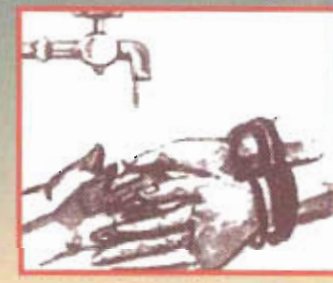
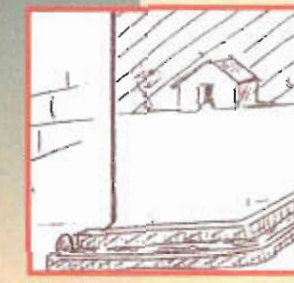
A Manual on
Control of Gastroenteritis
with special reference to
Andhra Pradesh, India





Prasanta Mahapatra
Samatha Reddy

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At the time of publication in 2002, the Institute of Health System was located in HACA Bhavan, Hyderabad, AP - 500 004, India. In November 2021, the Institute of Health Systems shifted to its present location in Sivananda Rehabilitation Home Campus, Kukatpally, Hyderabad 500072.

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Disclaimer

The manual on control of gastroenteritis has been prepared following consultation with experts and is based on information available at the time of its preparation. Health officials and health workers should have regard to any information on these matters which may become available subsequent to the preparation of the manual.

The guidelines, suggestions and recommendations are made in good faith. The authors recommend that persons with specific problems consult a medical practitioner. Neither the Institute of Health Systems, Hyderabad nor any other person associated with the preparation of the manual accepts legal liability or responsibility for such advice or recommendations.

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Publisher's Note

Preparation of this manual was commissioned by the Government of Andhra Pradesh. Copies of the manual for official circulation have been published by the Director of Health, Hyderabad, Andhra Pradesh.

We feel that the manual has wider application and would be of interest to general public, health system researchers, public health officials elsewhere, both in and outside India. This priced publication has been brought out by the IHS publications to make it available to a wider audience.

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Preface

Government of Andhra Pradesh Commissioned[1] the Institute of Health Systems to prepare a comprehensive manual to achieve better control of the gastroenteritis (GE) situation in the state. We, the GE Manual Preparation Team, at IHS are very pleased to offer, through this manual, our contributions towards control of GE in the state. Immediately after commissioning, we started collecting all available materials about gastroenteritis control activities in the state. We interacted with the officers in the Directorate of health dealing with communicable disease control and gastroenteritis. We discussed the matter among the Institute's faculty and attended the National Workshop on Communicable Disease Control conducted by the State Government in December, 2000. The workshop was very informative.

This manual departs from traditional programme implementation manuals in the sense that this is a manual addressed to every one in the state, who has a role towards control of gastroenteritis. We start with a brief overview of causes of GE and basic insights which may help every one contribute to its control. In Chapter-1 we argue that incidence of gastroenteritis is an indicator of our social and economic development. Access to adequate quantity of safe drinking water, closed sewerage system, and good nutritional status by most of the population will automatically result in a sustained reduction in the level of GE incidence. All these three factors are linked to economic development. In addition, literacy and resultant awareness among people about health status enhancing personal hygiene will contribute to reduction of GE incidence. This is the social factor we refer to. The second chapter describes the epidemiology of gastroenteritis, including how to recognise various manifestations like diarrhoea, dysentery, causative organisms and risk factors, etc. The chapter ends with an analysis of GE incidence in AP. The third chapter is addressed to all individuals, families and households. We feel this is the most important chapter of the manual. We describe about proper use of water for hygiene, and drinking and personal hygiene useful to avoid gastroenteritis. The next chapter is meant to assist community health workers with information and insights for management of gastroenteritis. Tips of recognition of gastroenteritis are provided. Steps for preparation of oral rehydration solution and its usefulness in management of GE are described. Chapter-5 is written from an public health managers point of view regarding prevention, control and management of GE. The Primary Health Centres in rural areas, and Health Officers in municipalities have a major role to play. The chapter gives instructions about surveillance of drinking water and food quality, early detection of GE outbreaks and medical management of GE cases. The need for proactive information and education strategy to secure community involvement in control

[1] Government of AP GORt. No. 1495 dated 7/12/2000, HM&FW department.

of GE outbreaks is emphasised. Health officers are expected to proactively release press notes giving information about the cause of outbreak, and what can people do to avoid or minimise its adverse effect. The chapter ends with information about the status of vaccination. The purpose is to educate all concerned about the futility of running after vaccination to control adverse effect of a GE outbreak. Based, on available evidence, it is argued that control efforts should focus on supplying safe drinking water, removing sources of contamination, proper management of GE cases etc. rather than on vaccination. Chapter-6 talks about epidemiological investigation of GE outbreaks. Case studies of a few actual GE outbreaks reported by the public health department are given. It is important that each outbreak is thoroughly investigated to localise the cause of outbreak .This will facilitate a rational and cost-effective response. Such investigations will also help educate public health officers to prevent similar outbreaks in future.

Water and food quality are the key to control of GE. Public health laboratory facility for testing of water and food samples play an important role. These facilities help public health officials properly investigate outbreaks. They also help members of public to get suspected water and food tested for their bacteriological quality. If more and more people use these facilities, they would have contributed to a more watchful society leading to eventual control of GE. To facilitate work of public health officials and empower general public in checking of water or food quality, Chapter-7 describes the public health laboratory facilities in the state. Addresses and where ever available contact telephone numbers of public health laboratories, water and / or food testing laboratories, etc. have been given. Information about such laboratory facilities in the private sector is also provided. Chapter-8 is about food hygiene. Our target audience are the caterers and food handlers. Public health officials and general public can also use information in this chapter to judge the extent to which particular food and catering establishments are operating in a hygienic manner.

Government of AP constituted an Expert Committee to study the problem of GE among a few other communicable diseases. Chapter-9, which is the last chapter of this manual, contains the recommendations of this committee about control of gastroenteritis.

This manual is a product of collaborative effort. We have received generous help from many people. Dr KV Satyanarayana Murthy, Associate Professor, Social and Preventive Medicine, Osmania Medical College was kind enough to spend two weeks with the Institute and helped us in getting started. Dr. Jaipal Reddy, Director Health has been very helpful in being available for discussions. We have learnt from his experience. Many a times we sounded him of our ideas and concerns and benefited from his assessment. Dr. Srinivasa Sarma, Additional Director, Communicable diseases, Dr. Gopal Reddy , Joint Director Epidemics, and Mrs. Krishnaveni, Deputy Statistical Officer were very helpful in providing

us with official information and data on GE incidence. We are grateful to Dr. Sangram Singari, Director, IPM for having provided us with information about public health laboratories and comments on the draft manual. Mrs. Shyamala, Chief Analyst, IPM helped us with information about water quality testing. Our thanks are due to G Rama Naidu, Chief Engineer, (RWS), Mr. Satish, and Mr. Parthasaradhi, Assistant chemists, in the same department for information on water quality testing facilities in their department. We would also like to thank our colleagues at the IHS for their help. Dr. PV Chalapathi Rao, helped us in getting started and by reviewing our draft. Ms Kavitha provided library and documentation support. Shri Goverdhan, Research Assistant helped us in gathering literature and official documents.

We are very grateful to the Government of AP, Shri C. Arjun Rao, Special Chief Secretary to Government of AP Health, Medical and Family Welfare Department, and Shri AK Tigdi, for their encouragement. Shri Arjun Rao has been the primary source of inspiration for our work.

June 15, 2001

Prasanta Mahapatra, Director
Samatha Reddy, Research Fellow

About Institute of Health Systems

Institute of Health Systems (IHS) is a civil society institution. It was established in 1990 and registered under the Societies Registration Act[1]. A group of concerned citizens, each specialising in a different field having linkages with health care, realised that the health services, in India, had been viewed as a technological affair. There are a lot of areas in the health care delivery system which cannot be handled well with medical technical skills that our health staff are usually equipped with. They recognised the need for development of skills in interdisciplinary areas like health management, health economics, health informatics, medical sociology, health policy studies, etc. The need for operations research to arrive at solutions appropriate to local needs was recognised. The Institute was set up to fill in this gap and to realise the vision of an equitable and cost-effective health care delivery system in India. IHS objectives include health systems research, development of interdisciplinary skills to improve efficacy of health care delivery system, health policy analysis, application of information technology in health sector.

The Institute is governed by a system of authorities consisting of an executive committee, a general body and the board of governors. Programs and activities of the Institute are carried by a team of faculty and staff lead by the Director, who is the chief academic and executive officer of the Institute. IHS is registered as a charitable scientific institution under section 12A of the Income Tax Act[2]. Contributions to IHS are eligible for exemption under section 80G of the Income Tax Act[3]. The Institute has been granted permanent registration by the Government of India Ministry of Home Affairs under the Foreign Contributions Regulation Act[4]. Starting with the first meeting held in July 1994, annual general body meetings are conducted every year, around December - January. IHS files its audited accounts with the Income Tax department every year. Annual reports are filed with the registrar of societies and are accessible to public through the registrar of documents. In addition the annual reports, and audited accounts of the Institute are made available, along with other publications of the Institute, to interested persons for a small charge. Membership of the Institute is open to any person who has consistently evinced interest and demonstrated commitment towards objectives of the institute and to Institutions with complementary objectives.

The Institute is largely supported by project based funding and income from services provided by it. IHS services, activities and projects broadly fall into research, training and consultancy assignments. The Institute strives to maintain a balance between these three modes of learning and application to provide an environment for intellectual development, knowledge based work and at the same time keep the skill set of its faculty well grounded to realities of social services delivery in India and other developing countries. The Institute fosters a team of faculty from multiple disciplines, provides modern office facilities, knowledge based resources, and an enriched work environment.

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[1]Registration number 3748/90, under the AP Telengana Area Societies Registration Act. 1350 Fasli.

[2]Commissioner of Income Tax letter no. II/12A & 80G/64/90-91 dated December 19, 1990.

[3]First granted by Commissioner IT AP-II, Hyderabad letter no. H.Qrs. No.II/12A & 80G/64/90-91 dated December 31, 1990. Latest renewal for the period 01-04-99 till 31-03-2002 by Commissioner IT, AP Proceedings number Hqrs-II/12A & 80G/77/97-98, dated 07-10-99.

[4]IHS permanent FCRA registration number is 010230292 vide Govt. of India, Ministry of Home Affairs letter no. II/21022/61(4)/93-FCRA-III.

Contents

I. Gastroenteritis as an indicator of our social and economic development. Insights about the problem of gastroenteritis

Gastroenteritis is an illness which may cause some or all of the following symptoms: (a) diarrhoea or dysentery; (b) stomach cramps; (c) vomiting; (d) nausea; (e) fever; and (f) headache. Doctors tend to distinguish gastroenteritis from diarrhoea / dysentery based on the presence or absence of vomiting. Vomiting occurs usually if the stomach is inflamed in addition to the small intestine, hence the term gastro (meaning stomach) and enteritis meaning inflammation of the intestine. In practice, however, the intestine and stomach may both be inflamed but to different degrees. The symptoms can vary depending on the cause of the illness, but the "classic" signs of gastroenteritis are a combination of diarrhoea, fever, and vomiting. Vomiting and fever may or may not occur, but either diarrhoea or dysentery is almost always part of the picture. In this manual the term gastroenteritis is used to include the entire range of manifestations including typical gastroenteritis characterised by enteritis and gastritis, diarrhoea, and dysentery. Diarrhoea, being the common denominator of almost all forms of gastroenteritis is sometimes, depending on context, used as a synonym.

The most common germs that cause gastroenteritis are bacteria, viruses and certain parasites. They may be found in soil, wild and pet animals including birds, and humans. Gastroenteritis occurs when these germs are taken in by mouth and this may happen in any of the following ways:

i. From person to person: This may occur directly by close personal contact or contact with the faeces of an infected person, or indirectly by touching contaminated surfaces such as taps, toilet flush handles, children's toys and nappies.

ii. Eating contaminated food.

iii. Drinking contaminated water.

iv. Airborne through vomiting, coughing and sneezing (mainly viruses).

v. Handling pets and other animals.

Food can become contaminated by people who have gastroenteritis, if they do not wash their hands properly after going to the toilet and before handling food. Bacteria which can cause gastroenteritis are often present in raw foods such as meats, poultry and eggs. These raw foods must always be handled, prepared and stored so as not to contaminate other foods. Proper cooking will kill these bacteria. If insects, rodents or other animals are not stopped from entering areas where food is prepared, they may contaminate food, equipment, benches and utensils with gastroenteritis germs. Creeks, rivers, lakes and dams may be polluted with faeces from humans or animals.

The importance of our immediate living environment for reduction of gastroenteritis can be gauged from a few historical accounts. In 1850s, John Snow observed in London the relationship of cholera incidence with the source of water supply. Up until 1849 cholera

rates were high in areas supplied with water by the Lambeth company, or the Southwark and Vauxhall company. Both these companies drew water from a polluted part of the Thames river. Between 1849 and 1854, the Lambeth company relocated its source to an upstream, less polluted part of the river. After the relocation, incidence of cholera declined in areas supplied by the Lambeth company. Cholera incidence in areas supplied by the Southwark and Vauxhall company did not change. Snow's investigation conclusively proved that water pollution was a major cause of cholera, which we call today as gastroenteritis. (MacMahon and Trichopoulous, 1996 p8-11; Hennekens and Burring, 1987, p5-7).

Surveying the decline of death rates in England and Wales during the registration period, McKeown acknowledged that the public health revolution of the late nineteenth century played an important role in reducing exposure to waterborne diseases such as diarrhoea, dysentery and cholera, which accounted for upto a quarter to a third of the mortality decline. In addition to public health technology, increasing human resistance due to improvements in nutrition appears to have had a positive contribution (McKeown 1976).

Figure-1.1 Contributors to GE incidence and mortality

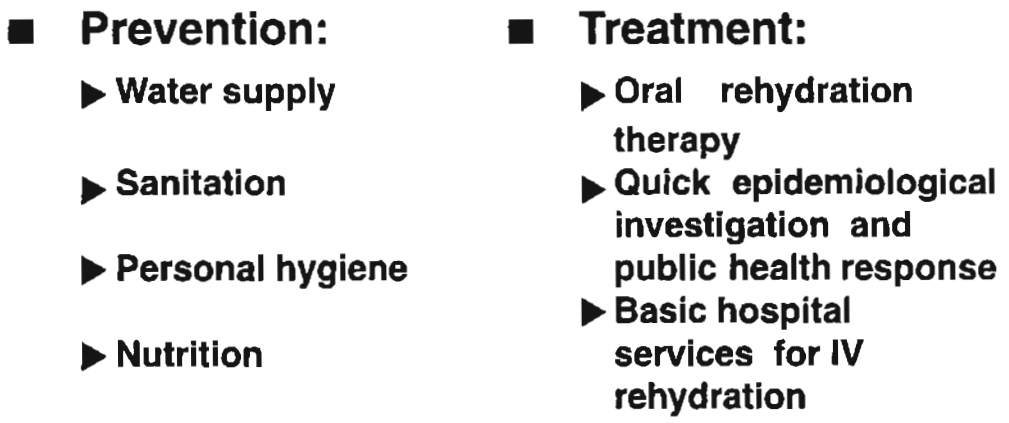


Figure-1.1 summarises the current state of knowledge about the primary contributing factors for a gastroenteritis morbidity and mortality in any community. The five primary risk factors are; (a) water supply, (b) sanitation, (c) personal hygiene, (d) food handler hygiene, and (e) nutrition. Water supply is important from two respects.

Availability of adequate water facilitates, personal hygiene and potable drinking water minimises exposure to pathogens. Sanitation works by interrupting the faeco-oral transmission of pathogens. Nutrition level affect the ability of human body to deal with parasitic, bacterial and viral infections. Under nutrition is known to make a person more vulnerable to infections. Gastroenteritis has vicous cyclical relationship with the state of human nutrition. Undernutrition makes a person more vulnerable to gastroenteritis, which in turn aggravates under nutrition. Water supply, sanitation and nutrition are to a large extent determined by the level of economic development. Personal hygiene, food handler hygiene, nutrition and for that matter household allocations towards water supply and sanitation are shaped by the level of literacy and education. Literacy and level of education have significant effect on personal hygiene, and food handler hygiene. Level of literacy

also tends to influence household allocations to water supply, and sanitation facilities. On the treatment side, oral rehydration therapy, the mainstay of modern day medical and health intervention to prevent deaths due to gastroenteritis is again a function of literacy. Hence it is appropriate to view the long term trend of gastroenteritis morbidity and mortality in a community as an indicator of socioeconomic development of that society. The basic insight then is that social and economic development efforts directed to improve water supply, build sewerage-drainage infrastructure, encourage households to provide sanitation and drainage facilities, health education to promote personal hygiene, health education and regulatory mechanisms to improve, food handler hygiene, education to popularise oral rehydration therapy can very significantly reduce morbidity and mortality attributable to gastroenteritis.

II. Epidemiology of gastroenteritis[1]

A. Definitions:

Gastroenteritis is an illness which may cause some or all of the following symptoms: (a) diarrhoea or dysentery; (b) stomach cramps; (c) vomiting; (d) nausea; (e) fever; and (f) headache. Doctors tend to distinguish gastroenteritis from diarrhoea / dysentery based on the presence or absence of vomiting. Vomiting occurs usually if the stomach is inflamed in addition to the small intestine, hence the term gastro (meaning stomach) and enteritis meaning inflammation of the intestine. In practice, however, the intestine and stomach may both be inflamed but to different degrees. The symptoms can vary depending on the cause of the illness, but the "classic" signs of gastroenteritis are a combination of diarrhoea, fever, and vomiting. Vomiting and fever may or may not occur, but either diarrhoea or dysentery is almost always part of the picture. In this manual the term gastroenteritis is used to include the entire range of manifestations including typical gastroenteritis characterised by enteritis and gastritis, diarrhoea, and dysentery. Diarrhoea, being the common denominator of almost all forms of gastroenteritis is sometimes, depending on context, used as a synonym.

Diarrhoea is usually defined in epidemiological studies, as the passage of three or more loose or watery stools in a 24 hour period. Infants who are exclusively breast-fed normally pass several soft or semi-liquid stools each day. This should not be confused with diarrhoea. Here increase in stool frequency considered abnormal by the mother should be used as the criteria to diagnose diarrhoea.

1. Acute watery diarrhoea

Acute watery diarrhoea begins suddenly and lasts usually for seven days but may last upto 14 days. Stool is loose and watery but without visible blood. Vomiting and fever may be there. Acute watery diarrhoea quickly leads to dehydration and unless controlled quickly, may lead to a vicious cycle of malnutrition followed by increased vulnerability to diarrhoea. Death is usually due to dehydration. Hence oral rehydration therapy or other forms of rehydration like Naso gastric feeding, intravenous fluid, etc. are critical for management of these cases. Rotavirus, enterotoxigenic E coli, shiggella, campylobacter jejuni and cryptosporidae, Vibrio cholerae 01, Salmonella, and enteropathogenic E. coli may also be involved.

2. Dysentery

This is diarrhoea with visible blood in faeces. Important effects of dysentery include anorexia (loss of appetite), rapid weight loss, and damage to the intestinal mucosa by the invasive bacteria . Shigella is the most common bacteria causing dysentery. Other less common pathogens giving rise to dysentery are; (a) campylobacter jejuni, (b) enteroinvasive E.coli and (c) Salmonella. In Andhra Pradesh, and most of India, Entamoeba histolytica is a common cause of dysentery, mostly in adults.

[1] We have largely borrowed material for the definitions from 'Readings on diarrhoea', WHO, 1992.

3. Persistent diarrhoea

Diarrhoea which begins suddenly but last for 14 or more days is referred to as persistent diarrhoea. The episode may begin as acute watery diarrhoea or as dysentery. Marked weight loss is frequent. Stool volume is usually more and there is risk of dehydration. More than one pathogen may be involved, including enteroaggregative E.coli, Shigella, and cryptosporidium. Persistent diarrhoea should be distinguished from chronic diarrhoea which is recurrent or long lasting diarrhoea due to non infectious cause such as sensitivity to gluten or inherited metabolic disorders. Thus laboratory isolation of pathogenic organisms in the stool is very helpful in differential diagnosis.

4. Chronic diarrhoea

As discussed above, chronic diarrhoea is due to non infectious causes such as sensitivity to specific food items or due to inherited metabolic disorders. This is to be distinguished from persistent diarrhoea which is infectious.

B. Epidemiological characteristics of GE:

1. Age

Most diarrhoeal episodes occur during the first 2 years of life. Incidence is highest in the age group 6-11 months, which coincides with weaning. This pattern reflects the combined effects of declining levels of maternally acquired antibodies, the lack of active immunity in the infant, the introduction of food that may be contaminated with faecal bacteria, and direct contact with human or animal faeces when the infant starts to crawl. Most enteric pathogens stimulate atleast partial immunity against repeated infection or illness, which helps to explain the declining incidence of disease in older children and adults.

2. Seasonality

Rotavirus diarrhoea occurs throughout the year, increasing in frequency during the drier, cool months, whereas bacterial diarrhoeas peak during the warmer, rainy season. The incidence of persistent diarrhoea follows the same seasonal pattern as that of acute watery diarrhoea.

3. Asymptomatic Infections

Most enteric infections are asymptomatic, and the proportion that is asymptomatic increase beyond two years of age owing to the development of active immunity. During asymptomatic infections, which may last for several days or weeks, stools contain infectious viruses, bacteria, or protozoal cysts. People with asymptomatic infections play an important role in the spread of many enteric pathogens, especially as they are unaware of their infection, take no special hygienic precautions and move normally from place to place.

C. Pathogens causing gastroenteritis

The microscopic organisms responsible for causing GE are of many varieties. Among the bacterial causative agents, V.cholera, and E.coli are significant. Among the viral agents,

Rotavirus is important. These causative organisms enter the polluted water or contaminated food from the excreta of any GE patient or a normal looking person who passes these organisms in his excreta but is not having motions or vomiting.

