# Diarrhea an Epidemic Havoc and Causative Agents in Nepal a Quintessential (Review)

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**Abstract:** Nepal has been suffered from frequent epidemics by different diarrheal agents like bacteria, protozoa and viruses. Cholera epidemic and enteric diarrhea are often become routine seasonal outbreaks, the main causes of morbidity and mortality. The two most prevalent diarrheal bacterial pathogens are *Vibrio Cholera* and *Aeromonas spp.* In both cases, the co-infecting bacterial pathogens detected are Shigella spp. and *Campylobacter spp*. The other major co-infective bacterial pathogens in both cases were *E. coli* O157:H7 and VTEC. The higher prevalence of diarrhea is reported in the age group of less than 2 years. Highest prevalence of parasitic infection cases *Cyclospora spp, E. histolytica* followed by *Giardial lamblia* and the least frequency by *A. lumbricoides.* Among the viruses family Caliciviridae—the noroviruses and sapoviruses are reported frequently. Antibiotic therapy and vaccination have benefited millions of persons worldwide. Yet, constrained resources have now threatened our ability to adequately administer threats of infectious diseases by placing clinical microbiology services and expertise distance from the patient and their infectious diseases. infection control need to develop outbreak management policies, procedures and programs like surveillance, early identification, importance of routine practices and isolation of cases to prevent disease spread among the communities. Come into rapid respond policies for gastroenteritis outbreaks and procedures for managing outbreaks associated with food are must. It is a high time to overhaul the existing societal changes in health and sanitation beliefs and habitats of people by avoiding their deep rooted orthodox traditions.

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## Introduction

Diarrhea kills more than AIDS patients out of those children are the main victims especially in rural area of Nepal and a catastrophic health problem in developing countries like Nepal. It has been a serious problem to tackle such health issues for authorities though many efforts have little improvements to mitigate the situation. Diarrhea is defined by the World Health Organization as having three or more loose or liquid stools per day, or as having more stools than is normal for that person. According to the World Health Organization (WHO) and UNICEF, there are about two billion cases of diarrheal disease worldwide every year, and 1.9 million children younger than 5 years of age perish from diarrhea each year, mostly in developing countries. During the past three decades, factors such as the widespread availability and use of oral rehydration salts (ORS), improved rates of breastfeeding, improved nutrition, better sanitation and hygiene, and increased coverage of measles immunization are believed to have contributed to a decline in the mortality rate in developing countries. In some countries, such as Bangladesh, a reduction in the case fatality rate (CFR) has occurred without appreciable changes in the water supply, sanitation, or personal hygiene and this can be attributed largely to improved case management. ORS and nutritional improvements probably have a greater impact on mortality rates than the incidence of diarrhea. Prevailing poor living conditions and insignificant improvements in water, sanitation, and personal hygiene, despite some improvement in nutrition, is perhaps important in explaining the lack of impact on the incidence.

## Causative agents and pathogenic mechanisms

### Bacterial agents

In developing countries, enteric bacteria and parasites are more prevalent than viruses and typically peak during the summer months. Frequent epidemic bacterial havoc like cholera and enteric diarrhea are often become headache to control and normalize the health situation in Nepal. Among different causative agents following are the main causes of morbidity and mortality.

Diarrheagenic *Escherichia coli*. *E coli* is the commensal flora of intestine though few groups have found frequent pathogenicity. The group distribution varies in different countries, but enterohemorrhagic *E. coli* (EHEC, including *E. coli* O157:H7) causes disease more commonly in the developed countries.

- Enterotoxigenic *E. coli* (ETEC) causes traveler's diarrhea.
- Enteropathogenic *E. coli* (EPEC) rarely causes disease in adults.
- Enteroinvasive *E. coli* (EIEC) causes bloody mucoid (dysentery) diarrhea; fever is common in such situations.

• Enterohemorrhagic *E. coli* (EHEC)* causes bloody diarrhea, severe hemorrhagic colitis, and the hemolytic uremic syndrome in 6–8% of cases; cattle are the predominant reservoir of infection. Nearly all types cause disease in children in the developing world.

• Enteroaggregative *E. coli* (EAggEC) causes watery diarrhea in young children and persistent diarrhea in children with association with human immunodeficiency virus (HIV).

• Enterotoxigenic *E. coli* (ETEC) causes diarrhea in infants and children in developing countries.

• Enteropathogenic *E. coli* (EPEC) causes disease more commonly in children < 2 years, and persistent diarrhea in children.

EIEC and EHEC are not found (or have a very low prevalence) in some developing countries.

**Campylobacter:**

•Though less in developed countries but asymptomatic infection is very common in developing countries and is associated with the presence of cattle vicinity to the place of abode.

• Infection is associated with watery diarrhea; dysentery on occasions.

• Guillain–Barré syndrome develops in about one in 1000 of people with Campylobacter colitis; it is thought to trigger about 20–40% of all cases of Guillain–Barré syndrome. Most people pull through their illness, but muscle weakness does not always completely resolve.

