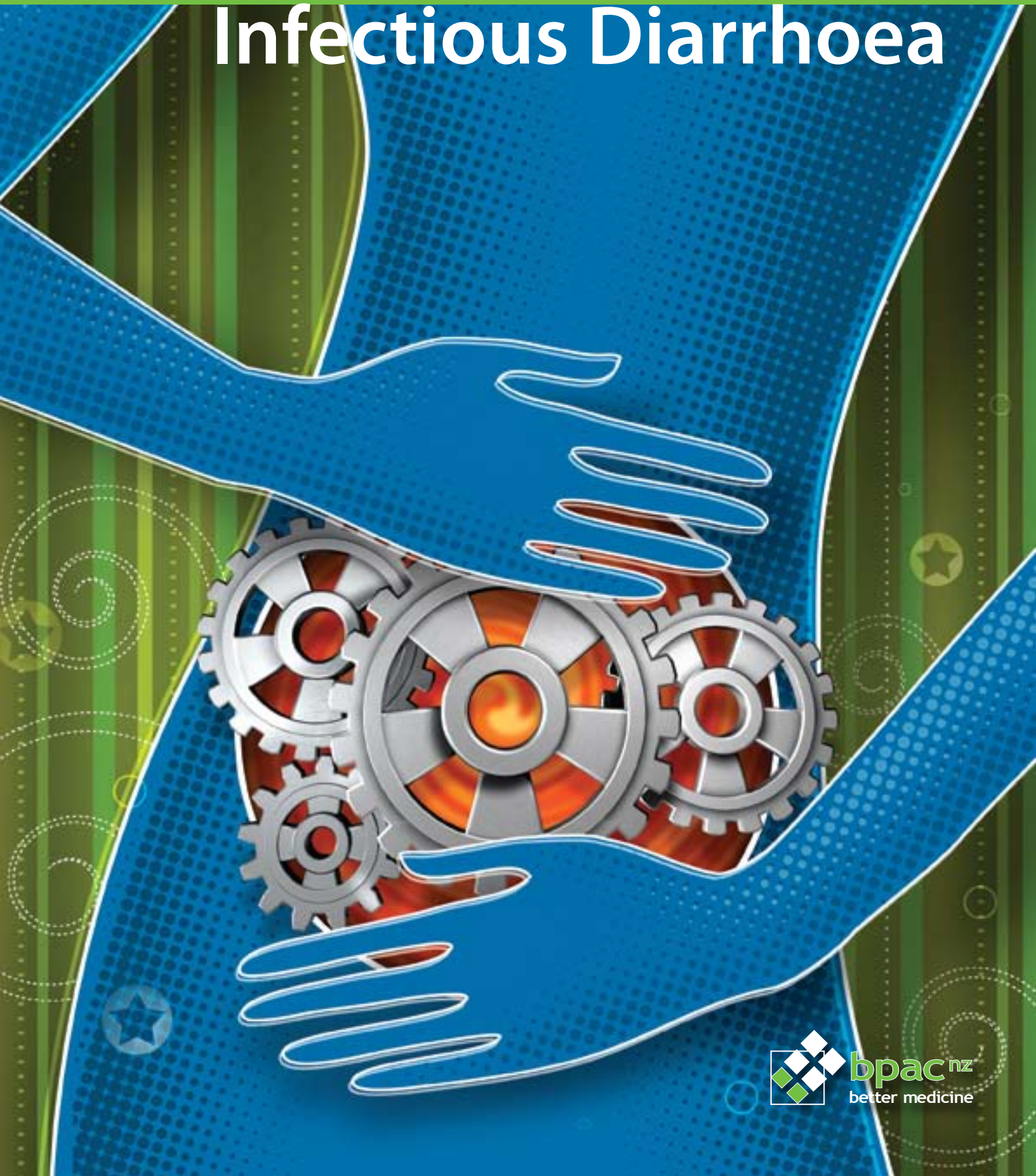


Laboratory Investigation of

Infectious Diarrhoea



Editorial Team

Tony Fraser
Professor Murray Tilyard

Clinical Advisory Group

Dr Dave Colquhoun
Michele Cray
Dr Rosemary Ikram
Dr Cam Kyle
Dr Chris Leathart
Dr Lynn McBain
Adam McRae
Dr Peter Moodie
Associate Professor Jim Reid
Dr David Reith
Professor Murray Tilyard