These germs are capable of survival in water for 1 to 3 days if the water is not chlorinated and especially if the water is from a surface water source like well or pond rather than a ground water source. Chlorine kills them instantly at prescribed concentrations. If the water is boiled for a few seconds, it will definitely kill these invisible germs. The only natural safety mechanism in nature to kill these germs is the contact with sunshine. Water taken from the same source may give rise to GE in some persons but no symptoms in some others.

Many factors are at work to determine if a person consuming water from a contaminated source would develop gastroenteritis or not. Firstly, the pathogen dose would vary with each drawing of water from the source. Secondly, the state of nutrition and health of the person consuming the water will determine whether his / her body successfully fights the infection without any symptoms or shows signs of gastroenteritis. However, it is difficult for us to know in advance if the food or water we are consuming is contaminated, and if contaminated, how much is the dose of pathogen, and what is the state of preparedness of our body. Hence the best solution is to adopt a life style and measures that minmise the chance of water source contamination, reduce the probability of consumption of water from possibly contaminated sources and improve the level of nutrition in general. The infectious agents most often connected with diarrhoea in young children in developing countries are as shown in the Table-2.1 below.

Table:2.1 Pathogens frequently identified from children with acute diarrhoea seen at treatment centres in developing countries.

Pathogen		Percentage of cases
Viruses	Rotavirus	15-25
Bacteria	Enterotoxigenic Escherichia coli (ETEC)	10-20
	Shigella	5-15
	Campylobacter jejuni	10-15
	Vibrio cholerae O1	5-10
	Salmonella (non typhoid)	1-5
	Enteropathogenic Escherichia coli	1-5
Protozoa	Cryptosporidium	5-15
No pathogen found		20-30

Note : A number of other pathogens known to cause gastroenteritis are not shown above, since they are less frequently involved. These are; Viruses: Norwalk agent, enteric adenoviruses. Bacteria: Aeromonas hydrophila, enteroaggregative E. coli, enteroinvasive E. coli, enterohaemorrhagic E. coli, Plesiomonas shigelloides, Vibrio cholerae non-O1, V. parahaemolyticus, Yersinia enterocolitica. Protozoa: Giardia lamblia, Entamoeba histolytica, Isospora belli.

Source: WHO; Readings on diarrhoea, 1992, Table-1.1

i. Viruses[2]

A great many diarrhoeal diseases are caused by viruses. The rotavirus (first discovered in 1973) has emerged as the single most important cause of diarrhoea in infants and children (WHO Bulletin, 1993). Studies in South India indicate that 22 to 66 percent of hospitalised cases of diarrhoea were associated with human rotaviruses (Steinhoff and John, 1980). Viruses are probably responsible for about one-half of all diarrhoeal cases in children aged upto 2 years (WHO, 1981).

ii. Bacterial Causes

Bacteria causing enteric infections and diarrhoeal diseases include V. cholerae 01, Salmonella, Shigella, enterotoxigenic E. Coli and Campylobacter jejuni. All these organisms, expect Campylobacter produce a potent enterotoxin similar to that produced by V. cholerae. Less known pathogens which cause diarrhoea causing pathogens are Yersinia enterocolitica and V. parahaemolyticus.

Salmonella cause inflammation of the bowel epithelium; Vibrio cholerae 01 do not. Both are endemic diseases in India. In cholera endemic areas, cholera probably accounts for not more than 5 to 10 percent of all acute diarrhoeas yearly, and in more than 90 percent of instances is clinically indistinguishable from other acute diarrhoeas. Campylobacters are slim, highly motile, S-shaped, gram negative rods, formely classed as vibrios. They are one of the commonest causes of enteritis. They do not seem to produce any toxin. It is not clear how they cause diarrhoea. Shigellae are a major cause of dysentery in India. Of the various types of shigellosis, infections caused by S.dysenteriae type 1 are the most severe and often occur in epidemic form.

iii. Others

Amoebiasis, giardiasis and other intestinal parasitic infections are associated with diarrhoea. Giardiasis is a recognised cause of diarrhoea. It flourishes in the duodenum and jejunum. The organisms can be present in very large numbers, the lumen of intestine teeming with them and the epithelial surfaces almost smothered with them.

The enumeration of the germs causing the enteric infections which lead to acute diarrhoea should not overshadow the fact that diarrhoea may be caused by a parenteral infection (non-digestive origin) and particularly so in younger children. These include ENT infections, respiratory or urinary infections, malaria, bacterial meningitis or even simple teething.

Besides the above causes, malnutrition may lead to certain nutritional diseases such as kwashiorkor, sprue, coelic disease and pellegra which are all associated with diarrhoea. In the developed countries, the causes of diarrhoea may be slightly different. Diarrhoea in the newborn is unusual and may be due to inborn errors of metabolism such as congenital enzyme deficiencies. It may also be associated with one or several other signs of the

[2] We have borrowed material for this and the following two paragraphs (i.e. viruses, bacteria and others) from Park and Park, 2000.

disease. Children with measels or who have had measels recently, run high risk of developing severe or fatal diarrhoea.

D. Host factors that increase susceptibility to diarrhoea. Who is vulnerable to get gastroenteritis?[3]

The infectious agents that cause diarrhoea are usually spread by the faecal-oral route, which includes the ingestion of faecally contaminated water or food, and direct contact with infected faeces.

Several host factors are associated with increased incidence, severity or duration of diarrhoea. They include:

a. Malnutrition: The severity, duration and risk of death from diarrhoea are increased in malnourished children, especially those with severe malnutrition.

b. Measles: Diarrhoea and dysentery are more frequent or severe in children with measles or who have had measles in the previous four weeks. This presumably results from immunological impairment caused by measles.

c. Immunodeficiency or Immunosuppression. This may be temporary, e.g. after certain viral infections (measles), or it may be prolonged, as in people with acquired immunodeficiency syndrome (AIDS). When immunosuppresion is severe, diarrhoea can be caused by unusual pathogens and may also be prolonged.

Following are some specific behaviours that promote the transmission of enteric pathogen and thus increase the risk of diarrhoea:

i. **Failing to breast feed exclusively for the first 4-6 months of life**: The risk of developing severe diarrhoea is many times greater in infants who are breast fed than in those who are exclusively breast fed; the risk of death from diarrhoea is also substantially greater.

ii. **Using infant feeding bottles**: Feeding bottles can be easily contaminated with faecal bacteria and are difficult to clean. When milk is added to an unclean bottle it gets contaminated and bacterial growth occurs if it is not consumed immediately.

iii. **Storing cooked food at room temperature**: If food is cooked and is kept for several hours at room temperature, bacteria in it can multiply many times. If it is served later, it may easily be contaminated, for example, by contact with contaminated surfaces or containers.

iv. **Using drinking water contaminated with faecal bacteria**: Water may be contaminated at its source or during storage in the home. Contamination in the home may occur when storage container is not covered or when a contaminated hand comes in contact with the water while collecting it from the container.

v. **Failing to wash hands after defecation, after disposing of faeces or before handling food.**

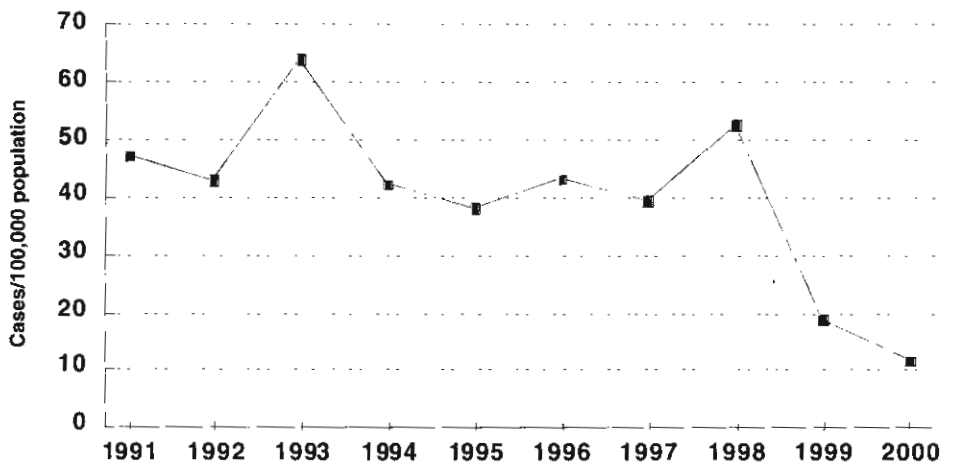
[3] This sub section is based on material from 'Readings on diarrhoea' WHO, 1992

vi. **Failing to dispose of faeces (including infant faeces) hygienically:** Infant faeces may actually contain large number of infectious viruses or bacteria, which is often believed to be harmless; animal faeces can also transmit enteric infections to humans.

E. Epidemiology of Gastroenteritis in Andhra Pradesh

The figure below shows gastroenteritis incidence in the state over the past decade (1991 - 2000). There is a gradual decrease in incidence except for the spurt of incidence in years 1993 and again in 1998.

Figure-2.1 Gastroenteritis Incidence in Andhra Pradesh, 1991-2000



The following figures shows district wise gastroenteritis incidence for the past decade. Six districts fall under high incidence, seven in medium incidence and ten in low incidence.

Figure-2.2 Gastroenteritis High Incidence Districts, 1991-2000

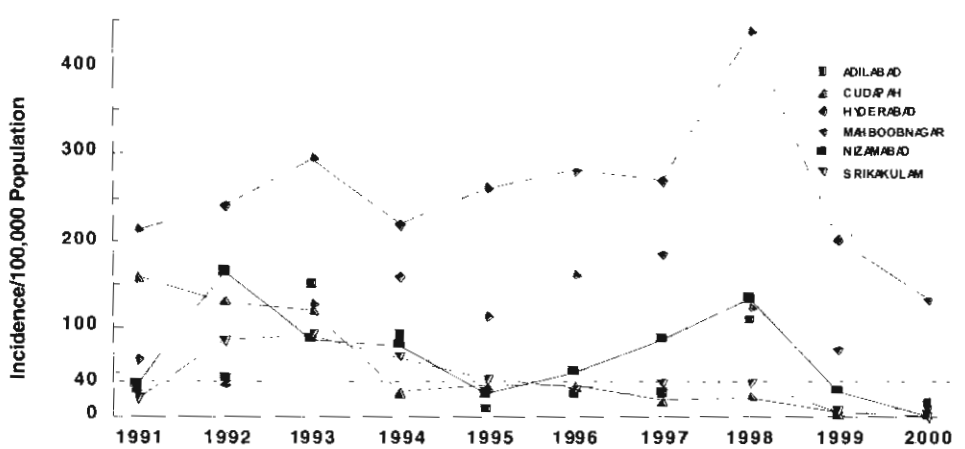


Figure-2.3 Gastroenteritis Medium Incidence Districts, 1991-2000

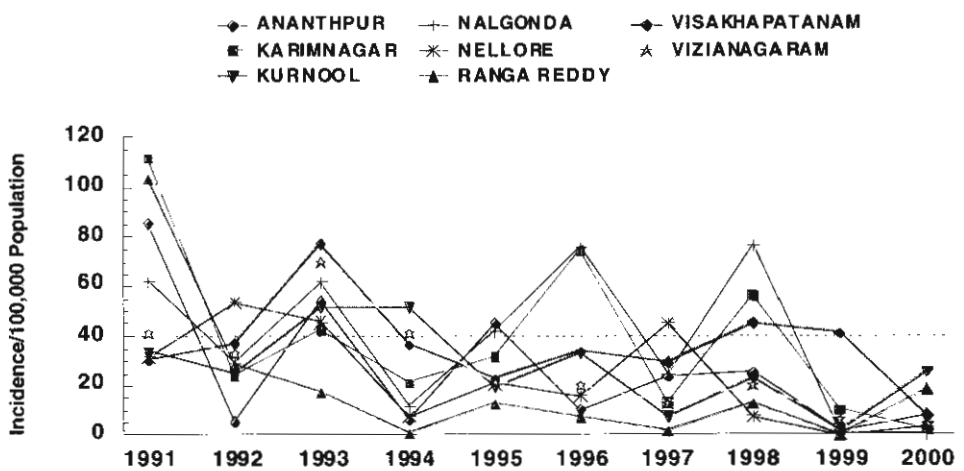
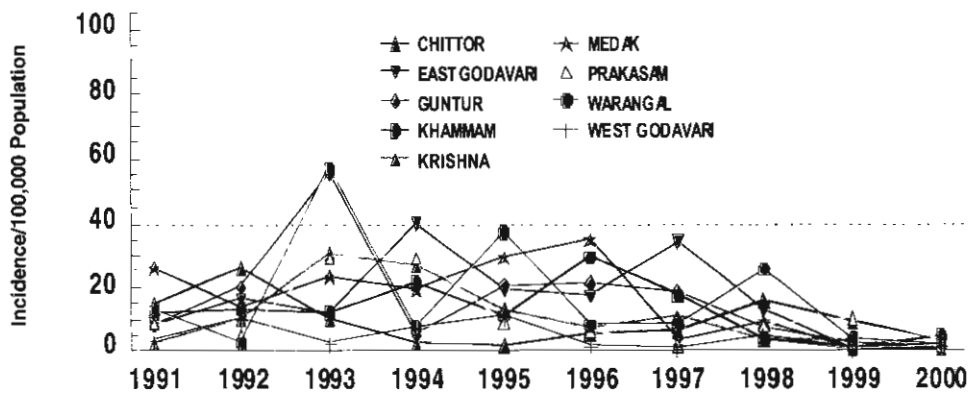


Figure-2.4 Gastroenteritis Low Incidence Districts, 1991-2000



The following table shows the GE incidence in Andhra pradesh. The over all incidence rate in the state is 40 for 1991- 2000, and has reduced from 47 in 1991-95 to 33 in 1996-2000. The downward trend of incidence rates is seen across the districts except for Hyderabad and Mahaboobnagar. In these two districts the incidence rates have slightly increased from 1991-95 to 1996-2000.

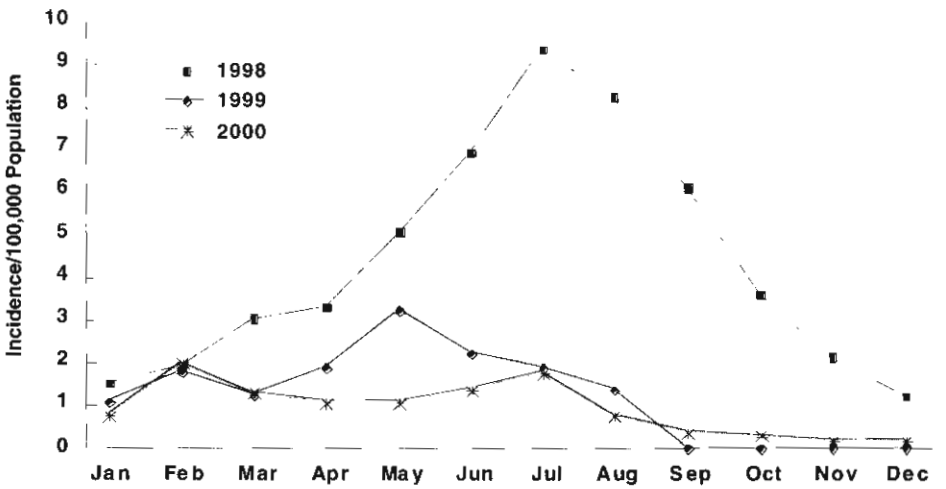
Table: 2.2 Gastroenteritis Incidence in Andhra Pradesh, 1991-2000

Districts	1991 to 2000	1991 - 1995	1996 - 2000
Hyderabad	256	248	265
Mahboobnagar	108	102	113
Nizamabad	71	80	62
Cuddapah	57	96	17
Adilabad	51	66	35
Srikakulam	43	63	23
Nalgonda	39	41	36
Karimnagar	39	46	31
Visakapatanam	36	41	32
Vizianagaram	27	41	13
Kurnool	27	36	18
Anantapur	27	39	14
Nellore	23	32	15
Ranga Reddy	20	32	8
Warangal	16	24	9
Medak	16	22	10
Guntur	16	22	10
East Godavari	16	19	13
Khammam	12	14	11
Prakasam	11	16	6
Krishna	10	16	5
Chittor	9	11	8
West Godavari	4	7	2
Andhra Pradesh	40	47	33

Knowledge of seasonal trends of gastroenteritis is essential for mobilisation of public health officials and effective prevention of epidemics. Unfortunately, seasonal data on incidence of gastroenteritis was not being collected regularly. Recently the Directorate of health has started collecting seasonal data on GE incidence. Currently GE incidence reports are expected every month. We have monthly data for three years, namely 1998, 1999 and 2000. Figure-2.5 shows the seasonal trends for these three years. As expected GE incidence is seen to be higher between April to September months. The level of GE incidence was much higher in 1998. It came down significantly during 1999. But the seasonal pattern of excess cases during summer and rainy season is evident from the incidence data for the three years. In 1998 peak month of GE cases was July i.e. rainy season. During 1999 the peak month was May i.e. summer. But for 2000 the peak month was February. The summer peaks of 1999 and 2000 are less than the summer level of cases in 1998. It is possible that there was no change in environmental factors operating in summer months. Lack of the rainy season peak in 1999 would suggest the environmental factors that generally operate

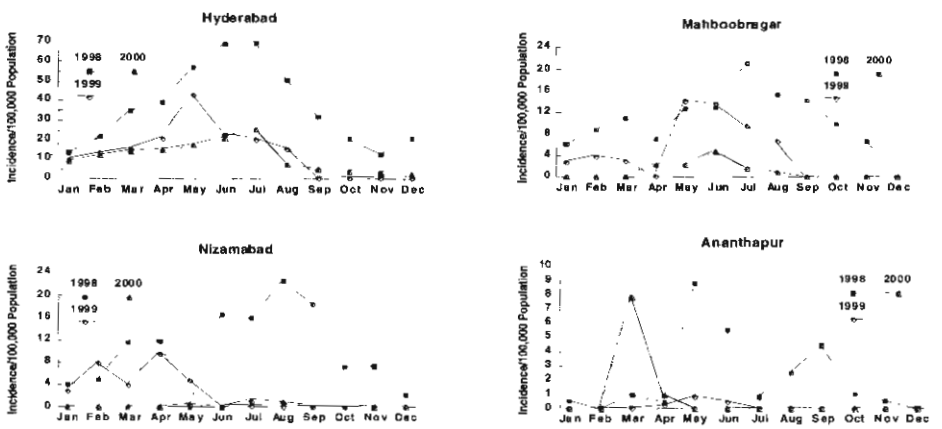
in rainy season might have been controlled in 1999. Overall level of GE incidence was lower in the year 2000. A small peak in incidence can be seen for the month of July. There was another small peak in February, 2000. The summer months had relatively higher incidence compared to the winter months.

Figure-2.5 Seasonality of Gastroenteritis in Andhra Pradesh 1998 -2000



Dissagregation of monthwise data by district shows that all districts do not follow the seasonal pattern apparent from the state level aggregation of month wise data. Figures 2.6-2.9 show seasonal pattern of GE incidence in various districts. Since incidence of GE was very high in 1998 almost all over the state, the peaks and furrows corresponding to this year dominates the charts in Figures 2.6-2.9. However, a few peaks relating to other years can also be seen for specific districts corroborating the observation made earlier that the seasonal pattern and level of incidence in specific districts does not necessarily reflect the state level averages. To further highlight this observation, districts have been included in different figures based on broad similarity of GE peaks in different periods.

Figure-2.6 Districts showing high level of GE through most of the year.



For example Figure-2.6 shows that the Hyderabad municipal corporation area, Mahboobnagar, Anantapur and Nizamabad districts experienced fairly high levels of GE cases almost through out the year except the months of November and December. Since Hyderabad, Mahboobnagar and Nizamabad account for the bulk of GE cases in the state during these years, the seasonal pattern of these districts is more or less similar to the state level aggregate of seasonal pattern.

Figure-2.7 Districts showing high level of GE in February / March

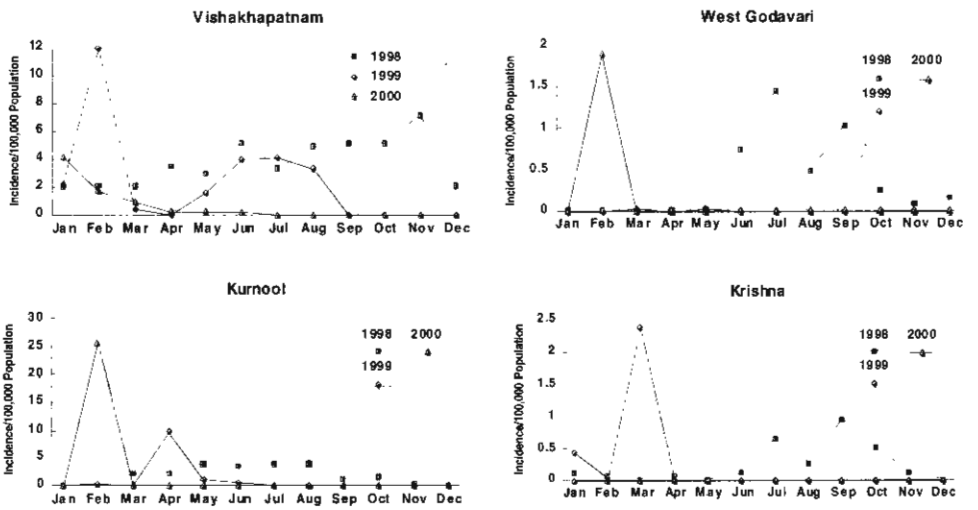
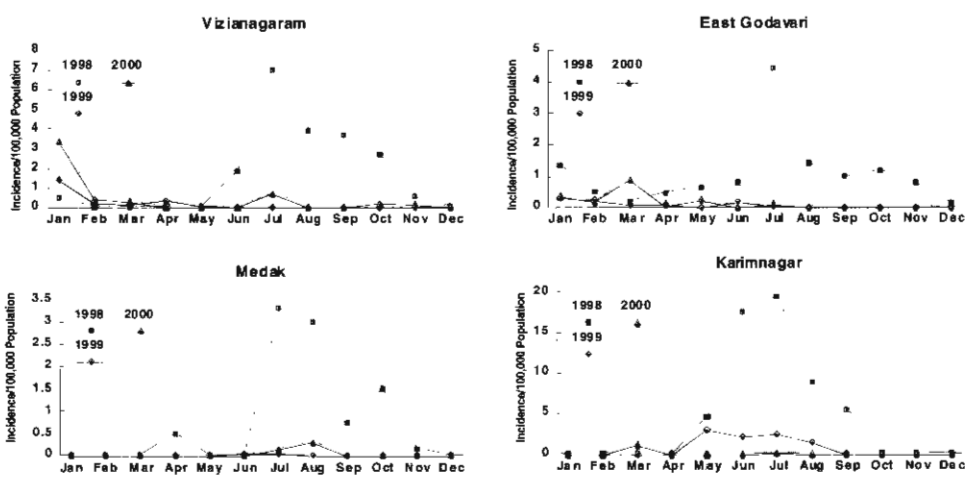


Figure 2.7 shows districts that have high incidence in the months February and March. In such special cases the investigation has to be carried at these districts to find out the cause for the exceptional high incidence in the months of February and March. The high incidence was seen in the years 1999 (Visakapatanam and Krishna districts) and in 2000 (West Godavari and Kurnool districts).