• Poultry is an important source of Campylobacter infections in developed countries, and increasingly in developing countries, wherein poultry is flourishing rapidly.

• The presence of an animal in the cuisine area is menacing factor in developing countries. Campylobacter is one of the most repeatedly isolated bacteria from the feces of infants and children in developing countries, with peak isolation rates in children 2 years of age and younger.

**Shigella species:**

• Hypoglycemia, associated with very high case fatal outcome rates (CFRs) (43% in one study) occurs more frequently than in other types of diarrheal diseases.

• S. sonnei is common in developed countries, causes mild illness, and may cause institutional outbreaks.

• S. flexneri is endemic in many developing countries and causes dysenteric symptoms and persistent illness; uncommon in developed countries.

• S. dysenteriae type 1 (Sd1) — the only serotype that produces Shiga toxin, as does EHEC. It also is the epidemic serotype that has been linked with many outbreaks during which CFRs can be as high as 10% in Asia, Africa, and Central America. For inexplicable reasons, this serotype has not been isolated since the year 2000 in Bangladesh and India. A likely 160 million episodes occur in developing countries, primarily in children. It is more common in toddlers and older children than in infants. It is a potential for epidemic spread; any infection should be reported promptly to the public health authorities. In children, hypoglycemia can lead to convulsions and death.

**Vibrio cholerae:**

Universal outbreaks of cholera have been reported throughout the world occasional outbreaks in Nepal are reported many times.

Many species of Vibrio cause diarrhea in developing countries.

• All serotypes (>2000) are pathogenic for humans. Serogroups O1 and O139 are the only two serotypes that cause severe cholera, and large outbreaks and epidemics.

**Parasitic agents**

Out of different parasites, *Cryptosporidium parvum*, *Giardia intestinalis, Entamoeba histolytica*, and Cyclospora cayetanensis: these are uncommon in the developed world and are usually restricted to travelers. Most commonly cause acute diarrheal illness in children.

• These agents account for a relatively small proportion of cases of infectious diarrheal illnesses among children in developing countries.

• *G. intestinalis* has a low prevalence (approximately 2–5%) among children in developed countries, but as high as 20–30% in developing regions.

• Cryptosporidium and Cyclospora are common among children in developing countries; frequently asymptomatic.

**Viral agents**

Side by side industrialized and developing countries, viruses are the leading cause of acute diarrhea, mainly in the winter season.

**Rotavirus:**

• This virus is responsible for one-third of diarrheal hospitalizations and 500,000 deaths worldwide each year.

• coupled with gastroenteritis of above-average severity.

• Foremost cause of severe, dehydrating gastroenteritis among children.

• Almost all children in both industrialized and developing countries acquire infection by the time they are 3–5 years of age.

• Neonatal infections are common, but often asymptomatic.

• The incidence of clinical illness peaks in children between 4 and 23 months of age.

**Human caliciviruses (HuCVs):**

•These are being the members of the family Caliciviridae—the noroviruses and sapoviruses (previously called "Norwalk-like viruses" and "Sapporo-like viruses." ).

• Noroviruses are the most common cause of outbreaks of gastroenteritis, affecting all age groups.

Sapoviruses primarily affect children. This may be the second most common viral agent after rotavirus, accounting for 4–19% of episodes of severe gastroenteritis in young children.

Adenovirus infections most commonly cause illnesses of the respiratory system.

Depending on the infecting serotype, this virus may cause gastroenteritis especially in children.

**Antibiotic-associated diarrhea**

Albeit this type of diarrhea is rare but there is strong evidence of efficacy for *S. boulardii* or *L. rhamnosus* GG in adults or children who are receiving antibiotic therapy. One study indicated that L. casei DN-114 001 is effective in hospitalized adult patients for preventing antibiotic-associated diarrhea and *C. difficile* diarrhea.

**Nepal**

There have been frequent outbreaks cholera in different places of Nepal particularly mid western Nepal the recent outbreak tolled many people. There were happened to be unreported outbreaks through out the history and the fatalities were high among rural areas. Nepal remains a place for frequent outbreak of diarrheal diseases and the outbreaks mostly go without identifying the causative agents.

**Table 1 Overview of causative agents in diarrhea**

| **Bacteria** | **Viruses** | **Parasites** |
|---|---|---|
| | | |
| *Diarrheagenic Escherichia coli*<br>*Campylobacter jejuni*<br>*Vibrio cholerae O1*<br>*V. cholerae O139**<br>*Shigella species*<br>*V. parahaemolyticus*<br>*Bacteroides fragilis*<br>*C. coli*<br>*C. upsaliensis*<br>*Nontyphoidal Salmonellae*<br>*Clostridium difficile*<br>*Yersinia enterocolitica*<br>*Y. pseudotuberculosis* | Rotavirus<br>Norovirus (calicivirus)<br>Adenovirus (serotype 40/41)<br>Astrovirus<br>Cytomegalovirus | **Protozoan**<br>*Cryptosporidium parvum*<br>*Giardia intestinalis*<br>*Microsporida*<br>*Entamoeba histolytica*<br>*Isospora belli*<br>*Cyclospora cayetanensis*<br>*Dientamoeba fragilis*<br>*Blastocystis hominis* |
| | | **Helminths**<br>*Strongyloides stercoralis*<br>*Angiostrongylus ostaricensis*<br>*Schistosoma mansoni,*<br>*S. japonicum* |

