

Changes in Occurrence of Diarrheal and Respiratory Diseases before and during COVID-19 Pandemic among Nepalese Population: A cross-sectional Study

Maheshor Kaphle^{1,*}, Anil Paudel², Laxmi Adhikari², Pratibha Shrestha³, Santosh Khadka², Rajesh Karki⁴

¹Department of Public health, Peoples Dental College and Hospital, Kathmandu

²Department of Public health, CiST College, Kathmandu

³School of Public Health at LSU Health Sciences Center-New Orleans, Louisiana, US

⁴Department of Public Health, Yeti Health Science Academy, Kathmandu

***Correspondence author:** Maheshor Kaphle; Contact: kafmahesh@gmail.com +9779841279138

ABSTRACT

Background: The government of Nepal has adopted a number of preventative and control measures to halt the spread of coronavirus disease (COVID-19). In this study, we aimed to determine whether the use of preventive and control measures such as hand washing, social distancing, lockdown implementation, and mask-wearing has significantly slowed down the spread of infectious diseases like diarrhoea and respiratory illnesses during the pandemic period.

Methods: A descriptive and cross-sectional study was conducted among 3086 participants across Nepal via electronic media from July 28 to August 30, 2020. The participants were asked to provide information about their experiences with diarrhoea and respiratory symptoms in the three months before and during the COVID-19 pandemic. The Mc-Nemar test was used to compare the incidence of respiratory and diarrheal diseases before and during the pandemic period.

Results: Compared to before and during the COVID-19 pandemic, vomiting (3.3%), diarrhoea (7.3%) and abdominal pain (12.1%) decreased to 2.8%, 6.9%, and 6.1%, respectively. Between two concurrent periods, such as before the onset and during the COVID-19 pandemic lockdown, the prevalence of dysentery and stomach pain was statistically different (p -value < 0.001). As the prevalence of the common cold decreased from 30.2% to 20.3%, so did that of sore throats (15.1% to 10.6%), coughs/chest pain (8.3% to 5.6%), dyspnoea (2.8% to 1.9%), and pneumonia (2.6% to 1.5%). This difference in the prevalence of respiratory diseases such as the common cold, sore throat, laryngitis/pharyngitis, cough/chest pain, dyspnoea, and pneumonia were statistically significant.

Conclusion: Upon comparing the COVID-19 period to the pre-pandemic period, it appeared that the symptoms of diseases like diarrhoea and respiratory illnesses were on the decline. Therefore, we can conclude that the Government of Nepal's preventive measures for COVID-19 have helped to reduce the prevalence of such diseases.

Keywords: COVID-19, Diarrheal diseases, Preventive measures, Prevalence, Respiratory diseases

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INTRODUCTION

The COVID-19 pandemic has spread all over the world since it first emerged in China.¹ WHO declared public health emergency on Jan 30, 2020 and pandemic

disease in March 2020.^{2,3} The first COVID-19 case in Nepal was reported on January 13, 2020 after a student returned from Wuhan, China.⁴ Different countries

adhered a variety of measures to fight against the pandemic. The majority of countries implemented strict lockdown, encouraged the use of masks, promoted hand hygiene, maintained social and physical distance and avoided overcrowding, etc.⁵ In order to control the spread of COVID-19 throughout Nepal, the government of Nepal decided to implement a lockdown and promote to adopt all the preventative measures on 24 March, 2020 and continued until 21 July, 2020 for the first wave. It was hoped that these measures may halt the spread of illnesses from one person to another by stopping the transmission of aerosols from infected people.^{6, 7}

There is evidence of human-to-human transmission through close contact, respiratory droplets, and touching contaminated surfaces.⁸ A mask can block or interfere with disease-carrying particles through its barrier technology.⁹ Precautionary measures like: wearing a face mask, washing or sanitizing the hands and avoiding social gatherings helped to prevent not only the spread of COVID-19 but also other viral and bacterial illnesses.¹⁰⁻¹² According to the studies, barely 2% to 30% of people in India, Bangladesh, China, and Ghana regularly washed their hands.^{13, 14} A study measuring the impact of personal protective measures, including the use of face mask and changing the mask every four hours, showed that the measures reduced the risk of upper respiratory tract infections by 44%.¹⁵ Similarly, the prevalence of respiratory and gastrointestinal illnesses decreased by 21% and 31% respectively as a result of proper hand hygiene.¹⁶

A systematic review revealed that using hand sanitizer and face masks decreased the secondary transmission of influenza, flu-like illness, and upper respiratory infections.¹⁷ Additionally, a Chinese research study found that during the COVID-19 pandemic, the prevalence of respiratory illnesses among women and children had decreased.¹⁸ And a study from the United States found that the prevalence of cough, shortness of breath, and influenza-like illness had decreased compared to the pre-pandemic period.¹⁹ However, there were no such studies on the prevalence of respiratory and diarrheal diseases both before and during the COVID-19 pandemic. Thus, the objective of our study was to assess the occurrence of respiratory and diarrheal diseases reported by Nepalese people before and during the pandemic.