Figure-2.8 Districts showing high level of GE between May-Jun to Aug-Sep.



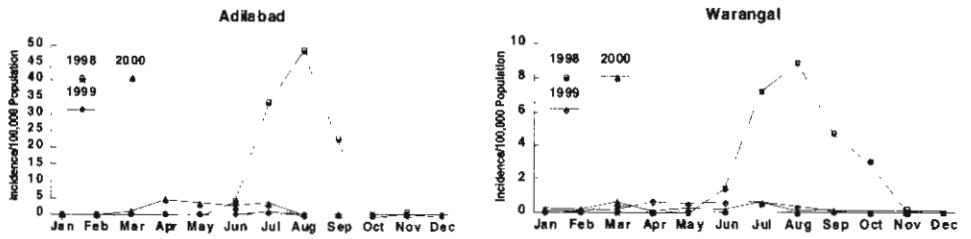
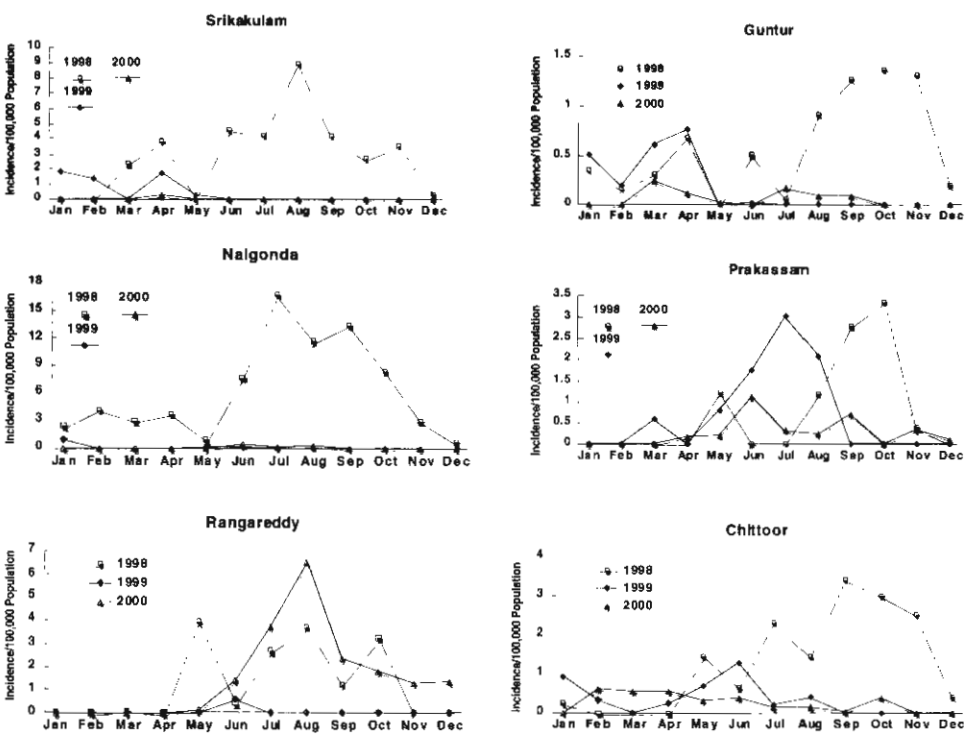


Figure 2.8 shows the pre and post monsoon trend in the incidence of GE. The incidence was at its peak in July, 1998 in Vizianagaram, East Godavari, Medak and Karimnagar districts and in August, 1998 in Adilabad and Warangal districts. These districts are under the medium incidence districts in the year 1998, but showing the trend of pre monsoon and post monsoon outbreak of GE clearly.

The seasonal pattern of incidence disaggregated by district reveals that information over a long period of time and by district and cities would help in more detailed analysis and help formulation of more effective preventive policies. Hence public health officials at all levels should gather and report GE statistics at regular intervals. These data should be analysed by month and preferably by week trends compared with previous years. Study of these trends should be supplemented with qualitative comparisons of changes in environment and plausible hypotheses should be developed to guide current strategy for prevention.

Figure-2.9 Districts showing high level of GE from June-July till Nov-Dec.



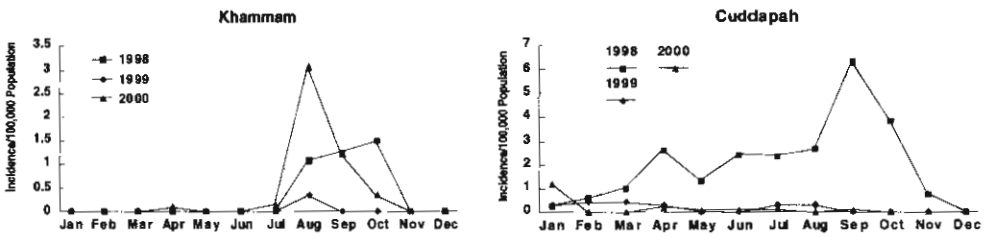
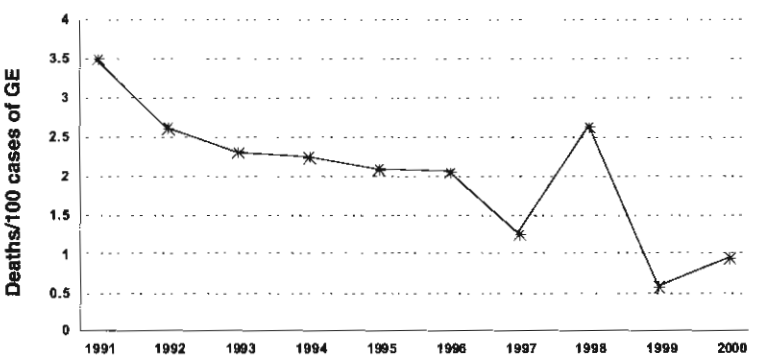


Figure 2.9 shows that the incidence has been high from June and the trend has been carried till November/ December especially in the year 1998, as the over incidence was high in that year.

Case Fatality Rate

Case fatality rate tells us how effective is the management of gastroenteritis once it occurs. In other words CFR tells us how successful is the household in recognising gastroenteritis and giving oral rehydration, how successful are our health workers in early management of gastroenteritis and how well our hospital teams are doing in management of severe gastroenteritis cases. Since we have very highly effective technology to manage gastroenteritis cases, the case fatality should be low. The sheet anchor of gastroenteritis management is giving fluids at home, oral rehydration solution, and management of fluid balance in hospitals.

Figure-2.10 Gastroenteritis Case Fatality Rate in AP, 1991-2000



There is a decline in GE incidence and related case fatality in the last two years. This decline in case fatality rate would suggest that health education efforts to promote oral rehydration and hospital management of gastroenteritis cases is having some impact. However, the absolute level of CFR, even after the recent reduction is not acceptable. As mentioned earlier gastroenteritis is a treatable condition. With appropriate management, almost every gastroenteritis patient should recover. But we are still left with a case fatality of about 1%. In other words 1 out of every 100 gastroenteritis patients is dying. Quite clearly, the health education efforts need to be further intensified, health worker skills in early management of diarrhoea needs to improve and hospitals must strictly follow practice guidelines.

There was an increase in case fatality in 1998. This again suggests that we have not been able to consolidate skills for effective management of gastroenteritis at different levels.

III. What can individuals, families and households do to eliminate the disease burden of gastroenteritis?[1]

Individuals, families and households have the power to control gastroenteritis. Most important step is to spread the knowledge about the link between the disease and personal hygiene, safe drinking water, food hygiene etc. World over increasing awareness of the connection between hygiene and GE, motivated people to improve their household environment and adopt healthy personal hygiene. This is invariably associated with dramatic and sustained reduction in incidence of gastroenteritis. Important areas for consideration of Individuals, families and households are:

i. Proper use of water for hygiene and drinking
ii. Hand washing
iii. Healthy cooking and eating practices to minimise risk of diarrhoea or dysentery in the family
iv. Use of latrines
v. Breast feeding
vi. Improved weaning practices
vii. Safe disposal of stools of young children
viii. Measels immunisation
ix. Home treatment of a child suffering from diarrhoea
x. Citizen action for good water supply and sewerage systems

Each of the above aspects of personal behaviour and household practice are described in more detail below:

1. Proper use of water for hygiene and drinking

Most infectious agents that cause diarrhoea are transmitted by the faecal-oral route. This includes transmission by contaminated drinking water or contaminated food, and from person to person. Clean water is essential for drinking and cooking. In addition, plentiful of water helps to encourage hygienic practices such as hand washing, cleaning of utensils, and cleaning of latrines. These practices can interrupt the spread of infectious agents that cause diarrhoea. To facilitate good hygiene, it is more important that the water supply be abundant than clean, although both qualities are desirable. Households that have ready access to a generous supply of water, and to clean water for drinking and cooking, have diarrhoea less frequently than families whose access to water is difficult or whose drinking-water is heavily contaminated.

i. Use the most readily available water for personal and domestic hygiene. If this water is likely to be contaminated, store it separately from water used for drinking or cooking.
ii. Collect drinking water from the cleanest available source.
iii. Protect water sources by keeping animals away, by locating latrines more than 10 metres away and downhill, and by digging drainage ditches to divert storm water.

[1] We have largely borrowed material for this chapter from 'The Management and prevention of diarrhoea. Practical Guidelines, Third Edition, WHO, Geneva, 1993'.

iv. Collect and store drinking water in clean containers. Keep the storage container covered and do not allow children or animals to drink from it. Do not allow any one to put his or her hand into the storage container. Take out water only with a long handled dipper that is earmarked for the purpose. Empty and rinse out the container every day.

v. Boil water that will be used for cooking or to make drinks for young children. Boil other drinking water, if unsure of the cleanliness of the source. Boiling of water only for less than a minute is enough, to make it potable.

2. Hand washing

One very important practice that minimises the risk of gastroenteritis is hand washing. Good hand washing requires use of soap, adequate water, and careful cleaning of all parts of the hand. Families should

i. Create a place within the home for hand-washing. This should have a water tap, bucket or drum containing water, and soap.

ii. Adopt house rules requiring all members of the household to wash hands well
   a. before eating,
   b. before serving of food,
   c. before cooking,
   d. after defecating and ablution,
   e. after cleaning a child who has defecates, changing nappies, or after disposing of a child's stool.
   f. after using a tissue or handkerchief;
   g. after working in the garden; and
   h. after playing with pets.

iii. An adult or older sibling should wash the hands of young children.

3. Healthy cooking and eating practices to minimise risk of diarrhoea or dysentery in the family

i. Avoiding raw food consumption excepting peelable vegetables and peelable fruits.

ii. Cooking food inside out till it is hot through out.

iii. Eating food while it is still hot, or reheating it thoroughly before eating.

iv. Washing and thoroughly drying all cooking and serving utensils after use.

v. Washing hands thoroughly with soap or ash after defaecation, or after contact with faecal matter. Also, washing hands before preparing or eating food, or feeding children.

vi. Some form of control on street food vendors and high risk eating places is to be enforced with the informed consent and cooperation of the community and that action shall be based on laboratory confirmation. Educated volunteers for environmental monitoring are to be enlisted if available within the community and subject to acceptability to formal community power structure.

vii. Houseflies play a relatively small role in the transmission of GE. But their presence in large numbers indicates a failure of sanitation barrier for water borne diseases and the barrier should be strengthened.

viii. It is very important that people with gastroenteritis do not prepare or handle food that is to be eaten by other people and that no one shares their towel, face washer, toothbrush or eating utensils.

ix. Do not handle raw and cooked foods with the same implements (tongs, knives, cutting boards), unless they have been thoroughly washed between uses.

x. Thoroughly cook all raw foods. Thoroughly wash raw vegetables before eating.

4. Use of latrines

Human excreta should be disposed off in a way that prevents them from contaminating water source, fruits and vegetables, or soiling people's hand. This is best achieved by use of latrines with closed sewerage connection to municipal sewerage line or to a septic tank. Toilets and wash areas should be properly drained, preferably with closed drainage system. The proper use of latrines can reduce the risk of diarrhoea to almost the same extent as improved water supplies, but the greatest benefit occurs when improvements in sanitation and water supply are combined and families follow hygienic practices. Every household should:

i. have and use a clean and well-maintained latrine that is used by all members of the family old enough to do so. Keep the latrine clean by regularly washing down fouled surfaces.

ii. If there is no latrine:
   a. defecate away from human habitation, and play grounds and at least 10 metres away from water sources.
   b. do not allow children to pick up earth or play with soil near the defecation area.
   c. avoid defecating upstream or uphill areas near habitations.

5. Breast-feeding

a. Mothers should give only breast milk to their babies for the first 4-6 months and then continue breast feeding up to 2 years of age or beyond, while giving other foods.

b. A new mother should be taught how to hold the baby for breast feeding and how to place the breast in the baby's mouth. This is best done by a female health worker or another woman who has successfully breast-fed her own children.

c. to breast feed most effectively, mothers should:

   a. start breast feeding as soon as possible after the baby is born

   b. breast feed on demand (increased sucking increases milk supply)

   c. express milk manually to avoid engorgement of the breasts during periods of seperation from the baby.

   d. not to give other fluids, such as water, sugar water, honey, milk or milk formula during the first 4-6 months of life; however, if the baby develops diarrhoea, extra fluids should be given.

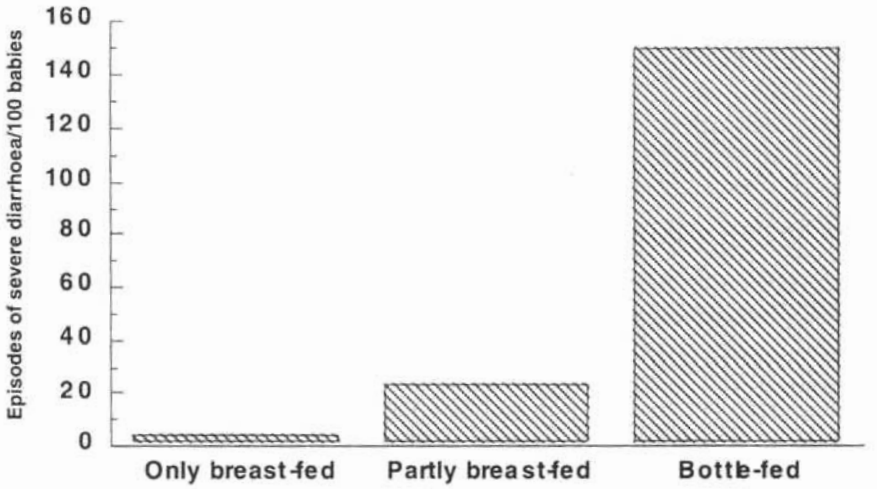
d. If the mother works outside the home and it is not possible for her to take the baby

with her, she should breast-feed before leaving home, on returning at night, and at any other time when she is with the baby.

e. A mother should continue breast feeding when her baby is ill, and after the illness. This is especially important if the baby has diarrhoea.

Breast-fed babies have fewer and less severe episodes of diarrhoea, and a lower risk of dying from diarrhoea than babies who are not breast-fed (Figure-3.1). Nearly all women can breast-feed satisfactorily and breast-feeding has many benefits for both infant and mother. Breast milk has antibodies that protect the infant from infection, and especially from diarrhoea.

Figure-3.1 Relative risk of severe diarrhoea during the first 6 months of life



Source: Mahmood DA, et al. Infant feeding and risk of severe diarrhoea in Basrah city, Iraq: a care-control study. Bulletin of the World Health Organisation, 67, 701-706, 1989.

6. Improved weaning practices

a. Clean, nutritious weaning foods should be introduced when a child is about four to six months old. Initially soft mashed foods are best.

b. A child's diet should become increasingly varied and should include- the staple food of the community (usually a cereal or root); beans or peas; some foods from animals, for example, milk products, eggs or meat; and green leafy vegetables or orange vegetables.

c. A child should also be given some fruit or fruit juice, and some vegetable oil or fat should be added to the weaning food.

d. Drinks are better given with a cup or spoon than with a bottle.

e. Family members should wash their hands before preparing weaning food, and before feeding a baby.

f. Food should be prepared in a clean place, using clean pots and utensils.

g. Uncooked food should be washed in clean water before it is eaten.

h. Cooked food should be eaten while it is still hot; previously prepared food should be thoroughly reheated before being eaten.

i. Foods that are being kept should be covered and, if possible, refrigerated.

7. Safe disposal of stools of young children

Recognise that stools of infants and young children can be as harmful as adult stool. Therefore hygienic disposal of the faeces of all young children is an important step to prevent diarrhoea in the family. Hence;

i. Quickly collect the stool of a young child or baby, and dispose it off in the latrine or bury it.

ii. Help older children to defecate into a potty and empty the stool immediately into a latrine and wash out the potty. Do not leave the potty with stool for long, even if it has a cover. Quick disposal of the contents of the potty and its clean up is important.

iii. Promptly clean a child who has passed stool. Then wash your hands with soap and water, as well as the child's.

8. Measles immunisation

Children who have measles, or have had the disease in the previous four weeks, have a substantially higher risk of developing severe diarrhoea or dysentery. Immunisation of children against measles helps in reducing the risk of sever diarrhoea, in addition to its primary effect of preventing measles.

9. Home treatment of a child suffering from diarrhoea

There are three rules to follow:

i. Give the child more liquids than usual: Oral rehydration solution is the best. Particularly if the child is less than six months old and has not yet started solid food, then Oral Rehydration Salts (ORS) solution, water would be the main fluids to be given. If the child vomits, then give in small quantities at a time, stop for a while and then resume. Slightly older children should be given food-based fluids like green coconut water, soups, rice water, butter milk (majjiga), etc. in addition. Give children under 2 years old approximately 50-100 ml (1/4 to + large cup) after each loose stool. Two to ten year old children should be given 100-200 ml (1/2 to 1 large cup) after each loose stool.

ii. Give:

a. Banana, apple juice and other fresh fruit juices.

b. If the child is six months or old or is already taking solid food, give cereal or another starchy food mixed with pulses and vegetables. It is all right to use some oil for the preparations. High-fibre or bulky foods, such as coarse fruits and vegetables, fruit and vegetable peels, and whole grain cereals has to be avoided as these are difficult to digest.

c. Breast milk is the best food for young babies. Continue to breast-feed frequently. If the child is not breast-fed, give usual meal.

d. Avoid foods and drinks with a lot of sugar. These foods can make the diarrhoea worse. Avoid stimulants such as tea or coffee.

e. Encourage the child to eat. Offer food every 3 or 4 hours (at least six times each day). Small, frequent feeds are best because they are more easily taken and digested by the child. After the diarrhoea has stopped, continue to give the child one extra meal each day. Most children need this extra meal for about two weeks. Children who have had persistent diarrhoea should be given an extra meal each day for at least a month. Malnourished children will continue to need extra food until they reach a normal weight for height.

iii. Consult a health worker or a doctor, if the child does not get better. Following are some signs and symptoms of worsening diarrhea and should be cause for consulting a doctor or a health worker.

a. Passage of many watery stools,

b. Repeated vomiting,

c. Increased thirst,

d. Failure to eat or drink normally,

e. Diarrhoea does not improve in three days,

f. There is fever, or

g. Blood in stools.

10. Citizen action for good water supply and sewerage systems

Watch out for defective water supply - sewerage systems!!

Effectiveness of household water supply and drainage is ultimately linked to the water supply and sewerage system maintained by the concerned local body (Panchayat, Engineering department, Municipality, Water and sewerage board, as the case may be). As responsible citizens, people can be watchful of defects or damage to water supply/ sewerage system in their area. You have a direct stance in proper maintenance of these facilities. So report any defect to concerned local authority.

IV. Community health workers manual for management of gastroenteritis[1]

This chapter is meant for primary health workers, health assistants, voluntary health guides, anganwadi workers, community health guides and anyone to whom people ask for advice about common health problems. DWCRA groups may use the material in this chapter to educate their members and women in their area about successful management of diarrhoea. Chapter 3 on "What can individuals, families and households do to eliminate the disease burden of GE" should also be read as a preparation to understand this chapter.

1. How to recognise gastroenteritis?

When a mother brings a child with diarrhoea to a health worker, she will usually mention diarrhoea when describing the child's problems. However, it is good practice to routinely ask about diarrhoea, especially when a child has an illness, such as measles, pneumonia, or sever malnutrition. Ask the following questions:

i. Does the child have loose or watery stool?

ii. Has there been loose stools with blood?

iii. Has the child been vomiting frequently?

iv. Has the child been suffering from fever?