Programme Development Team

Noni Allison
Rachael Clarke
Terry Ehau
Rebecca Didham
Peter Ellison
Dr Malcolm Kendall-Smith
Dr Trevor Walker
Dr Sharyn Willis
Dave Woods

Report Development Team

Justine Broadley
Lana Johnson

Web

Gordon Smith

Design

Michael Crawford

Management and Administration

Kaye Baldwin
Tony Fraser
Kyla Letman
Professor Murray Tilyard

Distribution

Zane Lindon
Lyn Thomlison
Colleen Witchall

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Dr Rosemary Ikram, Microbiologist, Medlab South
Dr Susan Taylor, Microbiologist, Diagnostic Medlab
Dr David Reith, Dunedin School of Medicine

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bpac^{nz}

10 George Street
PO Box 6032, Dunedin
phone 03 477 5418
free fax 0800 bpac nz

www.bpac.org.nz

All information is intended for use by competent health care professionals and should be utilised in conjunction with pertinent clinical data.

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FAECES	
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Key messages

- Laboratory investigations are not routinely required for most patients with acute diarrhoea
- If laboratory testing is indicated, a single stool specimen for faecal culture is usually appropriate
- Giardia and cryptosporidium require a single faecal sample and should only be requested if there are risk factors
- Testing for “ova and parasites” is rarely indicated
- Notification to the Medical Officer of Health is required if the case may be part of an outbreak

Tests to request for specific risk factors

Risk factors	What boxes to tick				Notes
	Culture	Giardia Crypto	Ova and cysts	C. difficile	
Diarrhoea, no risk factors	No tests				Manage symptomatically
Food handler	<input checked="" type="checkbox"/>				
< 5 years of age	<input checked="" type="checkbox"/>				Consider Rotavirus but testing is not routinely required
Child care attendance	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
Rural	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
Raw seafood	<input checked="" type="checkbox"/>				Provide clinical details to lab
Bloody diarrhoea	<input checked="" type="checkbox"/>				Provide clinical details to lab
Recent antibiotics or chemotherapy				<input checked="" type="checkbox"/>	
Recent hospitalisation				<input checked="" type="checkbox"/>	
Age > 70 years	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
Immunocompromised	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Overseas travel, immigrant	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Persistent diarrhoea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

Introduction

Infectious diarrhoea is the most common type of diarrhoea worldwide. It is the leading cause of childhood death in undeveloped countries. In New Zealand very few people die of diarrhoeal illnesses and most of these are elderly.

The New Zealand Food Safety Authority has recently reported an estimated 6.5 million cases of vomiting and diarrhoea each year in New Zealand, and approximately 5 million lost working days each year due to gastrointestinal illness.¹

The occurrence of diarrhoeal illnesses is estimated as being between 1.2 to 1.9 illnesses per person per year, with the highest rates for children under three years.²

It is difficult to determine the numbers of cases of infectious diarrhoea in New Zealand because many people never seek medical attention or are not investigated. However, in 2006 over 20 000 cases of infectious diarrhoea were reported.³ The most common causes of notifiable diarrhoeal infection in New Zealand are *Campylobacter*, *Salmonella*, and *Giardia*. For number of cases reported in 2005 and 2006, see Appendix 1.

Diarrhoea

Defining Diarrhoea

Diarrhoea is a change in bowel habit for the individual that results in substantially more frequent and looser stools. It is the consistency of the stools rather than the number that is important. For example, passing formed stools frequently is not diarrhoea.

A number of more precise definitions of diarrhoea are often used in research and hospital settings, but this degree of precision is not usually required in primary care. Infectious diarrhoea is often accompanied by symptoms of nausea, vomiting or abdominal cramps.

Diarrhoea may be defined as acute if the duration of symptoms is less than 14 days, persistent if it has lasted for more than 14 days, and chronic when symptoms have been present for more than four weeks.⁴

Differential diagnosis

Whilst the most likely cause of acute diarrhoea in general practice is acute gastrointestinal infection, the challenge is to identify those with other causes.

Consider:

1. Gastrointestinal infection
2. An associated symptom of an acute systemic infection/illness
3. Drugs/diet
4. Gastrointestinal conditions - acute abdomen e.g. appendicitis, inflammatory bowel disease, malabsorption, tumour
5. Others as clinical picture dictate e.g. thyrotoxicosis.