**Table 7 Patient history details and causes of acute diarrhea**

| **Food-borne outbreak** | **Water-borne transmission** | **Seafood, shellfish** | **Poultry** | **Beef, raw seed sprouts** |
|---|---|---|---|---|
| Salmonella, Shiga-toxigenic E. coli, Yersinia, Cyclospora | Vibrios, Giardia intestinalis, Cryptosporidium | Vibrio Norovirus Salmonella | Campylobacter Salmonella | Shiga toxin–producing E. coli (STEC) Enterohemorrhagic E. coli |
| | | | | |
| **Eggs** | **Mayonnaise and cream** | **Pies** | **Antibiotics, chemotherapy** | **Person to person** |
| Salmonella | Staphylococcus Clostridium perfringens? | Salmonella Campylobacter jejuni Cryptosporidium Giardia intestinalis | Clostridium difficile | Shigella, Rotavirus |

**Table 8 Transmission details, causes of acute diarrhea and Diagnosis**

| Means of transmission | agents | Diagnosis |
|---|---|---|
| Community-acquired or traveler's diarrhea, | Salmonella, Shigella, Campylobacter | Culture or test for ETEC |
| Nosocomial diarrhea (onset > 2 days after hospitalization) | Clostridium difficile | Test for Clostridium difficile toxins A and B |
| (when associated with outbreak, and when patient is > 65 yr of age with coexisting | Salmonella, Shigella, Campylobacter | Culture and identification |
| in immunocompromised or neutropenic individuals, or when systemic infection is suspected | Shiga toxin–producing E. coli | Detection of Shiga toxin–producing E. coli (when dysenteric presentation) |
| Persistent diarrhea (> 14 days) | EPEC, EAggEC | Detection of EPEC, EAggEC |
| Protozoa and other associated | Cryptosporidium, Giardia, Cyclospora, Isospora belli | Diagnosis of parasites, Screening for inflammation HIV/AIDS |

Few studies recognized *V. cholera* as a causative agent in diarrheal diseases outbreak among the adult population in Nepal. Cholera is highly prevalent in developing countries where the condition of water, sanitation and hygiene are not well maintained and hence transmitted from person to person. Nevertheless, the susceptibility pattern has not thus far been studied at the community or during outbreaks. Adequate literature producing evidences on the causative agents of diarrheal disease epidemic in Nepal along with the sensitivity pattern of the causative agents are uncommon in Nepal. Fortunately, few studies on laboratory based surveillance data have been analyzed and reported the number of cholera cases acknowledged.

In 2009, there was an outbreak of diarrheal diseases in far-western region of Nepal followed by a massive outbreak in Jajarkot and other districts of mid-western region of Nepal (Achham, Baitadi and Doti) middle of the April to September 2009 to observe the trend of morbidity. *Vibrio cholera* was responsible agent for the occurrence of outbreak in far-west region of Nepal. The organism isolated was sensitive to all the commonly used antibiotics. Among the samples obtained, a total of 33 samples (11 from Mid-Western region of Nepal and 22 randomly selected samples from Far-Western region of affected area) were used in this study. Samples were processed in four main steps that included Incubation, Pre-treatment, DNA Extraction and Multiplex PCR. The two most frequent diarrheal bacterial pathogens that were detected were Vibrio spp and *Aeromonas spp.* In both cases, the co-infecting bacterial pathogens detected were Shigella spp. (33.3% and 22.2% with Vibrio spp and *Aeromonas spp* respectively) and *Campylobacter spp* (22.2% in both cases respectively). The other major co-infective bacterial pathogens in both cases were *E. coli* O157:H7 and VTEC family respectively, although their numbers were low as reported. Dr. Gajananda Prakash Bhandri carried out to find the causative agents of cholera in mid western Nepal. The objective of this study was to identify the causative organism and analyse the sensitivity pattern of the antibiotics in the local context to suggest the use of drugs in future diarrhea outbreak in Nepal. on his study the susceptibility pattern of microorganisms to the antibiotics has also been studied. *Vibrio cholera* was isolated from 27 samples out of 51 samples collected from different districts of far-western region. All of the 27 Vibrio isolates were identified as *V. cholerae* O1 whereas none of the isolates were identified as *V. cholerae* O139. All 27 Vibrio isolates were found to be El Tor biotype, serotype 01,sub-serotypeOgawa strain.. Thus the only isolate found during this outbreak was *V. cholerae* 01 ElTor Ogawa.