If the answer to questions 1,3,4 (diarrhoea) or 2,3,4 (dysentery) is affirmative then this would be a classic case of gastroenteritis. Vomiting and fever may or may not occur, but either diarrhoea or dysentery is almost always part of the picture.

When there is diarrhoea, stools contain more water than usual and hence they are often called as loose or watery stools. Diarrhoea is to be recognised by an increased frequency of motion and passage of loose watery stools. For a child or person whose normal routine is to defaecate once, passage of 3 or more loose stools is a definite sign of diarrhoea. When diarrhoea occurs mothers may find that the stools smell strong or pass noisily apart from being loose and watery. Infants who are exclusively breast-fed normally pass several soft or semi-liquid stools each day. This should not be confused with diarrhoea. Frequent passing of normal stools is not diarrhoea. Here increase in stool frequency considered abnormal by the mother should be used as the criteria to diagnose diarrhoea.

Follow similar approach to recognise gastroenteritis in adults.

2. How to distinguish diarrhoea and dysentery?

Dysentery is diarrhoea with visible blood in faeces. Thus the key difference is presence of blood in stool.

3. Treatment of Gastroenteritis

Acute watery diarrhoea quickly leads to dehydration and unless controlled quickly,

[1] We have largely borrowed material for this chapter from 'The Management and prevention of diarrhoea. Practical Guidelines, Third Edition, WHO, Geneva, 1993'.

may lead to a vicious cycle of malnutrition followed by increased vulnerability to diarrhoea. Many mothers and adult patients will expect to be given a medicine to stop the diarrhoea. However, it is dehydration that carries the risk of death. Hence take time to explain to the mother, patient or attendant that it is important to replace the lost fluids, and to continue feeding the patient. Explaining that antidiarrhoeal drugs don't stop the diarrhoea and are useless and some are dangerous is important. Also explain that ORS solution will not stop diarrhoea, but that it will help keep the child strong until the diarrhoea goes away in a few days. In cases of dysentery, and suspected cholera with severe dehydration, treatment with antibiotics is necessary. In all other cases of diarrhoea, however, antibiotics will not help: diarrhoea will stop without special treatment.

i. The replacement of lost stool fluid is the important thing and not the mode whether oral or Intra Venous (IV).

ii. Losing time in giving ORS in mild or moderate patients leads to severe dehydration and requires IV therapy which could easily have been prevented.

iii. The ORS replacement must not be stopped and should continue till the loss of fluid in vomit or stool stops.

iv. Older children and adults are encouraged to drink as much water as they crave for, in addition to ORS.

v. The solution must be used within 24 hours, kept clean and covered with a lid.

vi. Patience is required in feeding ORS to children and it is to be made aware to the mother and all family members. Vomiting is not a valid reason to stop Oral Rehydration Therapy (ORT) Waiting for 10 minutes after vomiting and again giving ORS is to be ensured by the mothers. Health worker shall reinforce confidence in ORT.

vii. Under no circumstances, breast feeding should be stopped during ORT in children. Non breast fed infants under 6 months of age have to be given additional fluids of clean water about 200 -400 ml in the first 4 hours.

Oral rehydration solution has to be given for both diarrhoea and dysentery conditions. ORT is based on the observation that glucose given orally enhances the intestinal absorption of salt and water which corrects the water and electrolyte deficit. ORT is a very powerful and most effective treatment against diarrhoea and dysentery. In atleast 95% of watery diarrhoea, dehydration can be corrected or prevented using only ORS or ORT.

It is important to give ORS solution in small amounts at a steady pace (a teaspoonful every 1-2 minutes). If a child begins to vomit while being given ORS solution, wait 10 minutes then continue giving the solution, but more slowly, a teaspoon every 2-3 minutes. Some children may want to drink too quickly. This may make them vomit. The approximate amount of ORS required in ml may be calculated by multiplying the patient's weight expressed in Kg by 75. If you donot know the patients weight and are unable to weigh then use patient's age as a guide to estimate quantity of ORS solution to be given. The following are the guidelines for Oral Rehydration Therapy (for different age groups) during the first four hours:

Table-4.1 Oral rehydration therapy for different age groups

Age	Recommended quantity of ORS (ml) in the first four hours
Less than 4 months	200-400
4 - 11 months	400-600
12 - 23 months	600-800
2 - 4 years	800-1200
5 - 14 years	1200-2200
15 + years	2200-4000

Source : Guidelines for Cholera control, World Health Organisation, Annex 2, 43, 1993

The actual amount given will have to take into account the increase in ORS for

1. The patient's continued desire to drink
2. Persisting signs of dehydration during frequent monitoring
3. Patients whose weight is above average
4. Patients who are still passing watery stools during rehydration

If the powder is seen to absorb moisture, it should be discarded and a new packet is given.

4. Preparation of ORS solution

a. Wash hands with soap and water.

b. Pour all the powder from one packet of ORS into clean container. Use whatever container is available such as a jar, bowl or bottle.

c. Measure the correct amount of water as shown on the ORS packet. Most ORS packets require one litre of water. It is best to boil and cool the water before use, but if this is not possible, use the cleanest drinking water available.

d. Pour the water into the container. Mix well with a clean spoon until the powder is completely dissolved.

e. Taste the solution so that you know what it tastes like.

f. Mix fresh ORS solution each day in a clean container. Keep the container covered. The solution can be kept and used for one day (24 hours). Throw away any solution remaining from the day before.

5. What a health worker should do when packets of ORS are not available

Health workers have two alternatives if ORS packets are not available.

i. To manage an occasional case of GE, advise mother/ attendant to prepare ORS solution at home.

ii. To manage an outbreak of many GE cases in your community organise bulk preparation of ORS solution in the community.

Advising family members to prepare ORS solution at home

Rehydration solution can be made at home if the ORS packets are not available. Following steps has to be followed to prepare the rehydration solution:

i. Wash hands with soap and water
ii. One litre of boiled and cooled water is taken.
iii. A four finger scoop (2 level tablespoons) of sugar or jaggery or honey and
iv. A three finger pinch (1/2 teaspoon) of salt is added to the 1 litre of boiled and cooled water and stirred thoroughly.

The rehydration solution is given in small quantities to the patient every 2-3 minutes. Adult person needs 3 or more liters per day and children need at least one liter per day. The solution has to be prepared freshly as and when it is needed and not be stocked.

Bulk preparation of ORS solution

The following table shows how to make an oral rehydration fluid in large quantities, the example given is for 5 litres.

Table:4.2 Preparation of oral rehydration fluid in large quantities

Ingredients	Amount required for 1 lt of oral rehydration fluid	Amount required for 5 lt of oral rehydration fluid[1]
Water	1 litre	1 litre x 5 = 5 lt
Sodium chloride (Common salt)	3.5 g	3.5 g x5 = 17.5g
Glucose or	20 g or	20 g x 5 =100g
sucrose (Sugar)	40 g	40 g x 5 =200g
Sodium bi carbonate[2] or	2.9 g or	2.9 g x 5 =14.5g
Trisodium citrate dihydrate[2]	2.5 g	2.5 g x 5 =12.5g
Potassium chloride[3]	1.5 g	1.5 g x 5 =7.5g

Note: [1]If large volumes of the fluid are prepared, the amount of each ingredient should be increased proportionally.
[2]The solution can be made with out it, but it is better to have it.
[3]The solution can be made with out it, but it is better to have it. Do not add potassium chloride if accurate scales are not available.
Source : WHO; The management and prevention of Diarrhoea, 1993, Annex : 4

The ingredients should be measured accurately using scales (which may be available locally). This is especially important in measuring potassium chloride, errors in potassium measurements are dangerous.

If accurate scales are not available, the fluid should be prepared without potassium chloride. In this case, and if the child is already taking solid food, the mother should be advised to five fruit juice or mashed banana to provide potassium.

Do not mix the salts and sugar in dry form without adding the appropriate amounts of water when they are measured in bulk. You cannot ensure the uniformity of mixing of dry ingredients, and this could be dangerous.

6. Antibiotic treatment for dysentery:

Antibiotics should be used only for dysentery and suspected cholera. In diarrhoea of any other etiology antibiotics are of no practical value and should not be given. If a patient has blood in stools, it should be treated as suspected Shigella - dysentery with any one of the following antibiotics.

i. Trimethoprim (TMP)- Sulfamethoxazole (SMX): TMP 5mg/kg body weight and SMX 25mg/kg body weight twice a day for 5 days

ii. Nalidixic acid - 15mg/kg body weight, 4 times a day for 5 days or

iii. Ampicillin - 25mg/kg body weight, 4 times a day for 5 days

Start treatment with one antibiotic preferably Trimethoprim for 2 days. If the patient improves, the drug is continued for 5 days. If there is no improvement report to a doctor.

Amoebiasis is a very rare cause of dysentery in children. The clinical presentation of amoebiasis is slow onset of diarrhoea, which is in marked contrast to the abrupt or acute onset of shigella dysentery. Early treatment of shigellosis with appropriate antibiotics is important to decrease the severity, duration, and complications of the infection. Routine treatment (metronidazole) for E.histolytica should never be given. It is ineffective against shigellae, has adverse side effects, and increases the cost of treatment. Treatment for amoebiasis should be given only if the patient with dysentery fails to improve after consecutive treatment with two antibiotics, each given for 2 days, or when trophozoites of E.histolytica containing red blood cells are seen in fresh stools. Amoebic dysentery is more common in adults. For amoebiasis the following antibiotics are given:

a. Tinidazole

b. Metronidazole 10mg/kg body weight, three times a day for 5 days (10 days for severe disease).

c. Furazone

Gardiasis should be treated with an antiparasitic drug (metronidazole) when diarrhoea has lasted at least 14 days and cysts or trophozoites of Giardia are seen in faeces or small bowel fluid. The following are the antibiotic treatment details:

a. Metronidazole 5mg/kg body weight, 3 times a day for 5 days

b. Quinacrine 2.5mg/kg body weight, 3 times a day for 5 days

7. When to refer a case to doctor/ hospital?

If any one of the following situation arises, then the patient should be referred to a doctor/hospital.

i. Severe dehydartion

ii. Presence of fever

iii. Severe malnutrition.

How to recognise severe dehydration

The patient has to be referred to a doctor or hospital when he/she is not recovering from dehydration even after treating with oral rehydration solution and also when the patient is assessed for severe dehydration. The patient has to be given ORS solution till they reach referal facility. When the patient is not able to take ORS solution by mouth the patient has to be referred immediately for intravenous therapy.

The following table helps to assess the child for signs of dehydration.

Table-4.3 Assessment of dehydration levels and referral decision plan

	No Dehydration	Some Dehydration	Severe Dehydration
Look at: Condition	Well, alert	Restless, irritable	Lethargic or unconscious; floppy
Eyes	Normal	Sunken	Very sunken or dry
Tears	Present	Absent	Absent
Mouth and Tongue	Moist	Dry	Very Dry
Thirst	Drinks normally, not thirsty	Thirsty, drinks eagerly	Drinks poorly or not able to drink
Feel: Skin pinch	Goes back quickly	Goes back slowly*	Goes back very slowly*
Decide:	The patient has no signs of dehydration	If the patient has 2 or more signs including at least 1 sign, there is Some dehydration	If the patient has two or more signs, including at least one sign, there is severe dehydration
Referral Decision:	Continue to treat at home with ORS, etc.	Give ORS solution and actively monitor level of dehydration. Refer to a doctor.	Refer immediately to a hospital, where IV rehydration facility is available. Continue to give ORS solution.

*Pinching the skin may sometimes give misleading information: In the severely malnourished patient with marasmus, when the skin may go back slowly even if the patient is not dehydrated. In the obese patient or the patient with oedema due to Kwashiorkor, when the skin may go back quickly even if the patient is dehydrated

Presence of fever

i. If the child is under 2 months of age rehydration has to be done as necessary. If there is fever (38^0 C or above) even after rehydration, child has to be referred to hospital. Paracetamol or an antimalarial should not be given.

ii. If the child is 2 months of age or older: Paracetamol is given, if temperature is 39^0 C or above. If there is falciparum malaria in the area, and the child has any fever (38^0 C or above) or history of fever in the past 5 days, an antimalarial is given (or malaria programme recommendations are followed).

Severe Malnutrition

If the child has severe malnutrition, donot attempt rehydration, refer to hospital for management. Mother has to be provided with ORS solution and need to be told how to give 5ml/kg/hr during the trip.

8. Informing public health authorities about GE outbreak

The GE outbreak in the area has to be immediately reported to the local authorities and Primary Health Center/ Municipal health officer. Data related to the outbreak like number of cases, age and other related details of the patient with case history has to be maintained. The required materials like ORS packets are to be indented and to be stocked at the sub center level. Rehydration therapy need to be administered until other medical support is provided.

Cholera is a notifiable disease locally, nationally and internationally. In case the gastroenteritis epidemic is diagnosed to be due to cholera, within 24 hours, the health workers even at the most peripheral level are to notify to their medical officers whose responsibility is to notify to the state authorities within 24 hours for onward notification to the WHO. In addition you may share the information with news reporters, since dissemination of information can help to contain outbreak and minimise its adverse health effects. Alongside, the number of cases and deaths are also to be reported, daily. An area is declared free of cholera only after 10 days has elapsed since the death, recovery or isolation of the last case.

9. Prevention of Diarrhoea

An important part of the health worker's job is to help prevent diarrhoea by convincing and helping community members to adopt and maintain certain preventive practices. These are:

i. proper use of water for hygiene and drinking
ii. hand washing
iii. healthy cooking and eating practices to minimise risk of diarrhoea or dysentery in the family
iv. use of latrines
v. Breast feeding
vi. improved weaning practices
vii. safe disposal of stools of young children
viii. measles immunization

The health worker can teach, encourage, and set a good example to influence community members to adopt these preventive practices. Some simple facts that people in the community should know about each preventive practice is already been discussed in chapter IV " What can individuals, families and households do to eliminate the disease burden of gastroenteritis?"

10. What health workers can do to support preventive practices

Use good educational techniques

Whenever health workers have an opportunity, they should educate family members about prevention of Diarrhoea. Opportunities may occur when mother's come for prenatal care or to have their children immunised. Health workers should create other opportunities, such as educational sessions or home visits to mother's.

Health workers should be careful not to teach too much about prevention at one time. They should choose the messages that are most relevant for a mother or group of mothers. For example, mothers receiving prenatal care could be taught about breast feeding, which is an important way to prevent Diarrhoea in young infants. Mothers of babies of four to six months will need to know about safe weaning practices. If health workers use good educational techniques, they will be more effective in helping community members understand the benefits of the preventive practices.

Set a good example

Health workers should always "practice what they preach" about prevention. What a person does always sends a more powerful message than what he or she says. Participate in community projects to improve preventive practices

In cooperation with existing community groups, health workers can use their knowledge of ways to prevent diarrhoea to help plan useful projects. Some examples of projects that could be carried out with limited community resources, and that would significantly benefit many community members, include:

1. buying soap in bulk for the community
2. improving water resources
3. designating and supporting someone to build family latrines
4. gardening to produce better and cheaper ingredients for weaning food.

Support breast feeding

A health worker who attends the birth of a baby can help the mother begin breast-feeding by doing the things listed below. Health workers can also encourage traditional birth attendants or family members attending a birth to do these things.

1. Give the infant to the mother to begin breast-feeding immediately, or as soon as possible after delivery.
2. Let the mother and infant stay in the same room or bring the infant to breast-feed when hungry.
3. Do not give feeds other than breast milk to new born baby.
4. Show the mother the best way to breast-feed, and how to avoid problems with breast-feeding

Health workers can encourage breast-feeding mothers to form a breast-feeding support group who meet together to discuss any problems they may be having.

Demonstrate good latrine and toilet use practices

Identify households and public facilities in your area having well maintained latrines. Give preference to households who have used their creativity to build low cost hygienic latrines. Encourage people in your area to see these facilities to learn from concerned households all about building and maintenance of latrines.

Tell community members where the clean water sources are and how to improve water sources

Some of the sources of water in a community can probably be improved by taking simple measures such as those listed below. Community members may want to make improvements to water sources if health workers can tell them exactly what should be done.

1. Build a fence or wall around the water source to keep animals away
2. Dig drainage ditches uphill from an open well to prevent storm water from flowing into it
3. Donot allow washing in the water source
4. Donot allow children to play in or around the water source
5. Install a simple pulley device and bucket to make it easier to raise water from well

V. Prevention, Control and Management of gastroenteritis. Role of the Primary Health Centre and the Municipal Health Office

Primary Health Centre (PHCs) in rural areas and Municipal Health Officer (MHO) in urban areas are the kingpin of gastroenteritis prevention, control and management activities in the state. This chapter defines the role of the PHCs and Municipal Health Offices in gastroenteritis management.

a. Surveillance of drinking water quality
b. Surveillance of food quality
c. Promoting usage of latrines and development of sewerage systems
d. Early detection of impeding GE outbreak
e. Medical preparedness for GE
f. Notification of GE outbreak
g. Training and support to health workers
h. Information, education and communication with the community and handling of the news media
i. Role of vaccination in control of GE

A. Surveillance of drinking water quality

Surveillance of drinking water is essentially a health measure. Active surveillance of drinking water sources is intended to protect the public from waterborne diseases. Various components of water quality surveillance by the PHC / MHO include; (a) periodic sanitary survey of drinking water sources, and (b) Sampling and testing of drinking water quality. The PHC / MHO should have a written plan of annual sanitary survey of the area, and a plan for sampling of water from drinking water sources.

1. The purpose of sanitary survey

i. Coverage of all drinking water sources and updating the PHC / Municipal list of drinking water sources in the respective PHC / MHO area.

ii. Inspection of each drinking water source included in the sanitary survey plan, identification of deficiencies

iii. Reporting of deficiencies in drinking water source.

iv. Assess adequacy of drinking water availability and identify high risk areas.

2. Coverage and updating

Since a PHC area will have a large number of drinking water sources, it will not be feasible to survey all of them in a short period. Hence the sanitary survey plan should be drawn up in such a way that each public source is surveyed at least once a year and the work is distributed among available personnel, keeping in mind other public health related activities to be attended by them. The Medical Officer / MHO should personally inspect the major sources of drinking water supply covering large populations and should also do on-site check of a random sample of the sources surveyed by other health workers in his / her

jurisdiction. All public drinking water sources including those which may be owned by private entities but supplying water to the public should be inspected. In case of private spot sources of drinking water meant for consumption by respective households, inspection of all facilities may not be feasible. A random sample of private sources for household consumption should be drawn for purposes of sanitary survey.

3. Inspection of drinking water sources

Formats for sanitary survey of different type of water supply sources are given in Appendix-1. Use the appropriate form. One form for each source. For example if there are 10 wells in a village then one form is to be used for each of the ten wells. In case of piped distribution system, use one form for each public tap or for a habitation or contiguous residential area. Each inspection form has about 10 to 12 items to detect inadequacies or defects in the source that may contribute to poor bacteriological quality of water. A scoring system is to be followed giving one mark for each of the inadequacies present. A rough guide for determination of the risk of gastroenteritis among people consuming water from the source is given in the following table.

A copy of the sanitary survey report on the drinking water sources should be sent to the authority who is in charge of operation and maintenance of the facility. In rural areas, most public drinking water sources are maintained by the Gram Panchayat concerned.

Table:5.1 Formats for sanitary survey of water supply sources, and GE risk assessment scores

Source type	Inspection Format	Risk assessment - score range			
		Low	Intermediate	High	Very High
Dug well	WS-1	0-2	3-5	6-8	9-12
Tube or bore well (deep or shallow)	WS-2	0-2	3-5	6-8	9-11
Piped water supply system	WS-3	0-2	3-5	6-8	9-10
water tanker truck based distribution system	WS-4	0-2	3-5	6-8	9-10
Intakes from rivers, streams and reservoirs for water supply system	WS-5	0-2	3-5	6-8	9-10
Water treatment plant	WS-6	Assess each report individually			

4. Bottled drinking water

The consumers should be made aware of the Bureau of Indian Standards (BIS) certification that is essential for manufacturing the bottled water. Following are the standard definitions that are given by the BIS:

i. Drinking water: Water from any potable water source including public drinking water supply systems. The Indian standard IS 10500:1991 prescribes the requirements for the essential and desirable characteristics required to be tested

for ascertaining the suitability of water for drinking purpose.

ii. Packed drinking water: Drinking water filled in hermetically sealed containers of various compositions, forms and capacities that are suitable for direct consumption without further treatment. The Indian Standard IS 14543:1998 prescribes the requirements and methods of samples and test for drinking water (other than natural mineral water) offered for sale in packed form.

iii. Natural mineral water:

a. it is obtained from natural or drilled sources from underground water- bearing strata for which all possible precautions should be taken within the protected perimeters to avoid any pollution of, or external influence on, the chemical and physical qualities.

b. it is characterized by its content of certain mineral salts and their relative proportions and the presence of trace elements or of other constituents

c. of the constancy of its composition and the stability of its discharge and its temperature, due account being taken of the cycles of minor natural fluctuations;

d. it is collected under conditions which guarantee the original microbiological purity and chemical composition of essential components

e. it is packed close to the point of emergence of the same source with particular hygienic precautions and

f. it is not subjected to any treatment other than those permitted in the Indian Standard IS 13428:1998. This standard prescribes the requirements, methods of sampling and test for natural mineral waters offered for sale in packed form.

There are around 200 water bottling plants in our state and only 12 of them have BIS certification. The water bottling plants have to apply for the BIS certification and need to have the required equipment of BIS standards for manufacturing bottled water. The BIS evaluates the equipment and the product before it certifies and if they meet the necessary standards then the BIS certification is given. BIS also monitors these companies for quality control. If the plants doesn't follow the specified standards after BIS certification, the certification is canceled for the water bottling plants. For further details on BIS certification contact:

Director,
Bureau of Indian Standards,
5-8-56/C, LN Gupta Marg,
Nampally Station Road, Hyderabad.
Tel# 3201052.

It is essential that proper standards are maintained at the mineral water bottling plants. The general sanitation and the equipment are to be maintained hygenically and so is the personal hygiene of the personnel involved in the water bottling plants.