Infectious diarrhoea

Causes of acute infectious diarrhoea in New Zealand

Causes of acute infectious diarrhoea are listed in Table 1. The prevalence of different infectious agents varies throughout the world. In New Zealand the most commonly diagnosed, in order of occurrence, are *Campylobacter*, Rotavirus, *Salmonella* and *Giardia*. A summary of the clinically important causes of infectious diarrhoea is provided in Appendix 2.

Clinical details

As for any condition, the clinical details provide the information required for deciding the path of further management. For people with acute diarrhoea, it is important to determine the severity of their condition, identify if a pathogen may be causative, and to check the physical status of the person.

History: assessing severity

- Frequency and duration of diarrhoea or vomiting
 - ▶ Possible threats to adequate hydration
- Characteristics of the diarrhoea, blood or mucus
 - ▶ Bloody diarrhoea suggests bacterial cause
- Any other symptoms, in particular abdominal pain, fever or systemically unwell
 - ▶ If systemically unwell may have a bacterial infection
- Recent fluid intake and urine output
 - ▶ Hydration status
- Medication taken

Table 1: Causes of acute infectious diarrhoea in New Zealand

<p>Bacterial</p> <ul style="list-style-type: none"> ▪ <i>Campylobacter</i> ▪ <i>Salmonella</i> ▪ <i>Clostridium difficile</i> ▪ <i>Yersenia</i> ▪ Shigella ▪ <i>E coli</i> O157* ▪ <i>Vibro</i> 	<p>Virus</p> <ul style="list-style-type: none"> ▪ Norovirus ▪ Rotavirus ▪ Enteric adenoviruses
	<p>Protozoa</p> <ul style="list-style-type: none"> ▪ <i>Giardia</i> ▪ <i>Cryptosporidium</i>

**E. coli* O157 = one of the verotoxin producing *E. coli*

- General medical history/social support
- Medical conditions such as immunosuppressive medications, AIDS, gastrectomy
 - ▶ Predispose to infectious diarrhoea
- Pregnant women who may infect newborn if still excreting enteric pathogen at the time of delivery
 - ▶ May benefit from specific antibiotics

History: identifying pathogen

To identify infections that could be specifically treated with an antibiotic, avoid spread to others and identify any food source that could be a public health risk. Identification of any of the factors listed below may suggest one of the causative agents listed:

- Changes to normal diet, in particular food from different sources, alternative water sources, consumption of unsafe foods such as raw or under-cooked meat and unpasteurised milk (*E. coli*, *Salmonella sp.*, *Campylobacter sp.*) and raw seafood (*Vibro sp.*).
- Travel to a developing area (wide range)
- Unwell patient contacts; household, sexual or occupational (*Shigella sp.*, *E. coli*, *Salmonella sp.*, *Campylobacter sp.*, *Giardia sp.*)
- Recent hospitalisation or use of antibiotics (*Clostridium difficile*)
- Swimming in fresh water lake, river or swimming pools (*E. coli*, *Salmonella sp.*, *Campylobacter sp.*, *Cryptosporidium*)
- Recent visit to farm, petting zoo or contact with pets with diarrhoea (*E. coli*, *Salmonella sp.*, *Campylobacter sp.*, *Cryptosporidium*)

Physical examination

- Vital signs/abdominal examination/other examination as indicated
- Determine the hydration status* of patient and exclude other causes

* The most useful symptoms/signs are a combination of dry mucus membranes, absence of tears, low urine output and hypotension, however clinical determination of hydration status is inaccurate.