This study and findings from other studies clearly shows that diarrheal disease outbreak in adult population are mostly caused by *Vibrio cholera.*

Shyam Prakash Dumre, conducted laboratory-based surveillance from mid-June 2008 to mid-January 2009 at the National Public Health Laboratory, Nepal. Diarrheal samples alone were processed for *Vibrio cholerae.* Isolation and identification of the organisms were carried out as per standard protocol. The incidence of cholera was found to be 27.1%. Only *V. cholerae* O1 Ogawa biotype El Tor was found during the study. The 15-30 year age group was found to be more susceptible to cholera. The period from mid-June to mid-July had the highest incidence of cholera. Ampicillin, tetracycline, ciprofloxacin, and erythromycin were highly effective,

while 100% resistance was observed for furazolidone, nalidixic acid, and cotrimoxazole.

Another study by Sirjana Devi Shrestha as all the laboratory works were conducted in the bacteriology section of National Public Health Laboratory, Teku from March to September 2005. During this period a total of 340 stool samples from diarrhoeal patients were collected and processed according to the standard laboratory methods. Each patient suffering from diarrhoea was directly interviewed for his or her clinical history during sample collection.

A total of 340 stool samples were processed and studied from both sex including all ages of patients. Among the cases were sensitive to Furazolidone whereas 84.9% were resistant.

She concluded all *V. cholerae* strains processed sample 53 *Vibrio cholerae* cases were found. All isolated *Vibrio cholerae* O1 were El Tor, Inaba. All isolated (100%) *Vibrio cholerae* O1 were sensitive to Ampicillin, Ciprofl oxacin, Erythromycin and Tetracycline whereas all were resistant to Nalidixic acid and Cotrimoxazole. Only 15.1% isolated in this study were found resistant to Multi Drug Resistant (resistant to at least two antibiotics of different group). Ampicillin, Ciprofl oxacin, Erythromycin and Tetracycline were found still more potent antibiotics against *Vibrio cholerae* isolated during the study.

In a study from children hospitals from kathmandu, Shamshul Ansari and et al in 2013 follow a line of investigation with a purpose to assess the incidence of major genotypes of rotavirus causing acute diarrhoea in children less than 5 years of age. A total of 525 children outnumbered with acute diarrhoea in a children's hospital of Kathmandu, Nepal who were enrolled between April and September 2011. It has been estimated that approximately 25 % of child deaths are associated with diarrhoeal disease, particularly acute diarrhea. The incidence of acute diarrhoea due to rotavirus was 25.9 % (136/525) as determined by ELISA. The frequency of rotavirus cases was higher in children less than 2 years of age, among which the majority of cases (80.2 %) were in children between 6 and 24 months old. Genotypic characterization by RT-PCR revealed that the serotype G12 represented 55.9 % of cases in this study associated with P-types of either P[6], P[4] or P[8]. Further to this, a total of eight G/P combinations were identified, G12P[6] being the most common strain type of rotavirus in Nepal, with a prevalence rate of 46.4 %.

A study conducted by same afore mentioned person in TUTH under the title "Pattern of Acute Parasitic Diarrhea in Children under Five Years of Age in Kathmandu, Nepal" with an aim of finding the parasitic agents causing acute diarrhea in children. A total of 525 children with acute diarrhea in a children's hospital of Kathmandu, Nepal were enrolled between April 2011 and September 2011. The higher prevalence of diarrhea was in the age group of less than 2 years. The higher prevalence of diarrhea was in the age group of less than 2 years. Out of total 525 enrolled cases, protozoal parasites were found in 10.7% (56/525) of cases and helminthic parasites were found in 1.3% (7/525) of cases. Highest prevalence of 60.3% (38/63) of parasitic infection was found in the age group of 6 - 24 months followed by 7.9% (5/63) in the age group of less than 6 months. Of the total enrolled cases *E. histolytica* were 6.7% (35/525) followed by Giardial lamblia 3.4% (18/525) and the least frequency was due to A. lumbricoides constituting 0.6% (3/525).

A prior study conducted by T Ise, B M Pokharel and et el in 1996, an analysis of the seasonal outbreak of diarrhoea in children in Kathmandu, Nepal, reported *Vibrio cholera*, 01 biotype El Tor Ogawa was the major cause of this epidemic. The pattern of spread suggested a waterborne infection related to contaminated river water and this was confirmed by a field survey. Although the mortality rate was low, younger children were more susceptible. Enteropathogenic *E. coli* found to be a major cause for diarrhoea after cholera amongst children in this study.

Diarrhea is one of the leading diseases in Nepal which contributes to a significant increase (598/1000) in the incidence of diarrhea of children under five years in 2009/10 (DoHS). Prevalence of diarrhea is highest among children aged 6-11 months (22.6 %) and 12-23 months (19.6 %). PSI/Nepal has been promoting Water Guard – a household chlorine water purifications solution which enables parents and caregivers to effectively purify and ensure the safety of their family's water. Innovative Interpersonal Communication activities are organized in the community to address the misconception of 'clear water is safe water' and to generate awareness on the need to treat drinking water to prevent diarrhea.

Prof Dr Suman Rijal, B.P.Koirala Institute wrote Diarrhea is still a leading killer disease in Nepal.