5. Laboratory testing of water quality

Water samples for laboratory testing should be collected from the various sources during the annual sanitary survey. This is in addition to the regular sampling and testing

plan drawn up by the water supply maintenance system. Details regarding laboratory testing of water quality, procedure for collection of samples, etc. has been described in chapter 7 "Water and food quality testing and public health laboratory facilities in AP". PHC Medical officers, Health Officers and Gram Panchayat authorities should be familiar with these procedures.

6. Adequacy of drinking water availability and identification of high risk areas

i. The quantity of safe water available on average in the locality is 40 litres per person day.

ii. The density of spot water sources / hand pumps in the locality is less than one source / 250 persons.

iii. Problem village: A village where no source of safe water is available within a distance of 1.6 km or where water is available at a depth of more than 15 metres or where water source has excess salinity, iron, fluorides or other toxic elements or where water is exposed to the risk of cholera.

7. Legal provisions about water quality

i. The Andhra Pradesh Public Health Act (APPHA) , 1939:

Chapter-III of this act provides regulatory framework for maintenance of food hygiene. The Act fixes responsibility on the local authority for water supply. Thus the Municipal authorities and Gram Panchayats are legally required to provide sufficient supply of drinking water for consumption by the inhabitants of the area within their jurisdiction. Under section 20 the District Collector has powers to cause enquiries about sanitary condition of water supply system and adequacy of supply. Under section-21 the Director Public Health has powers to direct a local authority to improve water supply. Under section 24 the Health officer can give instructions to any person having control of drinking water source, to take appropriate action to maintain its hygiene.

B. Surveillance of food quality

Problems of food safety in food service establishments are often compounded by poor environmental conditions such as the lack of safe and sufficient water supplies, and inadequate facilities for the collection and the disposal of both solid and liquid wastes. Most outbreaks are caused by food that has been mishandled during preparation or storage. Mass catering with a time lag often leads to outbreaks. This happens because small catering establishments often cannot afford the facilities required for the storage of cooked food, cooking and refrigerated storage facilities are inadequate and employees and managers fail to understand the different requirements of mass catering.

1. Quality of street foods

Street foods are recognised as an important source of economical and nutritious food, particularly for the urban poor. Street food vendors are a necessary part of urban life. A high potential exists for serious health problems related to the preparation and handling of street foods. Microbiological contamination in street foods is practically unavoidable. A

study conducted in an urban area revealed that 36.37% of total street food were found to be contaminated with coliform organisms, 3,6% by E.coli, 1.7% with pathogenic E. coli. The water sample analysis showed that 29.6% were found to be contaminated with coliform bacteria, 15.5% samples with faecal coliform bacteria and 4.5% with E.coli. Entero-pathogenic E.coli were isolated from 2.7% of the water samples examined (Sagade, 1992)

Periodical training in personal hygiene, hygienic food handling should be organised. Street vendors should be encouraged to attend these training programmes. In addition, regular checks and sampling of food as well as water provided by the street vendors to their customers, must be done. Samples should be sent for laboratory test and remedial action taken based on results. Consumers should be educated about the higher risk of contamination of street foods.

2. Legal provisions about in food hygiene and sanitation

i. The Prevention of Food Adulteration Act, 1954:

Prevention of food adulteration act in India was enacted by the Parliament in 1954 and came into force on 1 June, 1955. The objective of the food laws vis-a-vis Prevention of food Adulteration Act is to provide consumer pure and wholesome food and to protect him from fraudulent trade practices. On the other hand, the intention of food laws is also to provide necessary guidance to the manufacturers/dealers in food. The food laws stress on the food industry to provide safe foods to consumers by maintaining appropriate quality standards. The act defines that any article of food prepared, packed and kept under unsanitary conditions whereby it becomes injurious to health as adulterated. Any article of food of putrid, rotten or decomposed or diseased animal or vegetable substance or is fungus or insect infested is also adulterated.

The Director, Institute of Preventive Medicine is the State food health authority responsible for enforcement of Prevention of Food Adulteration and rules in the State. (S)he is assisted by Assistant Food Controllers and Food Inspectors who are located in different parts of the state.

ii. The Andhra Pradesh Public Health Act (APPHA) , 1939:

Chapter-XII of this act provides regulatory framework for maintenance of food hygiene. The Act prohibits sale of unsound food. Consumption of dead animals by any one is prohibited. Importing of meat etc. have to be done with permission of the Health Officer.

C. Promoting usage of latrines and development of sewerage systems

Health officers should promote the use of modern latrines with closed sewerage systems. See chapters 3 and 4 for more discussion about the advantages of using modern latrines with closed sewerage systems, and some suggestions to promote use of latrines.

D. Early detection of impending GE outbreak

During the GE outbreak , the records maintained on cases of diarrhoea are scrutinized fast by the compilation and analysis's procedures for standard deviation where professional

statistician is available. Then, a GE outbreak should be suspected if a patient older than 5 years develops severe dehydration or dies from acute watery diarrhea, or if there is a sudden increase in the daily number of patients with acute watery diarrhea, especially patients who pass the "rice water" type of stools.

The medical and health personnel shall be on the alert during the GE outbreak for immediate notification to the next highest authority and also the nearest health facility, even by telephone or radio. The paramedical personnel should specify the name, age, address of the patient, and the date the illness began. Members of voluntary organisations, religious leaders, teachers, students and other community members are encouraged to bring the suspicion of GE epidemic voluntarily to the health personnel and also to help in detecting and reporting cases.

If there is any suspicion of an impending GE outbreak in an area which has never previously reported a confirmed case of GE, then a thorough bacteriological and epidemiological investigation is to be requisitioned to determine the cause of the outbreak. The district epidemic control cell is also to be promptly informed of new area GE suspicion.

E. Medical preparedness for GE

In an unprepared community, GE can cause death in as many as 50% of severe cases. On the other side, good organisation of health facilities and good preparedness and an evidence based strategy will keep the case fatality in severe GE patients lower than 1%. The medical and health measures for GE preparedness are as follows.

1. Review clinical protocol for management of GE patient in acute condition of dehydration

The medical officers serving in GE prone communities have to refresh their clinical protocols for the assessment of dehydration in a GE patient and also the loading and maintenance regimens in ORT and IV rehydration according to precise parameters such as body weight or body surface area. Also refer to Chapter-4 for more details about management of diarrhoea by health workers.

2. Stocking of essential supplies for management of GE cases

In order to respond immediately to an epidemic of GE and to prevent fatalities, stocking of minimum supply for an epidemic and access routes for large quantity supplies have to be ensured.

Small buffer stocks are kept at PHCs and large stocks at the District level. The point emphasized in the stocking of buffer supply is, the preparedness stocks are not drawn from routine supply quantities but are specifically set aside in the annual supply as additional supply for GE preparedness and action. These buffer stocks are rotated into daily out and in patient pharmacies so that they will not be expired before utility, and replaced with recent routine stocks of the rotated quantities. Calculation of supplies and equipment is to be based on a minimum attack rate expected for a GE epidemic, i.e., 200 - 400 cases per 100,000 population. This will allow enough supplies and equipment for the first few weeks of the epidemic and by then, actual requirements can be accurately reassessed.

Table 5.2 Estimated minimum requirements to treat 100 cases of GE during a GE outbreak.

S.No	Material	Unit	Qty
1	Oral rehydration salt (ORS) packets to make one litre of solution.	Count	650
2	Normal saline injection	Count	40
3	Ringer's lactate injection	Count	80
4	Intravenous (IV) sets	Count	120
5	Scalp vein sets for expected pediatric patients.	Count	10
6	Naso gastric tubes-adult size	Count	3
7	Naso gastric tubes-paediatric size	Count	3
8	Tetracycline 250 mg - 10 capsule strips	Count	48
9	Cotrimoxazole - single strength tablets TMP 80 mg+ SMX 400 mg.		300
10	Large water dispensers with tap. Some thing like the water filters with tap to allow for clean distribution of oral rehydration solutions.	Nos	2[1]
11	Cotton wool	Kg	5
12	Adhesive tape.	Rolls	3

[1]Additional water dispensers should be mobilised from households or from tent houses.

The amount of supplies as above allows IV followed by ORS for 20 severely dehydrated patients and exclusive ORS for the remaining 80 other moderately dehydrated patients.

3. Mobile control teams

Mobile GE control teams have to be constituted for (a) areas where access to health care is low, and (b) where the local health personnel have no experience in management GE. The mobile GE control teams shall be well versed in the following.

a. Provide on the spot training in case management for local health staff.

b. Supervise appropriate disinfection measures, chlorination procedures and environmental sanitation measures in water supply and excreta disposal.

c. Carry out health education activities and disseminate information to the public to prevent panic

d. Carry out a preliminary epidemiological study to establish at least the mode of transmission of the outbreak and if possible, pin down the source of infection.

e. Rigorously ensure the collection of stool and environmental specimens, including suspected foods, water samples to the regional laboratory.

f. Calculate and arrange for required emergency logistical support, delivery of drug and ORS supplies, lab material and other facilities.

4. Emergency treatment centres

Immediate reach of effective rehydration is the life saver in GE outbreaks. Many deaths can be prevented by an emergency prepared team and the excellent results obtained also serve to calm public fears.

As far as possible, most cases can be treated in existing PHCS or subcentres if drugs and ORS are available. If appropriate facilities, supplies. and trained staff are not available or are far away, or if there are too many cases to be handled by existing health facilities, it will be necessary to establish emergency treatment facilities in affected communities. Temporary facilities can be established in huts, school buildings, or tents, and can be provided with the necessary supplies and trained staff. Quarantine or isolation of patients at the emergency treatment centres is not to be practiced at all. Health workers are not needed to wear face masks caps etc. Only one facility is to be maintained strictly, i.e., convenient hand washing facilities for people working with or visiting GE patients.

The safe disposal of excreta and vomit at these emergency treatment centres is to be prepared for with standard disinfectants as follows.

Table:5.3 Standard Disinfectants for excreta disposal

Disinfectant	Amount/ litre	% concentration
Bleaching powder	50 g	5
Crude phenol	100 ml	10
Cresol	50 ml	5
Formalin	100 ml	10

Excreta and vomit should be collected in impervious vessels and disinfected by adding an equal volume of one of the disinfectants as above and allowed to stand for 1 to 2 hours. Faeces should be broken up with a stick to allow proper disinfection.

If the disinfectants listed above are not available, an equal amount of quick lime or freshly prepared milk of lime (1 lime to 4 water) is added to the excreta, mixed and left to stand for 2 hours. After the disinfection treatment, the remains are buried in the ground. Bed pans and urine pots are first cleaned and disinfected with 2.5 % cresol for 1 hour.

The rooms are disinfected with spraying or mopping of floors with 1 % formaldehyde or 2.5 % cresol or with chlorinated lime of 25% free chlorine.

In conclusion, preparedness for GE epidemic is based on sound evidence of saving maximum number of lives and shortening any inevitable epidemics to low danger levels.

F. Notification of GE outbreak

According to International Health Regulations, 1969/83, it is mandatory to notify Cholera to local, and WHO authorities. The laboratory confirmation is also to be reported after the clinical notification. A case of Cholera should be suspected when:

i. In an area where the disease is not known to be present, a patient, 5 years of age or older, develops severe dehydration or dies from acute watery diarrhea.

ii. In an area where an epidemic is occurring, a patient, 2 years or older, develops acute diarrhea.

iii. A case of cholera is confirmed when, Vibrio cholerae is isolated from any patient with diarrhea.

Both suspected or confirmed cases are equally notifiable and no difference in notification is to be entertained in notifying them. First suspected cases of cholera in the local area shall be reported first to WHO as early as possible. Hence all the medical personnel shall have preparedness for GE which includes notification of cholera cases.

In local areas where GE is already confirmed previously, the compulsory weekly report as sent to the state authorities is to be consolidated for statistical compilation at the nearest district centre for evidence of impending outbreak according to standard deviations for the corresponding period during the previous year.

Notification is to be done only after laboratory confirmation. Subsequent confirmed cases need not be notified. Treatment particulars need not be notified.

G. Training and support to health workers

All health workers and paramedical personnel should be provided with refresher courses about prevention of gastroenteritis and management of gastroenteritis cases. Review with them about estimation of chlorine demand, collection of water and food sample for laboratory testing, post chlorination estimation of free chlorine and the avoidance of erroneous rehydration leading to hyponatremic or hypernatremic complications. The demonstration of ORT in ORT corners is streamlined in all health centres by one of the centre's paramedics for GE preparedness. Refer to and use the material in chapters 3 and 4 for this purpose. Additional material about peculiarities of the local area and latest developments in management of GE outbreaks should also be provided.

H. Information, education and communication with the community and handling of the news media

The key to successful management of GE outbreaks is to inform and educate the community about the plausible causes of the outbreak. This will enable the community to respond with appropriate practices. Most individuals will work to reduce the risk of being affected. Dissemination of such information will also help medical practitioners in the area to give appropriate advice to their patients, prompt diagnosis, and more complete reporting of all GE cases.

Press notes should be issued informing people of what ever data is readily available with the Health Officer. Rapid investigations of the outbreaks should be done to identify all plausible causes of the outbreak. News reporters tend to highlight the human burden on account of gastroenteritis outbreaks. Number of people affected and number of deaths are usually reported. In addition, the reporters should be encouraged to report information about plausible causes and possible remedial steps.

The press note should provide information about the state of water sources, their role if any in causing the outbreak. The quality of drinking water, hygiene practices and the food handlers sanitation practices are the prime factors to be focused. When an outbreak occurs the above issues need to be investigated and the causes need to be reported.

It is important to publish the guidelines for prevention and control of the infection. Chapters 3, 4 and this chapter in this manual gives information in this regard. The necessary information from those chapters can be taken and published accordingly. The press notes may highlight some or all of the following facts about GE depending on the situation.

i. About 90% of diarhheal disease episodes can be managed with increased intake of ordinary fluids.

ii. Among the remaining 10% of diarrheal episodes, 9% can be safely managed with Oral Rehydration Solution therapy.

iii. And only 1% of all diarrheal disease episodes do require intravenous drip fluid rehydration.

iv. The case fatality rate even in severe GE can be kept as low as 1% with simple but consistent use of oral rehydration therapy.

v. Once an outbreak of GE starts, there is no role for either vaccination or mass chemopropylaxis (preventive antibiotics for normal people at risk) whatsoever.

vi. Once an outbreak of GE starts, public health authorities should investigate and localise origin of the out break and map the mechanism of its spread. These information should be generated at the earliest and disseminated to medical practitioners and the general public.

I. Role of vaccination in control of gastroenteritis

According to current evidence, there is no role for vaccination in control or prevention of cholera. The reasons why vaccination does not work are given below. The following paragraphs also give some information about various efforts to develop vaccines against gastroenteritis. This information may help public health officials and health workers to find answers to some commonly asked questions about vaccination.

1. Cholera Vaccine

Cholera vaccine is the only specific prophylactic available against cholera. The vaccine employed at present is a saline suspension of approximately 6000 million each of classical Ogawa and Inaba serotypes of V. cholera 01 per ml, so that each millimeter of the vaccine contains a total of 12,000 million vibrios. The organisms are killed and preserved by the addition of 0.5 percent phenol. The vaccine protects equally well against El Tor infection, but similar cross protection of vaccines prepared for El Tor vibrios had not been demonstrated.

Primary immunization consists of 2 equal doses, injected sub cutaneously, at an interval of 4 to 6 weeks. The dosage is as follows:

Table:5.4 Immunization dosage for different age groups

Age groups	1st Dose	2nd Dose
Adults & children over 10 years	0.5 ml	0.5 ml
Children aged 2-10 years	0.3 ml	0.3 ml
Children aged 1-2 years	0.2 ml	0.2 ml

The protective value of currently available vaccines is estimated to be about 50 percent for a period of 3-6 months (Joo, 1974). Increasing the antigenic content did not improve the effectiveness of the vaccine.

In recent years doubts have been raised about the usefulness of cholera vaccine as a preventive measure. The existing vaccines do not prevent the introduction of cholera into a country or interrupt transmission; they do not prevent the development of the carrier state or affect the severity of disease. They are of no value in controlling epidemics. They have no effect on the frequency of inapparent infection. Furthermore, the vaccination programs usually do not adequately reach the most susceptible segment of the population. On the other hand, anti cholera immunization has created in the past a false sense of security to both recipients and health administrators.

Mass vaccination, as usually practiced at the commencement of an epidemic, is considered a waste of time and valuable resources (WHO 1980, Somer et al 1973). Moreover, serum hepatitis, a more serious problem, has been found to follow mass vaccinations campaigns in a number of countries. Limited selective vaccination programs can be considered only in populations at exceptionally high risk, i.e., those who lack or have inadequate medical and sanitation facilities. However, even in such circumstances, because of the short incubation period of cholera, once the epidemic of cholera has broken out, vaccination is of no value.

To sum up, cholera vaccines available at present are not helpful in the control and prevention of cholera (WHO 1980). They can be used as an adjunct to other preventive measures such as drug prophylaxis, sanitation and health education. International research work is in progress for the development of more potent cholera vaccines - toxoid vaccines, purified antigens, aluminum phosphate-absorbed vaccines, oral vaccines, mixtures of toxoid and killed vibrio vaccines (WHO 1979, Pal et al 1980). Killed, whole-germ vaccines (WCV) reinforced with B sub units (WCV/B), administered in 3 doses at 6 - week intervals, have been found to afford approximately 68 percent protection for children, over the age of five years, for a period of 3 years, but it declines rapidly after 6 months. The presently experimented live vaccine is CVD - 103 HgR strain of Vibrion Cholerae 01. The immunologically effective, safe dose has been ascertained. Field trials are now being planned for the evaluation of its effectiveness in affording protection in regions with pandemic and epidemic cholera (De S et al, 1975).

2. Anti-Rotavirus Vaccines

Trials aimed at evaluating their effectiveness, safety and immunogenicity are presently under way. The development of these vaccines, based on the rhesus monkey, bovine or human rota virus, is difficult owing to the many serotypes, to the adverse reactions elicited and to the moderate immune responses. Tetravalent rhesus rota virus plus reassorted monkey/human rota viruses seem most promising at present. Once these vaccines have proved definitely effective, more thorough studies on any possible interface with the oral polio virus will be required to determine how large a dose of anti rotavirus vaccine may be administered in the framework of the Expanded Programme for Immunization (EPI)

3. Anti-Shigella Vaccines

Two approaches to candidate vaccines are currently under study: genetic engineering and non-virulent mutants. However, neither of these approaches has as yet resulted in the development of a product that is ready for clinical field trials.

4. Anti-Enterotoxigenic Escherichia Coli Vaccines (ETEC)

A prototype containing formol-killed germs and the B sub unit of the cholera toxin (justified by the protection against toxic diarrhoea afforded by this sub unit) is presently being experimented in Sweden. Subsequent phases will include trials on travelers and children.

VI. Epidemiological investigation of gastroenteritis outbreaks

Diarrhoeal diseases are endemic with seasonal peaks. However, when serious outbreaks of acute diarrhoeal disease occur, the common cause is either; (a) Shigella dysenteriae, or (b) Vibrio cholerae, which causes cholera. Proper epidemiological investigation can help identify real outbreaks of gastroenteritis, demarcate the affected population, and identify the mechanism of transmission. Each of these three pieces of information is vital for an effective response to control the outbreak, minimise its adverse health impact and learn about prevention of such outbreaks in future.

Information about unusually excess cases of GE can come from many sources. For example; (a) health workers report about GE cases in their area, (b) GE cases show up among the PHC outpatients, (c) medical practitioners in the area report unusual increase in GE cases, (d) nursing homes and hospitals in the area receive many GE cases, (e) news reports about GE cases, etc. An epidemiological investigation should always be started by the concerned PHC Medical Officer (PHCMO) / Municipal Health Officer (MHO), whenever excess cases of GE occur in their area. Whether the PHCMO / MHO can complete the investigation depends on the nature of the outbreak, and other competing demands on the officers time including the time required for clinical management of the GE cases and implementation of control measures. If the cause of the outbreak is unclear, and / or the mechanisms of transmission is not well understood, or a large population is involved, then the PHCMO / MHO should seek assistance from the DM&HO, Directorate of Health, and the Director Institute of Preventive Medicine for epidemiological investigation. The Dy DM&HO, DM&HO, Regional Directors and the Directorate of Health should make their independent assessment about the need for a specially constituted epidemiological investigation team (EIT) for GE and its composition. For investigation of small to medium outbreaks the team may be constituted by the DM&HO / Director Health. The team should include (a) one or more laboratory scientists, and .(b) one or more epidemiologist. Professional competence of the team members should be the prime criteria for inclusion in the team. Sources of laboratory scientists include; (a) Directorate of IPM, (b) Regional Public Health Laboratories, (c) District public health laboratories, (d) Water quality monitoring laboratories, (e) private laboratories doing water and food quality testing. Refer to the chapter 7 on "Water and food quality testing and public health laboratory facilities in AP". Possible sources of epidemiologist include (a) public health specialists within the Directorate of Health, (b) Community medicine departments of medical colleges, (c) Other health system research institutions like the Indian Institute of Health and Family Welfare, Hyderabad, and the Institute of Health Systems, Hyderabad. National institutions with technical resources for investigation of GE outbreaks include; (a) National Institute of Communicable Diseases, New Delhi (b) National Institute of Epidemiology, Chennai (c) National Institute of Virology, Pune (d) National Institute of Cholera and Enteric diseases, Kolkota (e) Regional Medical Research Centre, Bhuvaneshwar (f) Regional Medical Research Centre, Port Blair(g) Regional Medical Research Centre, Dibrugarh. In case of doubt the DG ICMR, New Delhi and DGHS Delhi should be contacted to advice about the institutional and professional resources for epidemiological investigation of GE outbreaks.