MATERIALS AND METHODS

2.1. Study design and study site

While the country was under lockdown due to the COVID-19 pandemic, a nationwide online cross-sectional study was conducted in Nepal among the adults over the age of 18, from July 28 to August 30, 2020.

2.2. Sample size determination and sampling technique

To include a diverse sample during the COVID-19 lockdown, we utilized a convenient non-probability sampling technique. The sample size was initially determined using Cochran's formula, with a population proportion of 50% and an allowable error of 5%, resulting in an optimal sample size of 385. However, during the data collection period, we approached 3225 individuals. After excluding participants who did not provide the required and complete information in a timely manner, the final sample size was 3086.

2.3. Ethical clearance

This study was approved and reviewed by Institutional Review Committee of CiST (Central Institute of Science and Technology) college (Ref. No. 12/076/077). Before commencing the actual study, participants' consent for information was obtained. Information confidentiality was strictly maintained.

2.4 Data collection

The study team developed a questionnaire after conducting an extensive literature review. The questionnaire consisted of two sections: the first section contained questions related to socio-demographics and safety behavior, while the second section focused on respiratory and gastrointestinal symptoms experienced by participants within two concurrent time periods—three months before and during the COVID-19 pandemic. Participants were asked questions such as "Did you experience vomiting, diarrhea, dysentery, or abdominal pain and consult a doctor?" for diarrheal diseases and "Did you experience common cold, sore throat, laryngitis/pharyngitis, chest pain, dyspnea, or pneumonia and consult a doctor?" for respiratory issues. The questionnaire underwent pre-testing with 95 participants, and their responses were excluded from the final analysis. The

questionnaire was created using Google Forms and shared on various social media platforms, including Facebook and LinkedIn, as well as the website of CiST College. The study team mobilized college students who were scattered all over the country due to COVID lockdown to distribute the questionnaire among their friends, relatives, and acquaintances. In order to prevent duplication, only one response was allowed per online form, and only one participant per family was asked to provide information, as specified in the data collection form.

2.5. Data analysis

The data was downloaded into an Excel spreadsheet and cleaned as necessary from the Google form. The data were, then, imported into SPSS version 22 and changed from string to numeric type, suitably coded, and subjected to further analysis. Numerical variables were presented as mean and standard deviation, whereas, categorical variables were presented as frequency and percentage. The Mc-Nemar test was used to examine the change in the prevalence of respiratory and diarrheal diseases before and during the COVID-19 pandemic period, considering a p-value < 0.05 as a significant level.

RESULTS

In this study, a total of 3225 respondents took part, out of which 3086 provided complete information, resulting in a response rate of 96.13%. The participants' ages ranged from 18 to 71 years, with a mean age (SD) of 23.7 ± 6.7 years. Among them, 51.4% of the participants were male. Most of the participants (65.7%) belonged to nuclear families, 81.5% were unmarried, and 71.4% were from *Brahmin/Chhetri* cast. Additionally, 94% of the participants followed the Hindu religion. More than half of the participants had upper-middle-class socio-economic status (62.4%), and 59.4% had a higher education/diploma or above. (Table 1)

When compared to before and during the COVID-19 pandemic, the prevalence of nausea and vomiting (3.3%), diarrhea (7.3%), and abdominal pain (12.1%) decreased to 2.8%, 6.9%, and 6.1%, respectively. The prevalence of common cold decreased from 30.2% to 20.3%, as did that of sore

throats (15.1% to 10.6%), coughs/chest pain (8.3% to 5.6%), dyspnoea (2.8% to 1.9%), and pneumonia (2.6% to 1.5%). However, there was no reduction in the occurrence of dysentery. (Table 2)

Table 1: Socio-demographic characteristics of participants (n=3086)

Variables	Characteristics	n (%)
Gender	Female	1500 (48.6)
	Male	1586 (51.4)
Age	(mean $\pm$ sd)	23.7 $\pm$ 6.7
Type of family	Nuclear	2032 (65.8)
	Joint	990 (32.1)
	Extended	64 (2.1)
Marital status of the respondents		
	Married	548 (17.8)
	Unmarried	2514 (81.5)
	Separated	7 (0.2)
	Divorced	6 (0.2)
	Widow/widower	11 (0.4)
Socio-economic status of house hold* (Class)		
	Lower	14 (0.5)
	Upper lower	328 (10.6)
	Lower middle	656 (21.3)
	Upper middle	1926 (62.4)
	Upper class	162 (5.2)
Educational status of house hold head		
	Illiterate	63 (2.0)
	Primary school certificate	143 (4.6)
	Middle school certificate	282 (9.1)
	High school certificate	762 (24.7)
	Intermediate or diploma	535 (17.3)
	Graduate	1060 (34.3)
	Profession or honours	241 (7.8)
*Socio-economic status of household is based on International Wealth Index category		