*CDC published in a report Cyclospora cayetanensis* is an intestinal protozoal pathogen so as to highly endemic in Nepal. The seasonal transmission occurs almost exclusively from May through October, with a peak in June and July. For the reason that this is outside the main tourist seasons, the primary effect is on expatriates who stay through the monsoon. In addition to watery diarrhea, profound anorexia and fatigue are the characteristic symptoms of *Cyclospora* infection. The cure of choice is trimethoprim-sulfamethoxazole; no highly effective alternatives have been identified.

In 17 July 2009 (IRIN) -proclaims neglect of the rural health system and poor preparedness result in

thousands of avoidable diarrhoea-related deaths annually in Nepal. "The diarrhoea epidemic has repeated again due to the government's lack of effective preventive measures which we have been reminding the officials of every monsoon," Prakash Amatya, director of NGO Forum for Water and Sanitation, told IRIN.

By Pokhrel D, Viraraghavan T.et al diarrhoeal diseases are still a foremost challenge in Nepal because of insufficient safe water supply, poor sanitation and deprived living conditions. However, several other factors such as the literacy rate, socio-economic status, and social, religious or personal perception of the cause of disease may influence the rate of morbidity and mortality of diarrhoeal diseases. A yearly minimum death of 30,000 and morbidity of 3.3 episodes per child was estimated due to diarrhoea.

A study conducted by Batu Krishna Sharma, Shiba Kumar Rai et al presented the status of intestinal parasitosis in public school children (1 to 10 classes) in a rural area of the Kathmandu Valley have shown high levels of multiple parasitic infections. The overall prevalence of parasitosis was 66.6% (395/533). Tibeto-Burman children had a non-significant higher prevalence, compared with Indo-Aryan and Dalit children. Half (53.8%; 191/355) of the children had multiple parasitic infections. Altogether, nine types of parasites were recovered. The recovery rate of helminthes was higher (76.9%) than protozoa (23.1%). *Trichuris trichiura* was the most common helminthes detected, followed by hookworm, *Ascaris lumbricoides* and others. *Entamoeba coli* was the most common protozoan parasite, followed by *E. histolytica, Giardia lamblia* and others. In this study, more than half the children had polyparasitic infections. This is a clear indication of large numbers of various species of parasites in the local community.

Both protozoal and helminthic intestinal parasitic infections are common in HIV-infected people seeking care in healthcare facilities. The poor immune status as indicated by low CD4 T-cell count and TB may account for such a high risk of parasitic infection.

Raihan Shrestha and Mahendra Maharjan, study revealed that *Ascaris lumbricoides* was most common intestinal helminth parasite with a prevalence rate of 22.63% (112/495). *Enterobius vermicularis* was the least prevalent helminth parasite with prevalence rate of 0.40% (2/495). 30 (6.06%) students were infected with *Trichuris trichiura,* 9 (1.82%) with *Strongyloides stercoralis,* 8 (1.62%) with Hookworm, 5 (1.01%) with Taenia sp. and 4 (0.81%) with *Hymenolepis nana.* Among 137 positive cases, *A. lumbricoides* accounted for 81.75%, *T. trichiura* 21.89%, S. stercoralis 6.57%, *Taenia sp.* 3.65%, Hookworm 5.84%, *H. nana* 2.92% and *E. vermicularis* 1.46%

K Ono, S K Rai, found that a total of 334 diarrheal fecal samples (from 210 males and 124 females) collected in Kathmandu, Nepal, were studied for various kinds of enteropathogens. Overall, 33% fecal samples were positive for one or more enteropathogens. Altogether eight species of bacteria, three genera of viruses, and five species of protozoan parasites were detected with considerable seasonal variations. Among the bacterial isolates, enteropathogenic *Escherichia coli topped* the list followed by *Vibrio spp*. Only one sample had Shigella (S. sonnei). Rotavirus type A was the most frequently detected among the enteric viruses, followed by human enterovirus and human adenovirus, respectively. Among the enteric protozoan parasites, *Giardia intestinalis* was the most frequently detected followed by *Cryptosporidium parvum*. Detection of bacterial and protozoan pathogens showed a slightly high tendency in the summer season compared with that in the other seasons, whereas the detection of viruses was significantly high in the winter season. Of the total 57 water samples, 43 (75%) showed one or more bacterial species out of which 51% (22/43) were *E. coli*. Among the *E. coli* isolates, 68% were EPEC. Enterohemorrhagic *E. coli* (O157) was not detected.

The long-term consequences of diarrheal diseases remain poorly studied, and analyses of global trends have not considered them. Niehaus and others in 2002 evaluated the long-term consequences of acute diarrheal disease on psychomotor and cognitive development in young children. Following a cohort of 47 children in a poor urban community in northeastern Brazil, they correlated the number of diarrheal episodes in the first two years of life with measures of cognitive function obtained four to seven years later. They found a significant inverse correlation (average decrease of 5.6 percent) between episodes of early diarrheal disease and overall intellectual capacity and concentration, even when controlling for maternal education or helminthes infection, which are known to be independent predictors of malnutrition and cognitive defects.