A. Purpose of assessment

The purpose of an epidemiological investigation of a possible gastroenteritis outbreak is usually one or more of the following.

i. Confirm that an epidemic of acute diarrhoeal disease exists and estimate its geographical distribution

ii. Identify the transmission mechanism and inform all concerned about it so that they can take appropriate action to break the transmission.

iii. Identify the causative organisms if any and its drug susceptibility characteristics. Communicate the same to medical practitioners and health workers.

iv. Estimate its health impact and

v. Assess existing response capacity and identify the most effective control measures to minimize the outbreaks ill effects.

B. Conducting the assessment

The assessment team should be equipped with specimen containers and sufficient transport media (such as Cary- Blair) for collecting specimens to analyse at the closest competent laboratory.

C. Confirming an outbreak of acute diarrhoeal disease

1. Confirmation of GE outbreak by clinical diagnosis

This can be carried out by examining a number of cases. A gastroenteritis outbreak should be suspected if a patient older than 5 years develops severe dehydration or dies from acute watery diarrhea, or any patient above the age of 2 years has acute watery diarrhoea in an area where there is an outbreak of cholera, or if there is a sudden increase in the daily number of patients with acute watery diarrhoea, especially patients who pass the "rice water" type of stools. Standard case definitions for suspected cases of acute diarrhoeal disease are:

i. A patient aged five years or more develops acute watery diarrhoea, with or without vomiting.

ii. A patient aged five years or more develops severe dehydration or dies from acute watery diarrhoea.

iii. A case of cholera is confirmed when vibrio cholerae 01 or 0139 is isolated from any patient with diarrhoea.

iv. Bacillary dysentery is confirmed by evidence of acute onset of bloody diarrhoea with visible blood in the stool.

2. Statistical confirmation of existence of epidemic

Since gastroenteritis is a common source epidemic, there is no role for statistical comparison of previous year's experience for the corresponding period. The existence of an epidemic is confirmed by obvious clinical determination of sudden large numbers involved.

3. Laboratory confirmation of GE and isolation of causative organism

i. Collection and transport of stool samples

a. Collection of stool samples: The stool is collected in a clean, dry, disinfectant free and leak proof container. Presence of mucus, pus or blood in the stool is recorded. If the specimen contains worms or tapeworm segments, they are transferred to a separate container for identification.

b. Rectal swabs: If it is not possible to obtain feces, collect a specimen by inserting a cotton wool swab into the rectum for about 10 seconds. Care should be token to avoid unnecessary contamination of the specimen with bacteria from the anal skin.

c. Label the specimen container. Mention about presence of mucus, blood etc. Make a lab test request letter giving clinical details of the case.

d. Transport and preservation of sample:

1. Send the sample to reach the laboratory within 2 hrs. Use a tightly sealed screw capped sterile bottle with Cary - Blair transport medium or VR medium. Use alkaline peptone water, if it is likely to take more than two hours to reach the laboratory.
2. If transport media is not available, soak strips of blotting paper with liquid stool. Send these to the laboratory in carefully sealed plastic bags to prevent leakage of the potentially infectious material.
3. Each specimen container must be placed in a separate plastic bag to prevent leakage of the potentially infectious material.
4. Send the samples using a cold chain. If this is not possible send at ambient temperatures.
5. The entire pack that is being transported should be handled in an upright position. and the parcel addressed correctly along with a label indication the nature of material inside.

ii. Processing

a. Inspect the parcel for evidence of any leak or breakage of specimen containers.

b. Reject specimens that have been grossly contaminated with other material.

c. Carefully study the clinical information provided with the specimens for making a provisional diagnosis in order to define the type of processing required.

d. If the laboratory is not in position to carry out the required preliminary tests, it would be ideal to redirect them to another laboratory after informing them in advance.

e. The processing must be started without delay and completed in time in order to be of practical use in controlling the outbreak.

iii. Reporting:

a. If all the affected people have similar symptomatology, it is not mandatory to wait

until all the specimens are processed, as it will adversely affect the prompt institution of appropriate control measures and defeat the very purpose of sending the specimens to laboratory.

b. Therefore in such instances, it is essential to inform as soon as possible the moment a diagnosis of the causative micro organism (along with anti microbial sensitivity wherever applicable) is made. The rest of the samples can be processed for statistical, epidemiological and academic purposes.

c. The result must be communicated to National Reference Centers for notifying the outbreaks as well as to keep track of the causative micro organisms - in terms of the species involved and strain variation.

D. Defining the area of the epidemic and the population involved in risk

The area is defined with the help of a pre existing map of the larger segment of administration into which the epidemic area belongs. A rapid gathering of information of cases is done to demarcate the circumference of the epidemic occurrence in the map. The population as available in the census records for the demarcated area is used as the denominator for temporary estimation purposes.

i. Start with a list of habitations, municipal wards of the suspected area as its sample

ii. Collect population data from the most readily available source.

iii. List of all reported GE cases by habitation/ ward from where the patient came. Current residence of the patient at the time of onset of GE symptoms should be the basis of assignment to habitation/wards and not usual residence. Suppose a person is an usual resident of habitation and was visiting habitant when he developed GE symptoms, this case should be assigned to habitation for purpose of this tabulation.

iv. Build a table in the following format and carry on the calculations

Table:6.1 GE incidence in a habitation/ ward

Habitation/ Ward Identity No	Name	Population	Cumulative GE cases	Cumulative Incidence
			Day 1	
			Day 2	
			Day 3	
			Day 31	

The following table is used to know the details of the patient and the related health care institution where the patient is being treated.

Table:6.2 Patient particulars of an health care institution

Name of the patient	Habitation/ Ward	Health Care Institution
	Identity No Name	Identity No Name

E. Parallel control measures

Gastroenteritis control measures should be initiated immediately based on the positive verification of diagnosis of gastroenteritis. Also, the epidemiological investigation is to be started immediately for gastroenteritis following the positive verification of diagnosis of gastroenteritis. These two activities can not be made to wait until confirmation by the laboratory as the loss of life and morbidity will be very large due to any delay.

In case the occurrence of cases decreases suggesting the absence of an outbreak, then the matching evidence from laboratory report is to be taken into consideration before withdrawing the control measures and epidemiological investigations.

F. Collecting information on a representative sample of cases

Focus on what is already known about patterns of spread for both bacillary dysentery and cholera to identify possible sources of the outbreak and means of spread. The case fatality ratio should be calculated and used to assess the adequacy of patient management.

The case fatality ration should be <1% for cholera, and from 1% to 10% during epidemics of Sd1.

a. Cholera: Because spread can occur by contaminated food and water, or more rarely by person to person contact in overcrowded conditions, questions about possible types of exposure has to be asked.
b. Bacillary dysentery: Because spread can occur through contaminated food or water or direct person to person transmission, questions to determine how the spread is occurring need to be asked.

Time: When did the cases occur? Is their number increasing? Did many people become ill at the same time at the outbreaks beginning?

i. A simple graph to show the number of cases reported per day to be made.
ii. If the diarrhoeal disease outbreak has affected a wide area, simple graph for different areas affected, showing the number of cases reported per day can also be drawn.

Place: Where cases have occurred? Is the outbreak spreading? Did many people become ill at the same time at the outbreaks beginning?

a. Cases can be mapped geographically, by date of onset.

Maps that identify water sources, settlements, health facilities and major transport routes should be used. If they are not available, a rough sketch map including this information has to be drawn. This helps to identify risk areas and their relation to road and rail links and existing health facilities, which are important to understand mechanism of spread.

G. Assessing the impact on health

Assessing local response capacity and immediate needs

The following questions are guidelines for assessing the local response capacity and determining the need for outside resources.

i. What steps have local health officials taken to organise the epidemic response? Is there a plan of action, standardized reporting procedures, and trained staff?

ii. Are guidelines for management prepared and followed? What is the case fatality ratio?

iii. Are all supplies for treatment readily available (ORS, intravenous fluids, antibiotics, soap and chlorine)?

iv. What links have been established with key community leaders (eg: to facilitate health education, improve case detection, and protect water sources)?

v. Are health facilities accessible to the affected populations? Are temporary treatment centers needed?

vi. Are there sufficient trained health workers to treat cases properly?

vii. Are resources being diverted to ineffective control measures, such as trade and travel restrictions?

viii. Local epidemiological surveillance:

a. Are there sufficient trained personnel, laboratory and communications support to maintain surveillance? Is outside help needed?

b. Are more extensive field investigations needed?

c. Can surveillance of diarrhoea cases and environmental sources (particularly sewage, using ,Moore swabs) be maintained until Vibrio cholerae O1 or O139 is no longer isolated from people and that environment in non endemic areas?

H. Case studies of GE outbreak

1. GE outbreak among brick workers in Ganapathiguda village

i. The case:

Ganapahtiguda village near the Rural Health Centre (RHC) Patancheru has about 22 brick manufacturing units. Only two of them have regular water supply connections from the Manjira scheme. The brick manufacturers bring migrant labour from other states like Orissa, Madhya Pradesh and Maharshtra. These labourers camp at the brick manufacturing site. Around January - February 2001, the camping population around these brick units was about 777. There is no drinking water provision for these labourers. Water from borewells

is usually impounded in a pond for the brick manufacturing activity. The camping labourers and their families generally use the impounded water for drinking and cooking.

There was a GE outbreak among the residents of these migrant labour camp in February, 2001. Two deaths occurred, one on February 1, and another on March 1. Altogether 45 cases of GE reported to a field camp set up in response to the outbreak. Another 16 cases reported to RHC Patancheru, four of whom had to be hospitalised.

ii. Comments:

Water from the deep borewells might have been free of contamination. But use of the water impounded in open ponds is the probably cause of this outbreak.

2. GE outbreak after Ramanavami festival in Lingavaram village, Krishna district - 1999

i. The case:

Every year the villagers of Lingavaram celebrate Ramanavami with a lot of enthusiasm. Keeping with tradition Ramanavami was observed by the villagers, in March, 1999. The festival lasts for nine days and ends with celebration of marriage between Lord Srirama and Devi Sita on the ninth day. Tradition requires that every one participating in the celebration drink Panakam and Vadapapu after completion of Sitarama Kalyanam. Panakam is usually prepared in large quantities and every one is free to drink as much as (s)he likes. Unfortunately, a large number of devotees in Lingavaram, who took Panakam on the Sriramanavami day of 1999 ended up with diarrhoea. A total of 60 cases of gastroenteritis / diarrhoea were reported within two days. Two persons died of dehydration.

ii. Comments:

a. Report by the PHC Medical Officer based on which the above case is reported does not give details about source of water used for preparation Panakam.

b. It will be useful to investigate source of water and study the exact procedure followed for preparation of Prasadams.

c. A point worth noting is the dose. This festival is characterised by sharing moderate to large quantities of Panakam by the devotees. This practice gives scope for a higher dose of micro organisms to be transmitted resulting in the manifestation of an GE outbreak. The lesson for public health authorities is that you try to understand details of cultural practices during fairs and festivals. If there is a tradition of sharing large quantity of commonly prepared food item, then be more vigilant about the process of preparation. Talk to the organisers and priests in advance and learn how these items are going to be prepared. Give advice about precautions to be taken to prevent inadvertent contamination of prasadams and food items.

3. GE outbreak in Anantapur town

i. The case:

Anantapur town has a population of nearly 2 lakhs spread over 36 wards. There are

two protected water supply sources; (a) Sri Satya Sai water supply scheme supplies mainly to old town and extension areas (b) Infiltration wells from the Thadakaleru river bed behind municipal park from where water is pumped into collection tank where chlorination is done and pumped to overhead tank near TTD Kalyanamandapam which supplies to the new town area. For some of the extension areas like Azad Nagar and Georipeta etc., water is directly pumped from the collection tank.

In Anantapur summer usually starts from middle of February. It was March 2001. The town was already reeling under summer heat and was facing acute shortage of drinking water. The Municipal authorities had given permission to telecom authorities for digging and laying of telephone cables in the fourth and fifth road colonies. Water to these areas is supplied from overhead tank near TTD Kalyanamandapam. The water distributory mainline from 1st cross to Peddamma temple was damaged while the Telecom department was laying cables. Water from the damaged pipeline was flowing on to the road from 2nd March 2001. A sewer drain passes at a distance of 2 feet away from the damaged pipeline. Water from these damaged pipeline was consumed by the residents of 4th and 5th road colonies.

About 11 cases of diarrhoea were reported to the Government general hospital from 4th morning onwards. Six of them were from the fourth and fifth ward area. Number of cases increased to 24 by the next day. A total of 142 cases were reported as of 11th March 2001 of which 115 were from 4th and 5th wards. Date wise admission of GE in the District hospital is given below.

Date	GE admissions	From 4th & 5th ward	Deaths
4-3- 2001	11	6	Nil
5-3-2001	24	23	Nil
6-3- 2001	35	28	Nil
7-3-2001	24	24	1
8-3- 2001	28	19	Nil
9 -3-2001	7	7	Nil
10-3- 2001	7	7	Nil
11-3-2001	6	1	Nil
Total	142	115	1

The Telecom authorities forgot to report about the damage to water pipe line to the Municipal authorities. Information about pipeline damage reached municipal authorities only after GE cases were reported and there were newspaper accounts of the outbreak. The damaged water pipe line was repaired by 5th morning.

Inspection of the Thadakaleru infiltration collection wells revealed that the collection well did not have cover to prevent contamination from bird droppings. Surroundings of the water tank was not clean. Chlorination procedures was not being done properly.

ii. Comments:

a. This case shows multiple failures leading to the outbreak.

b. Firstly the supervisors incharge of telecom were lethargic and had failed to report the damage to water pipeline.

c. Secondly the regular operators of water distribution failed to locate the damage in time.

d. Thirdly, if the residual chlorination level had been maintained at the water treatment site, the adverse effect of leak in water pipeline might have been minimised. That would have allowed a little more time to the water supply engineers to rectify the leak without much burden of illness due to GE.

VII. Water and food quality testing and public health laboratory facilities in Andhra Pradesh

The contents of this chapter is to assist the public health officials, EIT members, volunteers and activists in the area of environment, science and health with information about the rationale of commonly done laboratory tests of water and food quality and to describe the public health laboratory infrastructure in the state. Details of addresses of public health laboratories both in the public and private sector at the time of writing (2001) are given. Wherever available, contact telephone numbers, prevailing charges for testing of samples etc. are also given.

1. Tests for water quality

In assessing the quality of drinking water, the consumer relies principally on his or her own senses. Identification of sources of contaminated water or food is the key to epidemiological investigation of GE outbreak. Hence laboratory analysis of water and food specimens from the suspected sources are required. It is therefore vital to maintain a quality of water that is acceptable to the consumer, although the absence of any adverse sensory effects does not guarantee the safety of water. Source of water that is aesthetically unsatisfactory may discourage the consumer from using an otherwise safe water supply.

There are a number of diverse organisms that have no public health significance but which are undesirable in drinking water because they produce turbidity, taste and odour, or because they appear as visible animal life in water. As well as being aesthetically objectionable, they indicate that water treatment and the state of maintenance and repair of the system are defective. Examples include, seasonal cyanobacteria, ferrous and manganese salts, microbial corrosion of pipes by iron and sulphur bacteria, colonization of jointing and fittings of pipes by bacteria. Some times slow sand filters also can draw down some larvae.

The factors which are not conducive to the persistence of the organisms in water include high temperature and direct sunlight on the water source for even limited periods.

Pathogenic organisms are often clumped or adherent to suspended solids in water, so that the likelihood of acquiring an infective dose cannot be predicted from their average concentration in water.

The likelihood of a successful challenge by a pathogen, resulting in infection, depends upon the invasiveness and virulence of the pathogen and upon the immunity of the individual. Certain pathogenic bacteria are able to multiply in food or beverages, thereby continuing to increase the chance of infection. Because of these properties, there is no tolerable limit for pathogens in potable water. Water intended for human consumption, for preparing food and drink, or for personal hygiene should thus contain no agents pathogenic to humans. Pathogen free water is:

i. attainable by selection of high quality uncontaminated sources of water and
ii. by efficient treatment and disinfection of water known to be contaminated with human or animal faeces and

iii. by ensuring that such water remains free from contamination during distribution to the user. The concept is "to create multiple barriers to the transmission of infection."

Easy and reliable presumption of faecal pollution

There is no exaggeration in the fact that, although many pathogens can be detected by suitable methods, it is easier to test for bacteria that specifically indicate the presence of faecal pollution or specifically indicate the efficiency of water treatment and disinfection. It follows that water intended for human consumption should contain none of these bacteria. In the great majority of cases, monitoring for indicator bacteria provides a great factor of safety because of their large numbers in polluted waters. This has been reinforced by many years of experience. The faecal indicator bacteria for water quality testing should satisfy the following local conditions.

i. They should be universally present in high numbers in the faeces of local human and animal populations

ii. They should be readily detectable in the above by very simple tests

iii. They should not grow in natural waters locally and most importantly,

iv. it is essential that their persistence in water and their degree of removal in treatment of water are similar to those of local water borne pathogens.

In practice, the organisms which are used as indicators of faecal pollution are:

a. E. coli

b. The thermotolerant and other coliform bacteria

c. The faecal streptococci and

d. spores of microbial indicators of water quality i.e. heterophilic plate count bacteria, bacteriophages etc.

While all the ideal criteria for water quality testing are not met by one organism, many of them are fulfilled by E.coli and to a lesser extent, by thermotolerant coliform bacteria. The faecal streptococci can be used as supplementary indicators of faecal pollution or of treatment efficacy in certain circumstances. "It is recommended that E.coli is the indicator of first choice when resources for micro biological examination are limited. Absence of E.coli can not be taken for granted because of the absence of organisms more resistant than E.coli to disinfection such as Cryptosporidium, Giardia etc. Spores of Sulphite reducing clostridia can be used as an additional parameter in this respect.

Complete identification of E.coli is too complicated for routine use, hence certain tests have been evolved for identifying the organism rapidly with a high degree of certainity.

E.coli is abundant in human and animal faeces, where it may attain a concentration of 10 to the power of 9 per gram. It is found in sewage, treated effluents, and all natural waters and soils that are subject to recent faecal contamination, whether from humans, agriculture or animals and birds. However, one may be tempted to take in the fact that

presence of E.coli may just be due to the presence of faecal contamination from wild animals and birds which can never be excluded. However, the consensus is, as animals can transmit pathogens infective for humans, the presence of E.coli or thermoresistant coliform bacteria can never be ignored, because the presumptions remain that the water has been faecally contaminated and that treatment has been ineffective.

Thermotolerant coliform bacteria is a broad group including E.coli, Klebsiella, Enterobacter and citrobacter. Thermotolerants other than E.coli (in addition to faecal origin) also originate from organically enriched water such as industrial effluents or from decaying plant materials and soils. Regrowth of thermotolerants in the distribution systems will not take place unless there is no free residual chlorine but if some unsuitable materials are in contact with treated water at a water temperature of more than 13 degrees centigrade.

Because thermotolerants are readily detected, they have a secondary role as indicators of the efficiency of water treatment processes in removing faecal bacteria. They are therefore useful in assessing the degree of treatment necessary for waters of different quality and for defining targets of performance for bacterial removal.

Total count of coliform organisms as against thermo resistant coliform count

Total coliforms as against thermoresistant coliforms are found in faeces and also in the environment (nutrient-rich waters, soil, decaying plant material etc.) and the non-faecal varieties are sometimes found multiplying in relatively good quality drinking water. Hence, they are used more as indicators of inadequate treatment, treatment contamination and indicators of the presence of excess nutrients in water. But these total coliforms are not presently used as direct indicators of pollution. The tests for these organisms have not lost their utility even today for routine monitoring of treated piped water supplies followed by differential tests wherever necessary.

Faecal streptococci are almost always present due to human faecal contamination of water sources and rarely to animal faecal contamination. They rarely multiply in polluted waters and are more persistent than E.coli or coliforms. They are primarily used as additional indicators of treatment efficacy. As they are highly resistant to drying they are particularly useful in routine monitoring of the following situations.

i. after installing new water main pipes
ii. after repairs of distribution systems
iii. Detecting pollution by surface run-off to ground water
iv. Detecting pollution by surface run-off to surface waters

Short term deviations above the guideline values do not necessarily mean water is unsuitable for drinking. Whenever a guideline value is exceeded, the surveillance agency in the concerned public health department should be consulted immediately for suitable action and other misleaders.

A. Water sampling methods

The IS 1622 standard prescribes methods of sampling and microbiological examination of water.

Sampling Bottles: The samples for bacteriological examination should be collected in clean, sterilized, narrow mouthed neutral glass bottles of 250, 500 or 1000 ml capacity. The bottle should have a ground glass stopper having an overlapping rim. The stopper shall be relaxed by an intervening strip of paper between the stopper and the neck of the bottle. The stopper and neck of the bottle has to be protected by paper or parchment cover. The bottle should be sterilised in hot air oven at 160°C for an hour or an autoclave at 120°C approximately for 15 minutes. The sampling bottle shall not be opened except at the time of sampling. The sampling bottle should not be filled upto the brim and 2 to 3 cm space should be left for effective shaking of the bottle.

Sampling Procedure: The samples shall be representative of the water to be tested and they should be collected with utmost care to ensure that no contamination occurs at the time of collection or prior to examination. The sample bottle should not be opened till the time of collection. The stopper should be removed with care to eliminate soiling. During sampling, the stopper and the neck of the bottle shall not be touched and must be protected from contamination. The bottle shall be held near the base, filled without rinsing, and the stopper replaced immediately. Then the paper wrapping should be tied to protect the samples from contamination.

a. Collection of sample from the tap

When a sample is to be taken from a tap in regular use, the tap should be opened fully, and the water run to waste at least for 3 minutes in order to flush the interior of the nozzle and to discharge the stagnant water in the service pipe. In the case of samples to be collected from taps which are not in regular use, the tap should be sterilised by heating it either with a blow lamp or with an ignited piece of cotton soaked in methylated spirit, until it is unbearably hot to touch. Then the tap should be cooled by allowing the water to run to waste before the sample is collected.