Sending specimens to the laboratory

Indications to send specimens to the laboratory

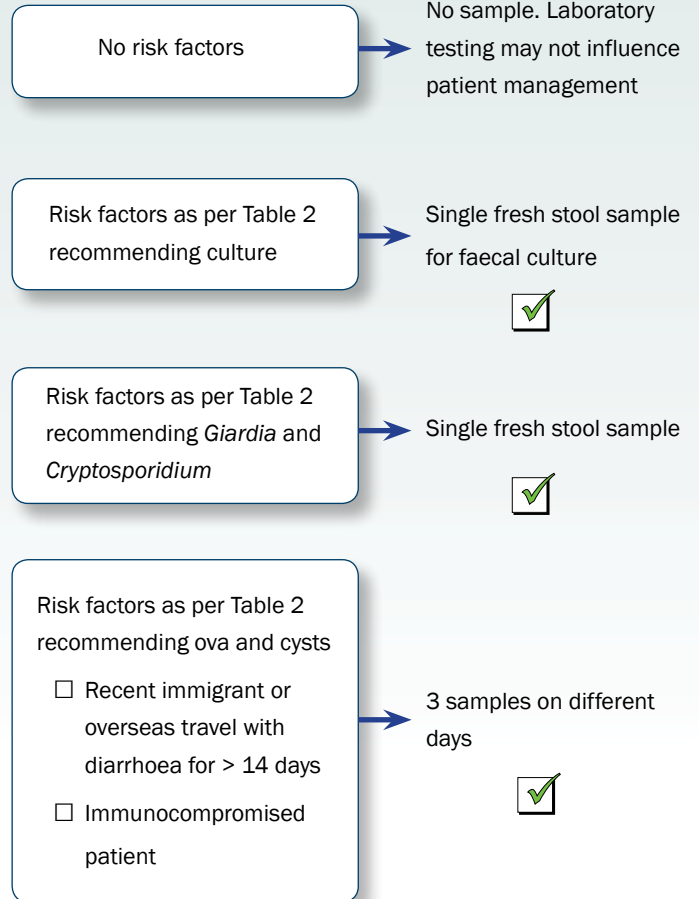
Specific investigations are not routinely required in the majority of patients with acute diarrhoea as the illness is usually self-limiting. If there is no clinical concern then the patient can be managed at home. Special care should be taken with personal hygiene and food preparation.

Although testing for enteric pathogens may provide little information that is relevant for the care of the individual, in situations where there is risk to public health, it can be more important.⁴

A laboratory diagnosis is useful for people who:

- may have an infection that could benefit from specific therapy,
- are at risk of severe complications,
- are at risk of spreading infection, or
- are involved in an outbreak and may have a common source of infection.

What samples are required?



Occasionally faeces specimens, received by laboratories for the investigation of acute diarrhoea, are accompanied by requests for *H. pylori* antigen and faecal occult blood. These tests are not indicated for the investigation of acute diarrhoea. If required for other reasons, they should be performed once the diarrhoea has resolved.



Table 2: Tests to request for specific risk factors

Risk factors	What boxes to tick				Notes
	Culture	Giardia Crypto	Ova and cysts	C. difficile	
	What sample to collect?				
	Fresh stool	Fresh stool	Stool in faecal fixative	Fresh stool	
	Number of samples to collect?				
Single sample	Single sample	1-3 stool samples	1-3 stool samples		
Diarrhoea, no risk factors	No tests				Manage symptomatically
Food handler	<input checked="" type="checkbox"/>				
< 5 years of age	<input checked="" type="checkbox"/>				Consider Rotavirus but testing is not routinely required
Child care attendance	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
Rural	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
Raw seafood	<input checked="" type="checkbox"/>				Provide clinical details to lab
Bloody diarrhoea	<input checked="" type="checkbox"/>				Provide clinical details to lab
Recent antibiotics or chemotherapy				<input checked="" type="checkbox"/>	
Recent hospitalisation				<input checked="" type="checkbox"/>	
Age > 70 years	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
Immunocompromised	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Overseas travel, immigrant	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Persistent diarrhoea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		



Faecal culture first: send only one sample

In New Zealand approximately 150 000 faecal cultures are requested annually.⁵ Analysis of latest data shows approximately 56% of these requests were part of a series of faecal culture tests i.e. two or more specimens sent over several days. This is usually unnecessary. When testing is required, a single faecal culture is the appropriate first line test.

Most guidelines recommend only one specimen be sent initially with further testing if diarrhoea is not settled within 5–7 days. Routine testing includes *Campylobacter*, *Salmonella*, and *Shigella*. Other pathogens routinely tested varies across New Zealand.⁶ Additional testing for other pathogens will be performed if the clinical details (see page 13) are suggestive of a different causative organism.

In the past, laboratories recommended three samples were collected for faecal culture, but analysis shows that this is not necessary, see Box 1.

Box 1: Analysis of faecal culture (DML, 2000)⁷

Diagnostic Medlab (Auckland) in have analysed results for patients who have had three specimens sent for bacterial culture for enteric pathogens:

- Specimen 1 detected 85% of positives
- Specimen 1 & 2 detected 95% of positives
- Specimen 1,2 & 3 detected 100% of positives

It was concluded a single specimen is required initially, with further specimens if symptoms persist and the initial specimen is negative.