Recent evidence suggests that genetic factors may also be involved in the developmental response to repeated diarrhea (Oria and others 2005). Better and more sensitive assessment tools are needed to define the relationships between diarrheal diseases and developmental disorders and to calculate individual and societal costs and the cost-effectiveness of interventions. In addition, early childhood malnutrition resulting from any cause reduces physical fitness and work productivity in adults. We assumed that enteric pathogens can survive in the environment outside of a host; this fact dictates the possible pathways a waterborne pathogen can exploit in completing its transmission cycle. Because infectious

diseases are transmissible, individuals may be indirectly at risk of an environmental exposure.

**Discussion**

An even greater problem than the reluctance to use the medical treatment provided is the continuing use of unhygienic methods of childcare. These include feeding children without first washing hands properly, using dirty utensils to carry drinking water, defecation in inappropriate places and a lack of latrines along with the provision of unsafe drinking water. Collectively, these factors are cited as the leading causes of diarrhoeal disease spreading among the young.

Altogether above reviewing the finding by different personals the causative agents of diarrhea in Nepal has shown that the bacterial isolates, enteropathogenic *Escherichia coli* peaked the list went after by *Vibrio spp* and averaged out Shigella (S. sonnei) the least among bacterial diarrhea. After which followed by Rotavirus type A was the most recurrently detected among the enteric viruses, followed by human enterovirus and human adenovirus, correspondingly. Along with the enteric protozoan parasites, *Giardia intestinalis* was the most repeatedly detected followed by *Cryptosporidium parvum*.

Going through the antibiotic susceptibility many diarrhoeagenic bacterial have found prone to resistance to most frequently used ones. The entire isolates (100%) *Vibrio cholerae* O1 were sensitive to Ampicillin, Ciprofl oxacin, Erythromycin and Tetracycline while all were resistant to Nalidixic acid and Cotrimoxazole. Only 15.1% isolated in this study were found resistant to Multi Drug Resistant (resistant to at least two antibiotics of different group).

A large percentage of the inhabitants remain at risk for such health hazards due to broke poverty, deficient sanitation awareness about basic hygiene and healthcare, unpotable drinking water and illiteracy or under- education. The majority fatality occurred in at the back of beyond villages in the mid-western region. What's more, there are problem of access with aid workers vying to get in to these villages because of lack of road facilities secondly impenetrable roads made shoddier by the rains.

Among afore mentioned many factors the count which are in short supply of safe water, underprivileged sanitation habits and destitute living conditions diarrheal diseases are still primarily many people have to take the bull by the horns in Nepal. On the other hand, several other factors for instance the literacy rate, social, religious or personal perception of the cause of disease and socio-economic status, may influence the rate of morbidity and mortality of diarrhoeal diseases that many people become victimized. In conjunction with water supply and sanitation intervention simultaneous environmental health education awareness programs might be effective mitigation measures to reduce diarrhoeal diseases in Nepal. These findings strongly indicate a need for a comprehensive program to combat intestinal parasites associated with morbidity and mortality in Nepal.

**Further Strategy**

Progress in potable water and safe and sound sanitation, the ease of use of antibiotics, enough nutrition, and extensive use of vaccines have add up to a remarkable plunge in deaths due to diarrheal diseases in the industrialized world. Similar schemes and tools can be appropriated to put off and care for these diseases in population who live in poorer countries like Nepal. Improved personal and household hygiene and access to potable drinking water and better sanitation are on the immediate need. Low-cost interventions should be offered in Nepal to help prevent infection and death from acute diarrhea in young children, including oral rehydration solution, Vitamin A and zinc supplements, and exclusive breastfeeding in the first six months of life, WHO has recommended that rotavirus vaccine be included in all national immunization plans. The cholera vaccine Shanchol was licensed in India and prequalified by WHO in 2011. Multiple typhoid vaccines are in development, as are a combined typhoid and paratyphoid vaccine and vaccines against enterotoxigenic E. coli (ETEC) and Shigela. Our strategy also calls for working with international health organizations to ensure that countries, donors, and partners focus sufficient resources and coordinate efforts to address enteric and diarrheal diseases.

**Further policy**

These data confirm the serious concern as to whether there will be adequate laboratory infrastructure resources available to meet the challenges posed by current threats of infectious diseases; especially in resource-constrained practice settings. Modern medicine has led to dramatic changes in infectious diseases practice. Vaccination and antibiotic therapy have benefited millions of persons. However, constrained resources now threaten our ability to adequately manage threats of infectious diseases by placing clinical microbiology services and expertise distant from the patient and their infectious diseases. Continuing in such a direction threatens quality of laboratory results, timeliness of diagnosis, appropriateness of treatment, effective communication, reduction of health care-associated infections, advances in infectious diseases practice, and training of future practitioners. Microbiology laboratories are the first lines of defense for detection of new antibiotic resistance, outbreaks of food borne infection, and a possible bioterrorism event.