The bottle should be held near the base with one hand and the stopper and paper covered over it and to be removed together and held in the fingers. The sample bottle should be filled from a gentle stream of water from the tap, avoiding splashing. The collection of samples from the taps which are leaky, should be avoided because the water might run down from outside the tap and may enter the bottle causing contamination. If this can not be avoided, special precautions should be taken to clean the outside of the tap and to flame it sufficiently to ensure sterility.

b. Collection of sample direct from the source:

Samples from rivers and streams should not be taken too near the bank or too far away from the point of draw off. For collecting samples directly from the rivers, lakes, tanks, wells, etc., a bottle with a string attached to the neck which is fully wrapped in paper and sterilised should be used. Before taking the sample, the paper cover should be removed, taking care not to allow the sides of the bottle to come in contact with anything. Another long clean string should be tied to the end of the sterlised string, and the bottle lowered into the water and allowed to fill up. The bottle should be then raised and the stopper with the cover replaced.

Another method of collecting samples from rivers or reservoirs is to hold the bottle by the bottom and plunge its neck downwards below the surface of the water: The bottle is then turned until the neck points slightly upwards, the mouth being directed toward the current. If no current exists, a current should be artificially created by pushing the bottle horizontally forward in a direction away from the hand. When full, the bottle is raised rapidly above the surface and the stopper replaced.

Where it is not possible to collect the sample directly into the bottle, a sample may be obtained by means of suitable metal jug. The jug is sterilised by pouring into it a teaspoonful of methylated spirit comes in contact with the entire inner surface of the jug and igniting. The jug should be lowered to the required depth and then drawn up and down two to three times before it is brought to the surface and to be rinsed at least twice before sample collection. The water from the jug should be poured into the bottle and the glass stopper of the bottle be replaced, care being taken to avoid the cover being caught between the stopper and the neck of the bottle.

Preservation and Storage: The initial time limit for starting analysis should be 1 hour but not more than 6 hours after collection of water samples. Under exceptional circumstances the analysis should be commenced at least within 30 hours and sample should be kept in dark at 1- 4°C.

Identification and Labeling: All samples should be legibly marked with the source of the sample, date and time of collection, and the name and designation of the person collecting the sample. As results of laboratory examination of the sample shall always be considered in conjunction with the sanitary survey of the water supply system, it is important that when submitting a sample for analysis, complete and accurate data of the nature and source of supply, topography of the water shade, possibility of pollution gaining access to the source, methods of treatment adopted, the condition of distribution system, and such other information as would be relevant from sanitary view point is furnished. It shall be ascertained whether the tap from where the sample is collected is supplying water from service pipe directly connected with the main or with a cistern or a storage tank.

B. Bacteriological Examination

It is essential for accurate and satisfactory laboratory work that good equipment in proper working order be provided. Standards of laboratory equipment are described in Bureau of Indian Standards, standard IS:1622-1981, Indian Standard, "Methods of sampling and microbiological examination of water".

Bacteriological testing for water:

Bacteriological examination of water is necessary for determining its fitness for use for human consumption, and for use in industries such as food processing and dairy. Water used for drinking, food processing and diarying should be free from faecal or sewage contamination because microorganisms causing water borne diseases are excreted in faeces of individuals suffering from the disease. Bacterial organisms of the coliform and streptococci groups, however, inhabit the intestinal tract of man and animals in great abundance and are readily detectable. Their presence in a sample of water is looked upon as an indication

of the probable presence of intestinal pathogenic organisms, while their absence from water usually precludes the presence of such pathogens.

Depending on availability of laboratory facilities one of the following two tests may be used. These two tests are; (a) Standard plate count, and (b) estimation of most probable number (MPN) of coliform organisms.

i. Standard plate count (Colony count):

Standard plate count (which is an empirical method) serves to indicate the efficiency of certain processes in water treatment, particularly coagulation, filtration and disinfection and the cleanliness of the mains, reservoirs, etc.. It provides an estimate of the general hygienic quality of water, which is important where large scale preparation of food and drink is concerned. Low counts are of importance for avoiding food spoilage, while rising plate counts give the earliest sign of pollution.

In solid medium counting of organisms depends on the fact that living cells will proceed to multiply and in time will produce sufficient progeny to form a colony visible to naked eye. Since bacteria occur in water as single cells, pairs, groups, chains or even dense clumps, not every individual living cell will develop into a separate colony on incubation. Therefore, number of colonies appearing on a plate does not necessarily represent the total number of organisms present in test volume. The results are expressed as number of colonies per ml. Detailed laboratory procedure for standard plate count is described in Bureau of Indian Standards, standard IS:1622-1981, Indian Standard, "Methods of sampling and microbiological examination of water".

Colony counts on nutrient agar at 37°C and 22°C are frequently used in the bacteriological examination of water. Colony counts provide a general estimate of the general bacterial purity of water. A single count is of little value, but counts from the same source at frequent intervals may be of considerable value. A sudden increase in the colony count is the earliest indicator of contamination. The recommended plate counts are:

Table:7.1 Tolerable limits of standard plate counts a measure of bacteriological quality of water.

Water at the point of consumption	Colony count after...	
	2 days at 37° C	3 days at 22° C
Disinfected (Chlorinated)	0	20
Not-disinfected	10	100

A bacterial plate count on yeast extract agar after incubation at 22° C for 7 days is the best general purpose indicator of microbiological quality especially for water with no chlorine.

ii. Most probable number of coliform organisms (MPN):

This test is based on the estimating the most probable number (MPN) of coliform organisms in 100 ml of water. The test is carried out by inoculating measured quantities of the sample water (0.1, 1.0, 10, 50 ml) into tube of McConkey's Bile Salt Broth with

bromocresol purple as an indicator. The tubes are incubated for 48 hours. From the number of tubes showing acid gas the estimation of MPN number of coliform organisms in 100 ml of sample water can be obtained from statistical tables. This result is known as the "Presumptive coliform Count" the presumption being each tube showing fermentation, contains coliform organisms. This reaction may be very occasionally due to the presence of some other organisms or combination of organisms other than coliforms with negligible margin of error in our conditions.

Confirmatory tests: The next step after MPN is to confirm the presence of coliform organisms in each tube showing a presumptive positive reaction. Such confirmatory tests are necessary to be done only on chlorinated water but not on unchlorinated water. Confirmation is done by sub culturing each presumptive positive tube in 2 tubes of brilliant green bile broth, one of which is incubated at 37° C for upto 48 hours for confirmation of the presence of coliform organisms, and the other incubated at 44° C and inspected after 6 to 24 hours to decide whether or not E.coli is present. E.coli is almost the only coliform organism which is capable of producing gas from lactose at 44° C. Further confirmation of the presence of E.coli, if ever necessary, can be obtained by testing for indole production at 44° Centigrade.

The number of positive findings of coliform group organisms (either presumptive, confirmed or completed) resulting from the multiple portion decimal dilution planting should be computed as combination of the positives and recorded in terms of the Most Probable Number.

iii. H_2S Test strip:

H_2S test strip bottles are supplied by UNICEF and also procured by the WQM labs. UNICEF's main aim is not just to supply the test bottles but to reach the communities with the technology. Under RWS scheme these are distributed to mandals for testing the water quality. Bacteriological contamination is determined using this test.

Procedure:

i. The vial is filled with the sample water upto the arrow level. The filter paper is allowed to soak in the water, if required it is gently shaken. Leave at room temperature for 24-48 hours.

ii. Observe the sample after 24-48 hours for blackening.

iii. If the colour turns black then water is not fit for consumption.

iv. Few drops of disinfectant is added and the vial is discarded. Autoclaving is preferred if the facility is available.

Following are some of the suppliers of H_2S vials in Hyderabad and other places:

Table:7.2 H_2S vial suppliers in Hyderabad and other places

Name	Address and telephone numbers
Satya Industries	86/1 Central Excise colony, Hyderabad 500013, Tel#7605148.
AP Industrial Components	Mr. B.Sengupta, Hiltron Electronic Complex, Mallital, Bhimtal, Nainintal District, UttarPradesh -263136, Tel#05942- 47086/ 47066, Fax# 05942 - 47062.
Ltek Systems	2B, Rajkamal Complex, Panchsheel Square, Dantoli, Nagpur 440012, Tel#0712- 542230, Fax # 0712- 521746.
Hi Media Laboratories Ltd	Mr. VM Varke, A-406, Bhaveshwar Plaza, LBS Marg, Ghatkopar (West), Mumbai 400086

2. Tests for food quality

The food sample taken for bacteriological examination should be handled aseptically and it should be truly representative of the lot.

A. Food sampling methods

The general requirements of the food sampling are as follows:

i. Sampling shall be carried out by a qualified, trained, experienced and duly authorized person. It is essential that the sample should be representative of the lot to be examined, which may comprise a large number of small packages of materials stored in large containers. Sampling, therefore, requires most careful attention to details if the subsequent analysis is to be of value. Since the samples are required for micro biological analysis, utmost precautions are also necessary to avoid extraneous contamination while drawing and handling the sample and to preserve them in their original condition till they are ready for examination in the laboratory.

ii. Wherever possible, samples of products in original unopened containers or packages should be drawn and sent to the laboratory without any delay. This will prevent possible contamination of samples during handling and also help in revealing the true condition of the product as prepared and offered to the public.

iii. Samples shall be drawn in a protected place without air draught and not exposed to humid conditions, dust or soot, and transferred to sterile containers under aseptic conditions as far as possible.

iv. The sampling appliances and sample containers shall be clean and sterile.

v. All precautions shall be taken to protect the samples, the material being sampled, the sampling instruments and the sample containers against adventitious contamination at the time of drawing the samples, opening sample containers and transferring the samples.

vi. Since it is impracticable to sterilize certain sampling devices in the field, it is preferable to sterilize such devices in the laboratory and transport them in sterile carrying cases. Where drills, triers, agitators, etc, are used in the field, it is often necessary to sterilize them between samplings. For this purpose, adequate number of sterile sampling devices/equipment should be carried by the sampling authority, where such facilities are not available.

vii. Hermetically sealed cans shall not be opened under field conditions.

viii. Each sample container shall be closed with the stopper or sealed airtight after filling with the sample and marked with full details of sampling, batch or code number, name of the manufacturer and other required particulars.

ix. Samples of dry foods shall be stored in such a manner that the temperature does not vary unduly from the normal temperature. Other samples (either in original packing or transferred to sample containers) shall be held in ice, dry ice or freezing mixture, if so required, according to the nature of the material sampled for analysis with a view to preventing any microbial growth or changes in the microbial flora of the samples during their transport to the laboratory.

x. No preservative or bactericidal or fungicidal agent shall be added to samples of foods required for micro biological analysis.

The details on sampling appliances, containers, scale of sampling, storage of samples etc are available in Indian Standard, IS: 5404-1984, "Methods for drawing and handling of food samples for microbiological analysis (First Revision)".

B. Bacteriological testing of food

The following methods are used for food quality analysis. (a) Isolation, Identification and Enumeration of E.coli (b) Coliform bacteria in foods and (c) Plate count of bacteria in foods. The detailed procedure for conducting these tests is given in Bureau of Indian Standards, standard SP:18 (Part 1)-1980, ISI Handbook of Food Analysis, Part -1 General Methods.

a. Isolation, Identification and Enumeration of E.coli

The typical E.coli usually produces smooth, non-mucoid colonies on solid medium. The laboratory investigation is directed only towards enumeration of E.coli to assess the hygienic quality of a product. The most probable number (MPN) is reported as the average of the results obtained from each of the duplicate dilution series followed.

b. Coliform bacteria in foods

The method is based on the principle that the members of coliform group are capable of producing acid and gas from lactose in the presence of bile salts. The test commonly conducted to detect the presence of coliform bacteria is called presumptive test and further tests are conducted to confirm the presence of coliforms.

c. Plate count of bacteria in foods

Measured volumes of different dilutions of samples are plated on suitable nutrient media, such as, nutrient agar or yeast agar plates, and the number of colonies are counted. The total viable count per millilitre or gram is calculated.

3. Public health laboratory facilities in the state

Following are the details regarding the water quality testing facilities available in the state. The public health laboratories are classified as State, Regional and District labs.

a. State laboratory[1]:

State public health laboratory is equipped to do bacteriological and chemical analysis of water samples. Services are available for free to all PHC's and public health authorities. Public can also avail its services by paying user charges. There are 3 sample collectors who collect the water samples from Hyderabad, Mahboobnagar, Nalgonda, Nizamabad, Medak and Rangareddy districts. In the twin cities the samples are collected twice a day, first sample at 6.30 to 8.30 am and second at 12 to 2 pm. The samples are collected with the help of Metro water works, as they provide transportation facility for water sample collection.

b. Regional Laboratories:

These labs are equipped for testing of water and food samples. They act as mini Institute of preventive medicine as they also provide other facilities like blood testing and Immunization.

c. District Laboratories:

District labs analyse only water samples. Each lab has two sample collectors who collect water samples for water quality testing.

Procedure of sample collection and testing:

Water for bacteriological testing is collected in the sterlised bottles provided by the public labs. The sample should be returned to the lab with in four hours of sample collection or the sample should be stored at 4^{o} c in the ice boxes. The samples are analysed for E.coli. The reports are furnished within two days and are sent to respective DMHO's, Executive Engineers, Panchayat Raj Department, District Collectors, Directorate of Health and Secretary, Health. The samples are collected from the public taps and sources provided under Protected Water Schemes. Public can also access the facilities of the public health laboratories by paying an amount of Rs. 100 for bacteriological analysis and Rs. 150 for chemical analysis.

[1]The state public health laboratory does various pathological, micro biological and biochemical tests of samples referred by hospitals in the twin cities. The lab is also equipped to analyse stool samples for microbiological tests of GE.

Table:7.3 Public health laboratories in the State

Place	Address, Telephone	Remarks
Hyderabad	Cheif Water Analyst, Institute of Preventive Medicine, Narayanaguda, Hyderabad - 500029. Tel#: 040 - 7560191 7567892, 7567893, 7567894, 7567895.	State public health lab. Water and food analysis is being carried out here. E.coli in water and food samples are estimated.
Guntur	Guntur Regional Laboratory, Medical College Campus, Guntur. Tel#:0863 - 320727	Regional public health labs. These labs conduct tests for water and food samples.
Kurnool	Kurnool Regional Laboratory, Medical College Campus, Kurnool. Tel#: 08518 - 21676	The hospital diet samples, food samples from port authorities, jails and social welfare hostels are tested.
Warangal	Warangal Regional Laboratory, Medical College Campus, Warangal. Tel#: 08712 - 26676	E.coli in water and food samples are estimated.
Visakapatnam	Visakapatnam Regional Laboratory, Medical College Campus, Visakapatnam. Tel#: 0891- 563018	
Eluru	District lab, Near water works, Eluru. Tel#: 08812 - 33454	Laboratories have facilities for water tests only.
Tirupati	District lab, Besides Govt. Maternity Hospital, Tirupati. Tel#: 08574 - 30820	
Wanaparthy	Jr.Analyst,WQM Lab,Wanaparthi, Plot No.12, SBH Road, Wanaparthy, Mahaboobnagar District. Tel#: 08543- 21764	
Ongole	Jr.Analyst, WQM Lab, D.No:37-1-258 (2/A), Near Hindustan Hotel, Trunk Road, Ongole. Prakasam District	
Vijayawada	Jr.Analyst, WQM Lab,Vijayawada, Main municipal water works campus, Vidyadharapuram, Vijayawada. Krishna District. Tel#: 0861 - 423570.	
Karimnagar	Jr.Analyst, WQM Lab, District Head Quarter Hospital Campus, Karimnagar. Tel#: 08722 - 44924	
Medak	Jr.Analyst, WQM Lab, No:1-9-12/4/4/1, Near Azampura, Medak- 502110 Tel#: 08452 - 22530	

Nalgonda	Jr.Analyst, WQM Lab, D.No: 5-4/26. RP Road, Nalgonda. Tel#: 08682 - 44629
Dhone	Jr.Analyst, WQM Lab, No:9-19-3-16, KVS Colony, Kothapet, Dhone. Kurnool District. Tel#: 22367
Narsaraopet	Jr.Analyst, WQM Lab, Narsaraopet, No:3-33-215, Opp.SSN College, NGO's Colony, Narsaraopet, Guntur District. Tel#: 08647 - 23513

4. Panchayat raj water quality monitoring labs

Panchayatraj water quality monitoring labs are part of Panchayatraj Engineering department. There are 51 labs in the state. At the Mandal level Assistance Engineer is responsible for sample collection and for sending the samples for the water quality monitoring labs. The Assistant chemist is incharge for the water analysis. The samples are drawn from the water sources that are provided from the panchayatraj department. Sample collectors from the WQM labs are also sent to the field to collect water samples. The samples are to be sent from each source atleast once in three months. During pre-monsoon and post-monsoon season samples are sent from all the sources for analysis. Data at the WQM labs is available by village and source wise.

Procedure

The samples are collected from different sources at the village level by the assistant engineer at the mandal level and are sent to the nearest located WQM labs. Details of the sample will be filled in a form and will be given with the water samples. Water for chemical analysis is collected in cans and for bacteriological analysis sterilised bottles are provided by the WQM labs. The sample should be returned to the lab with in four hours of sample collection or the sample should be stored at 4^{o} c in the ice boxes that are provided by the WQM labs. MPN of coliform bacteria and E.coli are the tests conducted. The reports are prepared within two days for chemical analysis and three days for bacteriological analysis. Separate report forms are used for chemical and bacteriological analysis. The reports will be sent to the respective assistant engineer at the mandal level with remarks by the assistant chemist for further action and in special cases a report will also be sent to PHC, DM&HO, DH. Following are the water quality testing laboratories under RWS

Table:7.4 Water quality testing laboratories under rural water supply scheme functioning under Executive Engineer, RWS division (PR).

District	Location
Srikakulam.	Srikakulam, Palasa & Uddanam
Vijayanagaram	Vijayanagaram, Parvathipuram
Vishakapatnam	Vishakapatnam Parthipuram
East Godavari	Kakinada, Rajahmundry
West Godavari	Eluru, Kovvuru
Krishna	Vijayawada, Gudivada
Guntur	Guntur, Narsaraopet ,Tenali
Prakasam	Darsi, Ongole
Nellore	Nellore, Gudur
Chittoor	Thirupathi, Chittoor, Madanapalli
Cuddapah	Cuddapah, Rajampet, Pulivendla
Anantapur	Anantapur (2), Penukonda
Kurnool	Kurnool, Nandyal, Adoni
Mahaboobnagar	Mahaboobnagar, Gadwal, Nagarkurnool
Ranga Reddy	Hyderabad, Pargi
Nalgonda	Nalgonda, Miryalguda
Nizamabad	Nizamabad, Banswada
Medak	Medak, Sanga Reddy
Warangal	Warangal, Eturunagaram
Khammam	Khammam, Kothagudem
Karimnager	Karimnager, Manthani
Adilabad	Adilabad, Manchiryal

5. Private water testing facilities in Hyderabad

Following are some of the private water quality testing laboratories in Hyderabad. These labs conduct bacteriological testing and will charge from Rs.250 to Rs.550 per sample. They will provide the sterilised bottle for water sample collection. The general tests conducted are for E. coli, total platelet count and Most Probable Number (MPN) of bacteria.

Addresses and telephone numbers of some of the private water testing facilities in Hyderabad

Bhagavathi Ana Labs, 1-10-250 Ashok Nagar, Hyderabad 500020. Tel # 7634871

Natural Resource Development Cooperative Society, 3-5-886/4/A, Himayath Nagar, Hyderabad 500029. Tel # 3225853

Pragathi labs and consultants pvt ltd, Sri Venkataramana Complex, Tarbund X roads, Secunderabad- 500003. Tel# 7897213

Sai Enviro Engineers Pvt. Ltd, 6-2-11/1, Falt No:201, Surabhi Plaza, Lakdikapul,

Hyderabad- 500004. Tel# 3303006

Vitro Labs, 2-2-647/A/80 Shivam Road, Sri Sai Baba Nagar, Hyderabad - 500013. Tel# 3225853

6. Food testing laboratories in the state

Table 7.5 Food testing laboratories in the state

Place	Laboratory	Remarks
Hyderabad	State Food Laboratory Public Health Lab and Food Health Admn., Government Analyst Food and Drugs Control Laboratory, Industrial Area, Nacharam, Hyderabad 501507.	State food labs, food analysis both chemical and bacteriological tests are conducted.
Guntur	Regional Agmark Laboratory Directorate of Marketing & Inspection, Kothapet, Main Road, Guntur- 522001, A.P.	Managed by directorate of marketing and inspection.
Visakhapatnam	Sub Office: H.No. 45-17-260, Venkateswara Nager, Visakhapatnam - 530016	Caters to the inspection of food for exports.
Hyderabad	Indian Grain Storage Institute Government of India, P.O.Box.No.1, Rajendranager, Hyderabad- 500030.	Managed by union ministry
Hyderabad	National Institute of Nutrition, I.C.M.R., Jamia Osmania P.O., Hyderabad - 500007.	Central government run laboratories.
Hyderabad	Food Corporation of India, Regional Chemical Laboratory, Progressive Towers, Khairthabad, Hyderabad-500004. A.P.	
Hyderabad	Quality Control Laboratory, Andhra Pradesh Foods, Nacharam, IDA, Hyderabad-501507.	Quasi government laboratory
Tanuku	Andhra Sugars Limited, Venkatarayapuram, P.O.No. 2, Tanuku-634215. A.P.	Private laboratories
Kakinada	M/s. Sterling Laboratories, 41-8-23, Srikrishna Bhavan Commercial Road, Kakinada- 533007. A.P.	

VIII. Food hygiene: caterers and food handlers manual

This chapter is useful for food handlers, caterers, and public health officials in dealing with food handling and catering establishments.

Most reported cases of food borne illness arise from foods that are prepared and mistreated or mishandled in food service establishments. Investigations of outbreaks of food borne disease throughout the world show that in nearly all instances, they are caused by failure to observe satisfactory standards in the preparation, processing, cooking storing or retailing of food.

