associated in-hospital morbidity and mortality following rotavirus vaccine introduction. The greatest reduction was seen in infants <1 year who accounted for 84.4% of rotavirus hospitalizations prior to vaccine Introduction <sup>(9)</sup> and mimic other study implemented in India which shows that the Diarrhea-associated hospitalization and outpatient visit rates ( children <5 years of age was 63 per 10 000 persons (range: 57–75 per 10 000), and declined to 39, 31, and 27 per 10 000 in 2008, 2009, and 2010, respectively) among American Indian and Alaska Native Children have declined after implementation of rotavirus vaccination in American Indian and Alaska Native populations <sup>(10)</sup>.

Another study was achieved to determine the global burden of rotavirus diarrhea among < 5 years which clarify that Rotavirus-associated mortality has decreased markedly over time in part because of the introduction of the rotavirus vaccine. This study suggests that prioritizing vaccine introduction and interventions to reduce diarrhea-associated morbidity and mortality is necessary in the continued global reduction of rotavirus infection <sup>(5)</sup> and similar other study done in Yemen which demonstrates that rotavirus vaccination in Yemen resulted in sharp reduction in diarrheal hospitalization ( the incidence of rotavirus hospitalization decreased from 43.79% in 2009 to 10.54% in 2014. Hospitalization due to rotavirus diarrhea was reduced by 75.93%) <sup>(11)</sup> and mimic other study done in Philippines which found that rotavirus vaccine introduction was associated with a substantial decline in diarrheal hospitalizations and outpatient consultations for diarrhea in Agusan del Sur, Philippines the reductions were 28% (n = 821), 56% (n = 507), 63% (n = 417) and 59% (n = 466) in 2013, 2014, 2015 and 2016, respectively. A declining trend was also seen in outpatient consultations in Agusan del Sur following RV vaccine introduction with declines of 27% (n = 2,333), 33% (n = 2,143), 45% (n = 1,764) and 67% (n = 1,059) in 2013, 2014, 2015 and 2016 <sup>(12)</sup>.

Regarding prevalence of diarrhea this study showed that there is reduction in prevalence of diarrhea in comparison between 2009 and 2018 which was 5.4 % and 2.5% respectively and one of the main causes of this reduction is administration of rotavirus vaccine .

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