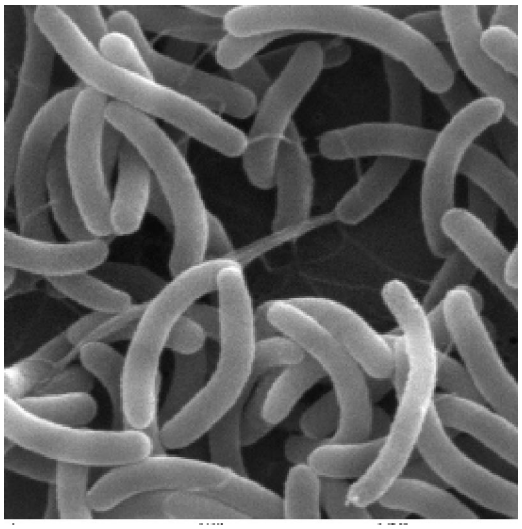
Maintaining high-quality clinical microbiology laboratories on the site of the institution that they serve is the current best approach for managing today's problems of emerging infectious diseases and antimicrobial agent resistance by providing good patient care outcomes that actually save money. Government of Nepal must develop policy statements and an action plan that supports the best use of our clinical microbiology resources to benefit the general public and their health of the Nepal. A major question to consider is whether maintaining microbiology laboratories within hospitals or medical centers is financially viable. Not many institutions have been able, or willing, to study this important issue. Clinical microbiology laboratory that is staffed and equipped to fully handle local patient care and infection control needs, and that has the on-site infrastructure capability to report their data to a national repository, such as the Centers for Disease Control and Prevention. To enhance their clinical microbiology laboratory support for infection control purposes. Effective communication is one of the most important characteristics of a microbiology laboratory, wherever it is located. To be effective, the opportunity for dialogue between health care providers and laboratory personnel must be readily accessible, if not immediately available. On the basis of our current knowledge, it appears that the management of infectious diseases will be best accomplished by the maintenance of clinical microbiology laboratories. Successful detection and interpretation of results clearly require adequate staffing with specially trained medical technologists and supervision by laboratory directors who have received training in a clinical and/or medical microbiology program that qualifies them for certification by Nepalese government authorized Board of Medical Microbiology under the academia of Biomedical sciences which must have to set up in near future. The microbiology laboratory also is a crucial component of the infection control team responsible for preventing health care-associated infections, thus promoting good patient care outcomes. Microbiology receives almost any clinical specimen, including swabs, feces, urine, blood, sputum, cerebrospinal fluid, synovial fluid, as well as possible infected tissue. The work here is mainly concerned with cultures, to look for suspected pathogens which, if found, are further identified based on biochemical tests. Also, sensitivity testing is carried out to determine whether the pathogen is sensitive or resistant to a suggested medicine. Results are reported with the identified organism(s) and the type and amount of drug(s) that should be prescribed for the patient. Virology is concerned with identification of viruses in specimens such as blood, urine, and cerebrospinal fluid. Parasitology that investigates parasites the most frequently encountered specimen here is faeces. However, blood, urine, sputum, and other samples may also contain parasites. All these should have to follow the standard laboratory methods and regulations.

IN rural Nepal, death due to diarrhoea is nothing new

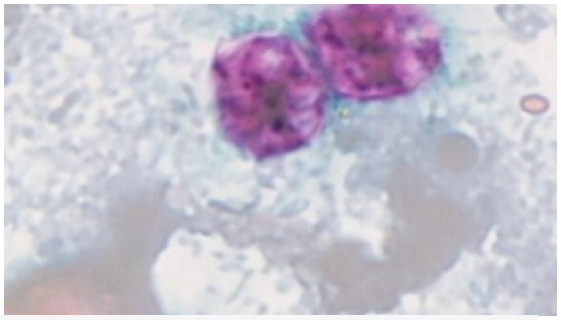

In cultivated on blood agar. Cultivation 24 hours, 37°C in an aerobic atmosphere

To cut a long story short we can suggest promoting the following stringent further strategy in coming days.

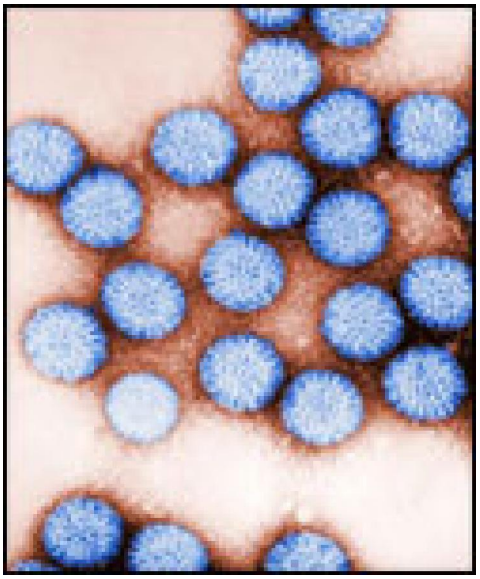
1. Develop outbreak management policies and procedures and infection control programs.
2. Understand the importance of surveillance, early identification, and isolation of cases to prevent disease spread.
3. Educate their staff on policies and procedures and the importance of Routine Practices.
4. Respond to and manage a gastroenteritis outbreak should one occur.
5. Develop procedures for managing outbreaks associated with food.