Three specimens are indicated when it is essential that the patient is confirmed as being free of infection, for example: food handlers or after *Salmonella* Typhi, *S. Paratyphi*, *Shigella* or VTEC infections.

Giardia and Cryptosporidium: direct antigen test on single faecal specimen

Giardia and *Cryptosporidium* are the commonest parasitic causes of diarrhoea in New Zealand.³ They are best detected with the *Giardia* and *Cryptosporidium* faecal antigen tests. Antigen tests are more sensitive and take less time to perform than ova and parasite examination. Testing of “ova and parasites” is rarely indicated.

Testing for *Giardia* and *Cryptosporidium* is indicated when a person has diarrhoea:

- For longer than seven days
- Following recent overseas travel, tramping trip or drinking from rivers/springs

- Following attendance at a child care centre
- Is immunocompromised

Cryptosporidium is also associated with lambs and calves, and there are occasionally outbreaks in swimming pools.

With the traditional ova and parasites methodology one to three stool specimens were required. *Giardia* and *Cryptosporidium* antigen can be detected in a **single** stool specimen with a sensitivity of 95-98%.⁸

Ova and cysts: rarely indicated

In New Zealand the most likely causes of parasitic diarrhoea for people who have not travelled overseas are *Giardia* and *Cryptosporidium*. These are best detected via the direct antigen test and a full ova and cysts examination need not be performed.

Although current data from the NZHIS data warehouse shows that faecal cultures are accompanied by requests for ova and cysts about 45% of the time,⁵ testing for ova and cysts is only indicated for people who have:

- Recently travelled to countries with poor food or water sources
- Recently immigrated
- Eosinophilia with diarrhoea lasting longer than 15 days
- Immunocompromised status

Occasionally, ova and cysts may be an appropriate request in a person with persistent diarrhoea. In some cases, protozoa previously considered as commensals (e.g. *Dientamoeba fragilis*) have been implicated in intestinal disease. Discussion with the laboratory would be recommended.

Send three specimens for ova and cysts

For ova, cyst and parasite examinations, there is some debate as to whether one sample is adequate. Some parasitologists still recommend three samples. It is important that the samples are collected at separate times because of the cyclic nature of parasite shedding in the faeces.

Viral Causes

Viral infection is probably the most common cause of infectious diarrhoea, and is usually relatively mild and of short duration. Common viral causes are Rotavirus and Noroviruses. Several other viruses are known to cause diarrhoea including enteric Adenoviruses, Astroviruses, and Sapoviruses but laboratory testing is not readily available for these.

Rotavirus is a common cause of diarrhoea in infants and young children,⁹ especially in the winter. Rotavirus is a self limiting infection, lasting approximately 48 hours. Management of the patient should focus on hydration status. Faecal testing is not routinely indicated, because it will not alter management in the community. If there are public health reasons for investigating an outbreak the Medical Officer of Health will arrange for appropriate testing.

Norovirus is frequently implicated in outbreak situations. Recently, significant outbreaks have occurred in hospitals, rest homes, cruise ships, prisons and ski fields. Laboratory testing in outbreaks is managed by the Medical Officer of Health. Requests for Norovirus from sporadic cases are not indicated in primary care.



Clostridium difficile toxin

Clostridium difficile is the major identifiable cause of antibiotic-associated diarrhoea. The prevalence of asymptomatic colonisation of the bowel ranges from <5% in the community to over 20% in hospitalised patients. Preceding antibiotic therapy or other chemotherapy can alter the bacterial flora of the colon, creating conditions that favour new acquisition and proliferation of *C. difficile*. Individuals who acquire *C. difficile* may be colonised or develop disease due to *C. difficile* toxin and the immune status of the host influences this outcome.

C. difficile toxin testing is indicated for patients who develop diarrhoea while in hospital, on or shortly after antibiotics, or receiving chemotherapy. *C. difficile* is more prevalent in the elderly. It has been shown to be the second most identifiable cause of infectious diarrhoea in people aged over 70 years.

Diagnosis of *C. difficile* disease is by the detection of toxin in faecal samples. If *C. difficile* toxin disease is suspected and a single faeces sample is negative, a second sample should be tested.

Listeria

Infection with *Listeria monocytogenes* can cause febrile gastroenteritis accompanied by bacteraemia and sometimes meningitis. Infection during pregnancy may be complicated by amnionitis and foetal infection. Diagnosis requires blood cultures.