Organisms may be introduced into the food chain from a variety of sources, and at different stages. Gastrointestinal pathogens may be derived from animal sources, the environment or occasionally, from humans. The elimination of pathogenic organisms therefore depends largely on the correct application of processing technologies, such as pasteurization, irradiation, cooking, freezing and pickling at the industrial, retail and domestic levels.

Need for food service sanitation

Review (Pollitzer, 1959) of cholera epidemics reveals that food plays an important role in the transmission of cholera. Food borne gastroenteritis is usually due to faecal contamination. Second, any food that is not cooked immediately before ingestion can serve as a vehicle for transmission. Although, the resistance of the cholera organism in the environment is not great; the organism is capable of surviving in foods and drinks long enough to transmit the disease to susceptible individuals.

The equipment and utensils used in the preparation of food act as sources of contamination. The food industry and the public health agencies have important roles to play in helping to ensure that safe food and drinks offered to the public. Cooked food can be more easily contaminated and has the potential to support the growth of disease organisms and production of toxins. The purpose of food service sanitation is the protection of the health of the consumer and to ensure that hygienic principles be applied to eliminate any conditions or operating method that might serve as avenues of contamination. Food service sanitation is also important from economic angle, as it would lead to reduced earning to the establishment. There are three aspects to preparation and delivery of hygienic food, namely (a) Hygiene of the food preparation premises; (b) Hygienic food handling, and (c) Personal Hygiene of food handlers.

A. Hygiene of the food preparation premises

The food preparation premises should be of sound construction and well maintained. The working environment should be well lit, well ventilated and tidy as this will encourage good working practices and promote food safety.

i. Water supply:
   a. Running clean water, preferably hot during winter, soap, nail brush and clean towel will be provided in each cookhouse.

ii. Wash area:

a. Adequate arrangements will be made for the washings, rinsing and sterilising of eating and drinking utensils. The wash area should be dry, clean and tidy. Sinks should be adequate, and draining boards should be sufficient and clean.

b. If a proper wash area cannot be provided, a properly constructed washing platform with a cement top or PVC top draining into a properly constructed soak pit through a grease trap must be provided. Maintenance of a grease trap and soak pit is extremely important to avoid fly, mosquito, cockroach and sand fly nuisance.

iii. Cooking platform and practices:

a. Cooking platform should be maintained free of any food particles, vegetable peelings and any other waste particles.

b. The platform should be cleaned soon after cooking and always maintained dry and clean. Frequent cleaning is also important since dried and encrusted residues are much harder to remove.

c. All cutting up of meat and pastry will be done on the cutting up blocks / boards and pastry slabs provided for the purpose

d. Only food which is to be used during the current day will be kept in the cookhouse. When not in the process of cooking or in preparation for cooking it will be protected from flies in fly proofed food safes.

iv. Cooks and other personnel:

a. Cooks should keep their nails clipped short and invariably wash their hands before they handle the food and after visit to latrine.

b. Persons suffering or recovering from typhoid, paratyphoid, gastroenteritis, such other communicable diseases shall not be employed on any job involving handling of food, water or such other ingredients for preparation of food.

c. Medical officers responsible for examination and certification of food handling personnel must rule out existence of any communicable disease. In addition, the medical officer must provide the candidate with health education regarding essential hygienic practices for food handlers. The fact that training on essential hygienic practices for food handlers has indeed been provided must be specifically mentioned in the certificate of fitness for food handling.

d. An update nominal roll of all persons employed in the cookhouse showing the immunisation record and the date of medical inspection will be maintained and displayed prominently in the cookhouse.

e. Personnel employed in cooking of food will be provided with aprons and hand towels. Aprons will always be worn at work, kept clean, and changed and washed when dirty.

v. Cooking equipment, pots and pans:

a. The cookhouse sinks, tables chopping blocks, cutting-up boards, pastry slabs, mincing machines, knives, forks, and spoons, and all other utensils will be kept clean when in use and will be thoroughly cleaned after the last meal. All utensils, when not in use, will be kept in the place allocated for them and will be available for inspection at any time.

vi. Cleaning practices:

a. Cloths used for cleaning can rapidly accumulate a large population of microorganisms, particularly when left moist, and their use can actually increase contamination rather than reduce it. The incharge will be responsible to ensure that there is always a sufficient supply of clean cloths available for drying washed dishes and cooking utensils. The cloths used for handling hot and sooty vessels will be separate and distinct. These clothes must be boiled in water containing washing soda and hung up to dry at regular intervals as required and definitely once at the end of the day.

b. All pots, pans and other utensils will be freed from grease, cleaned and dried after the last meal, and placed on a shelf on their sides with their interiors exposed to the air and to view.

c. Food scraps, vegetable peelings and such like refuse will not kept be thrown on the floor, but directly deposited in covered garbage bins provided for the purpose.

d. The floors of cookhouse will be scrubbed daily and excess water must be dried up by mopping.

vii. Construction

a. The layout of the premises and equipment should allow foods to be stored and handled without contact between raw and cooked products, either directly or via equipment.

b. The premises should be protected to prevent from entering of pests.

viii. General:

a. Personal clothing or underclothing and accessories are not to be washed, dried or kept in.

b. Smoking in the cookhouse is prohibited.

B. Hygienic food handling

A large part of the hygienic handling of food relates to the correct use of temperature in the control of microorganisms, avoiding temperatures where microbial growth is possible and ensuring that temperatures are sufficiently high to kill microorganisms. There should be means of keeping food at the required temperatures, for example perishable foods should normally be stored at less than 10°C. Food should be thoroughly cooked to ensure that all parts reach temperature of atleast 70°C. Precooked foods should be stored outside danger zone of 10-60°C and those served hot should be reheated to 70°C before consumption.

When dishes containing a mixture of cooked and raw ingredients are being prepared, it is important to cool the cooked component before mixing with the other ingredients. Failure to do this could lead to a temporary rise in temperature during which microbial growth can occur.

The other major objective of hygienic food handling is to avoid contamination, particularly of cooked or ready-to-eat foods. Physical measures such as the exclusion of vermin from the premises contribute to this and also operational procedures such as keeping the cooked food covered as much as possible.

Cooked food should be kept well separated from raw food to reduce the risk of cross contamination. Touching cooked foods with bare hands should be avoided. Utensils such as tongs or tissue paper, or clean gloves should be used when handling foods which are ready to eat such as salads and sandwiches.

C. Personal hygiene of food handlers

Food handling personnel play an important role in ensuring food safety throughout the chain of production, processing, storage and preparation. Mishandling and disregard of hygienic measures on their part may enable pathogens to come into contact with food and in some cases, to survive and multiply in sufficient numbers to cause illness in the consumer. The risk of food handling personnel to transmit disease is related to the degree of contact that they are likely to have with particulars sorts of food.

Proper personal hygeine as listed below has to be maintained by cooks and all other food handlers.

i. Wash your hands before serving food, after handling used dishes. Cooks should wash hands before starting work, after completion of each operation. For example wash after cutting vegetables, preparing stuff, preparing one dish and moving on to preparation of another dish.

ii. Wash hands with soap after using toilets. Do not return to cook area without washing and drying your hands.

iii. Keep your fingernails short and trimmed. Ragged nails harbour bacteria and are difficult to keep clean. Long nails can break off into food and present the same hazards as ragged nails.

iv. Do wear clean clothes and keep your hair clean and confined. Dirty clothing can carry disease causing microorganisms which can contaminate clean hands. Oily, dirty hair can carry and hold large numbers of disease- causing bacteria. Wear clean caps earmarked for the purpose and subject to regular cleaning and drying.

v. Do cover cuts and sores on the hands with bandages to protect food from contamination. Wear a glove over the bandage when working with food. Change gloves as often as hand washing is required.

vi. Notify your supervisor if you have diarrhoea or a communicable illness. Do not work with food.

IX. Recommendations of the Expert Committee on communicable diseases - Govt. of AP

The government of Andhra Pradesh has constituted Expert Committees for study of Japanese Encephalitis, Malaria, Dengue fever and Gastroenteritis. The expert committee met at Committee Hall of Director of Health, Office of Director of Health Services, Sultan Bazar, Hyderabad on 5th March 2001. Following are the recommendations:

i. Reduction of case fatality rate by early detection and effective case management through elaborate reporting systems.

ii. Need for new approaches both qualitative and quantitative, reorientation in treatment strategies and case management by involvement of the private sector medical practitioners.

iii. Better understanding of vector, food and water borne diseases and for interaction between different sectors of the society and concerted efforts by all the concerned departments.

iv. Strengthen the existing disease surveillance system to make it more systematic, sensitive and functional with built in feed back system, user friendly for identifies communicable disease.

v. Set up a network public health laboratories with strong microbiology and epidemiology components

vi. Strengthen Information, Education & Communication (IEC) programmes, identify role of Non Governmental Orgnisations (NGOs) and community for training, rehabilitation, for provision of safe water and linking appropriate actions for better resource mobilization (eg: Vector control measures by Zilla Parishad, IEC and chlorination etc. by panchayat)

vii. Setting up district level laboratories for water testing

viii. Setting up inter sectoral coordination for supply of safe drinking water

ix. Ensure adequate supply of chlorine tablets and ORS at community level.

x. Institute early treatment of GE cases to prevent deaths.

The expert committee members can also visit the problematic districts and interact with programme officials and community at large.

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Appendix -1

Formats for sanitary survey of water supply sources : Forms WS 1-5 have been developed based on Examples of sanitary inspection forms, "Guidelines for drinking water quality", Second Edition, Volume 3, Surveillance and control of community supplies, WHO, 1997. Form WS-6 is verbatim reproduction from Examples of sanitary inspection forms, "Guidelines for drinking water quality", Second Edition, Volume 3, Surveillance and control of community supplies, WHO, 1997.

Sanitary survey of dug well

Form: WS-1

Date of visit:

Water sample taken?

A. Identification:

1. Local name and description of the source:

2. Located in:

Habitn. Id and Name	Municipality:
Village Id and Name	Ward Id & Name
Gram Panchayat	PHC Name & HCId

B. Assessment of risk (If present score=1, else score=0)

Sanitary survey question and source characteristic		Score	Remark
1	Is there a latrine within 30 feet of the well?		
2	Is the nearest latrine on higher ground than the well?		
3	Is there any other source of pollution (e.g. Animal excreta, rubbish) with in 30 feet of the well?		
4	Is the drainage poor, causing stagnant water within 6 feet?		
5	Is the drainage channel faulty leading to water stagnation?		
6	Does the parapet allow surface water into the well?		
7	No pucca platform around the well or is less than 3 ft dia?		
8	Inadequately sealed wall within 10 feet below ground?		
9	Any cracks in platform, letting water to reenter the well?		
10	Is the draw mechanism (rope & bucket, hand pump, etc) unsanitary?		
11	No cover? Or If there is cover is it unsanitary?		
12	Does the installtion require fencing?		
	Total score for risk assessment		

C. General comments:

Name, designation and signature of surveyor

Significant persons present during the inspection:

Name & address	Designation / role	Signature

Sanitary survey of deep bore well, or shallow tube well

For m: WS-2

Date of visit:

Water sample taken?

A. Identification:

1. Local name and description of the source:
2. Located in:

	Habitn. Id and Name	Municipality:
	Village Id and Name	Ward Id & Name
	Gram Panchayat	PHC Name & HCId

B. Assessment of risk (If present score=1, else score=0)

Sanitary survey question and source characteristic		Score	Remark
1	Is there a latrine within 30 feet of the well?		
2	Is the nearest latrine on higher ground than the well?		
3	Is there any other source of pollution (e.g. Animal excreta, rubbish) with in 30 feet of the well?		
4	Is the drainage poor, causing stagnant water within 6 feet?		
5	Is the drainage channel faulty leading to water stagnation?		
6	No pucca platform around the pump or is less than 3 ft dia?		
7	Are there cracks in the platform around the hand pump?		
8	Is there any water stagnation on the platform?		
9	Is the draw mechanism (rope & bucket, hand pump, mechanical pump, etc) unsanitary?		
10	Is the hand pump loose at its base?		
11	Is this a shallow tube well?		
	Total score for risk assessment		

C. General comments:

Name, designation and signature of surveyor

Significant persons present during the inspection:

Name & address	Designation / role	Signature

Sanitary survey of piped water supply system (PWS)

Form: WS-3

Date of visit:	
Water sample taken?	

A. Identification:

1. Local name and description of the source:
2. Located in:

Habitn. Id and Name	Municipality:
Village Id and Name	Ward Id & Name
Gram Panchayat	PHC Name & HCId

B. Assessment of risk (If present score=1, else score=0)

	Sanitary survey question and source characteristic	Score	Remark
1	Is the supply intermittent?		
2	Are there any leaks in the distribution system?		
3	Is the area around the tapstand unclean?		
4	Does water accumulate near the tapstand?		
5	Are there human excreta within 30 ft of the tapstand?		
6	Is there any sewerage pipe line passing very close to the water pipe line?		
7	Is the plinth of the tapstand cracked or eroded?		
8	Does the tap leak?		
9	Is the overhead tank cracked, leaking, or covers open?		
10	Is the sump exposed to surface flow, other contamination?		
	Total score for risk assessment		

C. General comments:

Name, designation and signature of surveyor

Significant persons present during the inspection:

Name & address	Designation / role	Signature

Sanitary survey of water tanker truck distribution system

Form: WS-4

Date of visit:

Water sample taken?

A. Identification:

1 .Local name and description of the source:

2. Located in:

Habitn. Id and Name	Municipality:
Village Id and Name	Ward Id & Name
Gram Panchayat	PHC Name & HCId

B. Assessment of risk (If present score=1, else score=0)

Sanitary survey question and source characteristic	Score	Remark
Tanker filling stations		
1 Is the chlorine level less than 0.5 mg/litre?		
2 Is the filling station excluded from the routine quality control programme of the water authority?		
3 Is the discharge pipe unsanitary?		
Tanker trucks		
4 Is the tanker ever used for transporting other liquids besides Drinking -Water?		
5 Is the filler hole unsanitary, or is the lid missing?		
6 Is the delivery hose nozzle dirty or stored unsafely?		
Domestic storage tanks:		
7 Can contaminants (e.g. soil on the inside of the lid) enter the tank during filling?		
8 Does the tank lack a cover?		
9 Does the tank need a tap for withdrawal of water?		
10 Is the stagnant water around the storage tank?		
Total score for risk assessment		

C. General comments:

Name, designation and signature of surveyor

Significant persons present during the inspection:

Name & address	Designation / role	Signature

Sanitary survey of intakes from rivers, streams and reservoirs for water supply system

Form: WS-5

Date of visit:

Water sample taken?

A. Identification:

1. Local name and description of the source:
2. Located in:

Habitn. Id and Name	Municipality:
Village Id and Name	Ward Id & Name
Gram Panchayat	PHC Name & HCId

B. Assessment of risk (If present score=1, else score=0)

Sanitary survey question and source characteristic	Score	Remark
1 Is there any human habitatio polluting the source?		
2 Are there any farm animals upstream polluting the source?		
3 Is there any industrial pollution upstream?		
4 Is the intake installation freely accessible - without a fence?		
5 Is the intake unscreened?		
6 Does the intake point lack a minimum-head device (weir or dam to ensure minimum head of water)?		
7 Does the system require a sand or gravel filter?		
8 If there is a filter, is it badly maintained and dysfunctional?		
9 Is the flow uncontrolled?		
10 Any other factor with high risk of contamination?		
Total score for risk assessment		

C. General comments:

Name, designation and signature of surveyor

Significant persons present during the inspection:

Name & address	Designation / role	Signature

Sanitary inspection form for water treatment plant

Form: WS-6

Date of visit:

Water sample taken?

A. General information

1. Survey of ....
   Source Intake Treatment plant Distribution
2. Carried out by ....
   Name of person Agency
3. Name of supply ....
   State District Treatment plant
4. Address .....
5. Person in charge .....
6. Year started operation .....
7. Area served ..... Population served .....
8. Treatment-plant capacity Designed..... Actual.....
9. Security of plant : Fence Y/ N Security guard: Y/ N

B. Source

1. Type of water source: ....
   Reservoir Stream River Well Others

C. Intake

1. Is the intake adequate with respect to:

Location?	Y/N
Structure?	Y/N
Maintenance?	Y/N
Pollution source in the vicinity?	Y/N

D. Treatment processes employed

1. Fine screen .....
2. Grit chamber .....
3. Oil and grease trap .....
4. Pre sedimentation .....
5. Pre disinfection/ oxidation ....
   Chlorine Ozone

6. Activated carbon treatment .....

7. Aeration .....

8. Coagulation and flocculation ....
   Lime Alum Others

9. Sedimentation ....
   Rectangular Circular Others

10. Filtration ....
    Slow Rapid Granularcarbon

11. Disinfection ....
    Chlorine Ozone Others

12. Others processes (specify) .....

E. Sedimentation

1. No of sedimentation tank .....
2. Frequency of desludging .....
3. Type of desludging facility .....
4. Method of sludge disposal .....
5. General appearance of clarified water .....
6. Turbidity (NTU) at inlet..... (NTU) at outlet.....

F. Filtration

1 No of filters .....
2. Filtration rate .....
3. Filter run .....
4. Depth of gravel .....
5. Depth of sand .....

G. Backwashing

Criteria used for initiating backwashing:

Air scour: ....
Rate Duration

Water scour: ....
Rate Duration

Distribution of air and water supply in the sand bed:

....
Even Uneven

Capacity of clean water for backwash .....

Any mud balls or cracks in the filter bed

Before backwash .....

After backwash .....

Where does the wash water go? .....

H. Fluoridation

1.Chemical used: .....

2.Dosage of chemical:.....

I. Chlorination

1.Any interruption in chlorination? .....

2.Frequency of interruption: .....

3.Cause of interruption: .....

4.Type of chemical used: .....

5.Dosage of chemical: .....

6.Safety equipment and measures: .....

7.Reserve stock of disinfectant: .....

8.Storage conditions: .....

J. Clear-water tank(s)

1. No. of tanks: .....
2. Capacity of each tank: .....
3. Concentration of free residual chlorine: .....
4. pH: .....
5. Chemical used for pH adjustment and its dosage: .....
6. Any leak in the tank? .....
7. Is the tank properly covered and locked? .....
8. Any scum or foreign substances in the tank? .....
9. Are air vents and overflow pipes protected by screens? .....

K. Process control

	Yes	No	Frequently
1. Jar test	.....	.....	.....
2. pH	.....	.....	.....
3. Free residual Chlorine:	.....	.....	.....
4. Colour:	.....	.....	.....
5. Turbidity:	.....	.....	.....
6. E.coli/ thermotolerant coli:	.....	.....	.....
7. Fluoride:	.....	.....	.....
8. Others:	.....	.....	.....

SANITARY INSPECTION

L. Record keeping

1. Chemical Consumption:.....
2. Process-control tests:. .....
3. Bacteriological examination: .....
4. Residual chlorine:.....
5. Other:.....

M. Maintenance

	Cleaning	Calibrating/oiling/greasing
1. Screen:	.....	.....
2. Pumping facility:	.....	.....
3. Chlorine-dosing facility:	.....	.....
4. Alum-dosing facility:	.....	.....
5. Fluoride-dosing facility:	.....	.....
6. Instrument (gauge, recording etc.)	.....	.....
7. General housekeeping:	.....	.....
8. Storage of chemicals:	.....	.....
	Adequate	Inadequate

N. Personnel

1. No. of present staff:	.....	.....
	Permanent	Casual

2. Academic level of the plant superintendent or the most senior operator of the treatment plant:.....

3. Length of service in present water-treatment plant:.....

4. Total experience in water treatment:.....

O. Complaints received

From operators:.....

From management:.....

P. Problems (if any) with:

		Yes	No	Description of problems
1.	Fine screen:	.....	.....	.....
2.	Grit chamber	.....	.....	.....
3.	Oil and grease trap:	.....	.....	.....
4.	Presedimentaion:	.....	.....	.....
5.	Activated carbon:	.....	.....	.....
6.	Aeration:	.....	.....	.....
7.	Coagulation and flocculation:	.....	.....	.....
8.	Sedimentation:	.....	.....	.....
9.	Filtration:	.....	.....	.....
10.	Fluoridation:	.....	.....	.....
11.	Disinfection:	.....	.....	.....
12.	Other control:	.....	.....	.....
13.	Record keeping:	.....	.....	.....
14.	Maintenance:	.....	.....	.....

Q. Flow diagram of water works (insert diagram)

R. Remedial measures recommended

Measures to be taken immediately:.....

Measures to be taken later on .....

S. Have problems identified in the previous sanitary survey been corrected?

.....

.....

.....

.....

.....

.....

.....

.....

.....

Signature of inspector: .....

Abbreviations

AP	Andhara Pradesh
APPHA	The Andhara Pradesh Public Health Act
BIS	Bureau of Indian Standards
CFR	Case Fatality Rate
DM&HO	District Medical and Health Officer
E.coli	Escherichia coli
EIT	Epidemiological Investisation Team
EPI	Expanded Programme for Immunisation
ETEC	Enterotoxigenic Escherichia coli
GE	Gastroenteritis
HCId	Health Care Institution Identificaation Code
HM&FW	Health, Medical and Family Welfare
ICMR	Indian Council of Medical Research
IEC	Information, Education and Communication
IHS	Institute of Health Systems
IPM	Institute of Preventive Medicine
IS	Indian Standard
IV	Intra Venous
MHO	Municipal Health Officer
MPN	Most Probable Number of coliform organisms in 100ml of water
ORS	Oral Rehydration Salts
ORT	Oral Rehdration Therapy
PFA	Prevention of Food Adulteration Act
PHC	Primary Health Centre
PHCMO	Primary Health Centre Medical Officer
PR	Panchayathi Raj
RHC	Rural Health Centre
RWS	Rural Water Supply
SMX	Sulfamethoxazole
TMP	Trimethoprim
V.cholerae	Vibrio cholerae
WHO	World Health Organisation
WQM	Water Quality Monitoring

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