In the Mc-Nemar test, the difference in the prevalence of dysentery and abdominal pain before and after the COVID-19 pandemic was statistically significant (p-value < 0.001). Similarly, compared to before COVID-19 lockdown, respiratory illness and symptoms were lesser in occurrence during the pandemic period. There were also statistically significant differences in the prevalence of respiratory illnesses like the common cold, sore throat, laryngitis/pharyngitis, cough/chest pain, dyspnoea, and pneumonia (P-value < 0.001). (Table 3)

Table 2: Difference in the prevalence of self-reported diseases/symptoms before and during COVID-19 pandemic

Self-reported disease/symptoms	Before (n, %)		During (n, %)	
	Yes	No	Yes	No
Diarrheal disease/symptoms				
Nausea and vomiting	101(3.3)	2985(96.7)	85(2.8)	3001(97.2)
Diarrhea	225(7.3)	2861(92.7)	212(6.9)	2874(93.1)
Dysentery	32(1.0)	3054(99.0)	100(3.2)	2986(96.8)
Abdominal Pain	372(12.1)	2714(87.9)	189(6.1)	2897(93.9)
Respiratory disease/symptoms				
Common cold	933(30.2)	2153(69.8)	627(20.3)	2459(79.7)
Sore throat	466(15.1)	2620(84.9)	328(10.6)	2758(8.4)
Laryngitis/pharyngitis	226(7.3)	2860(92.7)	141(4.6)	2945(95.4)
Cough/chest pain	255(8.3)	2831(91.7)	173(5.6)	2913(94.4)
Dyspnoea	85(2.8)	3001(97.2)	59(1.9)	3027(98.1)
Pneumonia	80(2.6)	3006(97.4)	45(1.5)	3041(98.5)

Table 3: Occurrence at least one episode of diarrheal and respiratory disease before and during COVID-19 pandemic

Disease/symptoms			During COVID-19 Pandemic		Mc-Nemar Test
Diarrheal disease			Yes	No	P-value
Nausea vomiting	Before	Yes	39	62	0.149
		No	46	2939	
Diarrhea	Before	Yes	112	113	0.411
		No	100	2761	
Dysentery	Before	Yes	14	18	<0.001*
		No	86	2968	
Abdominal Pain	Before	Yes	137	235	<0.001*
		No	52	2662	
Respiratory diseases					
Common cold	Before	Yes	480	453	<0.001*
		No	147	2006	
Sore throat	Before	Yes	220	246	<0.001*
		No	108	2512	
Laryngitis/Pharyngitis	Before	Yes	93	133	<0.001*
		No	48	2812	
Cough/chest pain	Before	Yes	106	149	<0.001*
		No	67	2764	
Dyspnoea	Before	Yes	40	45	<0.001*
		No	19	2982	
Pneumonia	Before	Yes	31	49	<0.001*
		No	14	2992	

*Indicates statistically significant values ($p \leq 0.05$)

DISCUSSION

This study sought to assess the changes in the occurrence of respiratory and diarrheal diseases 3 months prior to and during the COVID-19 pandemic. There have been

no studies done to determine whether the preventative measures taken against COVID-19 helped to lower the incidence of other infectious diseases like diarrhoea and respiratory illnesses or not.

During the COVID-19 pandemic, nausea and vomiting (3.3%), diarrhoea (7.3%) and abdominal pain (12.1%) were less common than they were prior to the pandemic, falling to 2.8%, 6.9%, and 6.1%, respectively. Our finding was also supported by the study conducted in rural Nepal.²⁰ Our findings were corroborated by a similar study done in China under the prevention and control measures of COVID-19 found that one of the diseases with the largest decline was infectious diarrhoeal disease (275,746 cases) in terms of year-on-year comparison.²¹ Similarly, a study from Korea that examined how the COVID-19 pandemic along with public health measures affected the incidence of gastrointestinal diseases according to age and sex during the pandemic also came to the conclusion that gastrointestinal diseases like infective enteritis and irritable bowel syndrome decreased by 29% and 9% respectively during the COVID-19 pandemic.²² This may be due to the improved knowledge and attitude of people to maintain hand hygiene as the Nepal government urged people to do so for the prevention and control of COVID-19 transmission. One meta-analysis carried out to assess the effect of hand hygiene on infectious disease risk in the community setting also concluded that improvements in hand hygiene resulted in reductions in the gastrointestinal illness of 31% (95% confidence intervals [CI]=19%, 42%).¹⁶ Another Chinese study revealed that the incidence of gastrointestinal infection overall reduced by 45.28%, from 253.73 in 2015–2019 to 138.84 in 2020 per 100 000 ($p < 0.001$), with hand, foot, and mouth disease (HFMD) showing the highest decline (64.66%; $p < 0.001$) as an implication of the prevention and control measures during COVID-19 pandemic.²³ A longitudinal study assessed the effectiveness of behavioural modification interventions on cleanliness in lowering diarrheal morbidity in Bangladesh and revealed that these interventions helped to reduce the incidence of diarrheal diseases.²⁴