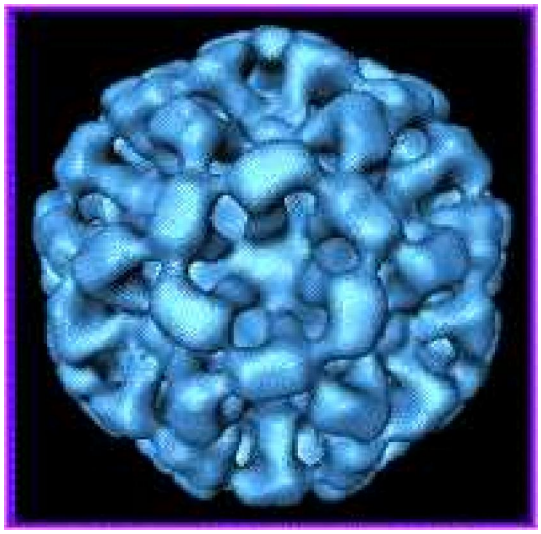
Scanning electron microscope image of *Vibrio cholerae*



**cyclospora**



Transmission electron micrograph of intact double-shelled rotavirus particles.



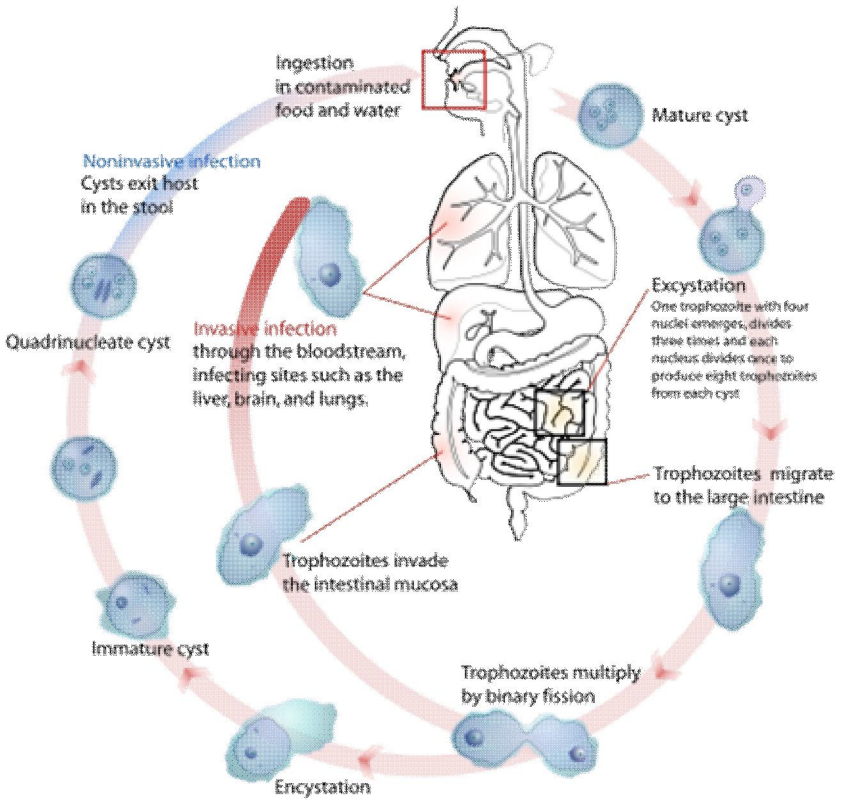
Norwalk virus by Immuno-EM.

**Conclusion**

Nepal faces Diarrhoeal diseases still are a foremost challenge. Among different causative agents *Vibrio cholera* 01 biotype El Tor Ogawa has been found the major cause of epidemics. Enteropathogenic *E. coli* found to be a major cause for diarrhoea after cholera and Shigella (*S. sonnei*) the least among bacterial outbreaks. Rotavirus type A has been brought into being the most commonly detected among the enteric viruses, pursued by human enterovirus and human adenovirus, correspondingly. *Giardia intestinalis* was the most frequently detected followed by *Cryptosporidium parvum* very often among the enteric protozoan parasites sometimes associated with other parasitic infestations like *Ascaris lumbricoides* and others. *Entamoeba coli* has revealed the most common protozoan parasite, followed by *E. histolytica, Giardia lamblia* and others. It is prevalent that the large numbers of various species of parasites exist on in the local neighborhood.

On the basis of our current knowledge, it appears that the management of infectious diseases will be best accomplished by the maintenance of clinical microbiology laboratories. Successful detection and interpretation of results clearly require adequate staffing with specially trained medical technologists and supervision by laboratory directors who have received training in a clinical and/or medical microbiology program that qualifies them for certification.

It is a high time to overhaul the existing societal changes in health and sanitation habitats of people by avoiding their deep rooted orthodox traditional beliefs. Many of them living in the verge from centre need enhancement in educational and economic welfare otherwise remain at risk due to extreme dilapidated poverty which further exacerbates their health.




Life-cycle of *Entamoeba histolytica*

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