Respiratory infectious disease prevalence from this study in Nepal has been changed significantly as a result of COVID-19 prevention and control measures and the decrease in incidence is directly related to the prevention and control measures at all stages. A study from China also found the number of visit due to respiratory disease had decreased January to June 2017 to 2020.¹⁸ The significant reduction in the prevalence of cough/chest pain and dyspnoea before and during the COVID-19 pandemic in our study findings was

supported by a previous, comparable study from the United States that reported the reduction in the prevalence of coughing and shortness of breath in 2020 compared to pre-pandemic 2019 year.¹⁹ Similarly, a Canadian study on the epidemiological analysis of the effectiveness of pandemic-related public health measures in reducing test positivity for seasonal respiratory viruses found that the overall test positivity for respiratory viruses during the COVID-19 was still low (7.2%) during the 2019–2020 post-influenza period.²⁵

The reduction in the prevalence of pneumonia from 2.6% to 1.5% in our study before and during the COVID-19 pandemic was similar with the finding of Taiwanese retrospective epidemiological surveillance research study (2017–2020) that found a sharp decline in all-cause pneumonia.²⁶ Furthermore, a systematic review study done on the impact of COVID-19 prevention measures on other common infections also concluded that following health protocols to avoid COVID-19 could help to lower the frequency of other infectious diseases like influenza and pneumonia.²⁷

Before and after the pandemic period, there was a statistically significant difference in the prevalence of respiratory problems/symptoms such as the common cold, sore throat, laryngitis/pharyngitis, cough/chest pain, dyspnoea, and pneumonia ($P\text{-value} < 0.001$). A study from China supported this result by indicating that non-pharmaceutical interventions (NPIs), such as the use of masks, regular hand washing, increased ventilation, less mingling, etc., played a beneficial influence in the prevention and control of respiratory and intestinal infectious diseases in 2020.²¹ Another study that examined the effect of increased public health interventions during the COVID-19 epidemic on gastrointestinal and respiratory infectious diseases in China found that overall respiratory infectious disease rates decreased by 7.47% from 181.64 per 100,000 in 2015–2019 to 168.08 per 100,000 in 2020 ($p < 0.001$).²³ Similarly, a comparative research on 19 major infectious diseases during the COVID-19 epidemic and post COVID-19 in Zhejiang found that non-pharmaceutical intervention reduced the incidence of 19 infectious diseases by 70.84%, from 9436.32 cases per 1,000,000 person-years to 2751.51 cases per 1,000,000 person-years, with a significant drop in the first response period of influenza, a respiratory illness.²⁸ Thus, the continuation of behavioural interventions such as

maintaining hand hygiene and wearing masks in crowded places will definitely help to prevent respiratory and diarrheal diseases in the coming days.

Strength and Limitations: The strength of our study is the large sample size that covers participants from most areas of Nepal. This is probably the first study in our knowledge that measures the differences in the occurrence of respiratory and diarrhoeal diseases before and during the COVID-19 pandemic that embarks on the importance of implementing the policy of practicing basic hygiene and social distancing in critical situations. Nonetheless, we acknowledge the self-reported occurrence of diarrhoeal and respiratory diseases as a limitation of this study that might introduce recall bias.

CONCLUSIONS

Respiratory and diarrheal disease cases decreased during the COVID-19 period compared to the pre-COVID-19 period. The infectious diseases such as, diarrhoeal (nausea and vomiting, diarrhoea, dysentery, abdominal pain, etc.) and respiratory (common cold, sore throat,

laryngitis/pharyngitis, cough/chest pain, dyspnoea, pneumonia) diseases typically spread through droplets, aerosols, physical contact, or via the fecal-oral route. We believe that the preventive and control measures such as, washing hands and frequently using alcohol base sanitizer, maintaining physical distance, lockdown, and wearing a mask have significantly decreased the spread of these infectious diseases. Further behavioural intervention research with causal relation is warranted to control respiratory and diarrhoeal diseases and health policymakers should emphasize on having policies related to hygiene and sanitation.

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