L. monocytogenes may be present in a variety of raw foods, such as uncooked meat and vegetables, as well as processed foods that become contaminated after processing.

The risk of an individual person developing listeriosis after consumption of a contaminated product is small. If an asymptomatic pregnant woman has eaten a contaminated product, no treatment or tests are recommended. However, if they develop a febrile illness over the next three weeks, blood cultures are recommended.

Clinical information is important for the laboratory

When sending a faeces specimen to the laboratory for testing, the diagnostic tests selected by the laboratory may be influenced by the clinical information supplied. Testing protocols may vary between laboratories and it is worthwhile knowing the practices of your local laboratory.

For example:

- Blood and mucus in the stool or hemolytic-uremic syndrome (HUS) should generate culture on a special agar for *E. coli* O157 (VTEC).
- Ingestion of raw seafood should generate culture specific for *Vibrio* species.
- Recent hospitalisation or antibiotic use may generate testing for *Clostridium difficile* toxin.

Specimen collection

Many patients are uncomfortable or embarrassed at the suggestion they should collect a faeces specimen. They may have a number of questions but feel self conscious asking. The test should be explained to the patient in a manner best suited to them. Most laboratories have patient information sheets available explaining specimen collection. A suggested protocol is provided in Appendix 3.

Rectal swabs may be used for babies or children when collection of a faecal specimen is impractical. A swab should be gently passed through the anal sphincter into the rectum then removed and placed immediately into transport medium.

The following are useful points to consider to ensure collection of a worthwhile faecal specimen:

- The causative agent in cases of infectious gastroenteritis is most likely to be found in faeces specimens obtained when the patients are actually experiencing diarrhoea.
- The yield from faeces collected in convalescence is reduced.
- Patients should collect enough faeces to approximately half fill the specimen container.
- Specimens should be kept cool (preferably at 4 °C) and taken to the laboratory as soon as possible and within 24 hours. If specimens are unable to be delivered immediately, they may be stored in a biohazard bag at 4 °C. Do not freeze specimens.
- After receiving the specimen from the patient, check that the appropriate specimen has been provided and is labelled correctly.

Test	Specimen container
Culture	Fresh stool with no additive
<i>Giardia</i> and <i>Cryptosporidium</i> antigen	Fresh stool with no additive
Rotavirus	Fresh stool with no additive
Ova, cysts, parasites	Check with your local laboratory. Some will provide a special container with fixative, others will accept fresh samples and add fixative themselves. If multiple specimens are requested these should be collected on alternate days.

Notifiable diseases

Disease surveillance is a way of collecting information on the incidence of diseases, which can be used to help prevent and control their spread.

Since December 2007 laboratories have reported test results indicative of notifiable diseases to the Medical Officer of Health. This does not replace the need for medical practitioners to notify, which is a legal requirement under the Health Act 1956. General Practitioners must continue to provide notifications because:

- GPs are able to provide valuable personal and clinical information beyond that available from laboratories.
- GPs are required to notify disease upon suspicion, which may be prior to laboratory confirmation. This enables early intervention and control spread if appropriate.

Please advise your patients of your diagnosis as well as notifying the Medical Officer of Health.

A flow chart of recommendations for dealing with acute gastroenteritis, which incorporates the role of the Medical Officer of Health, is provided in Figure 1.¹⁰

The local public health unit will manage the testing of faecal specimens in an outbreak situation, and can advise on clearance requirements if required. An overview is provided in Table 4.

Causes of gastrointestinal disease that are notifiable to the Medical Officer of Health are listed in Table 3.

Table 3: Conditions that are notifiable to a Medical Officer of Health

Acute gastroenteritis*	Campylobacteriosis
Giardiasis	Cryptosporidiosis
Shigellosis	Salmonellosis
Yersiniosis	Cholera
Taeniasis	Typhoid and paratyphoid fever
Listeriosis	

* Not every case of acute gastroenteritis is necessarily notifiable – only those where there is a suspected common source or from a person in a high risk category (eg, food handler, early childhood service worker, etc) or single cases of chemical, bacterial, or toxic food poisoning such as botulism, toxic shellfish poisoning (any type) and disease caused by verocytotoxic *E. coli*.

Figure 1: Gastrointestinal illness: Advice for Practitioners (Holmes, 2001)

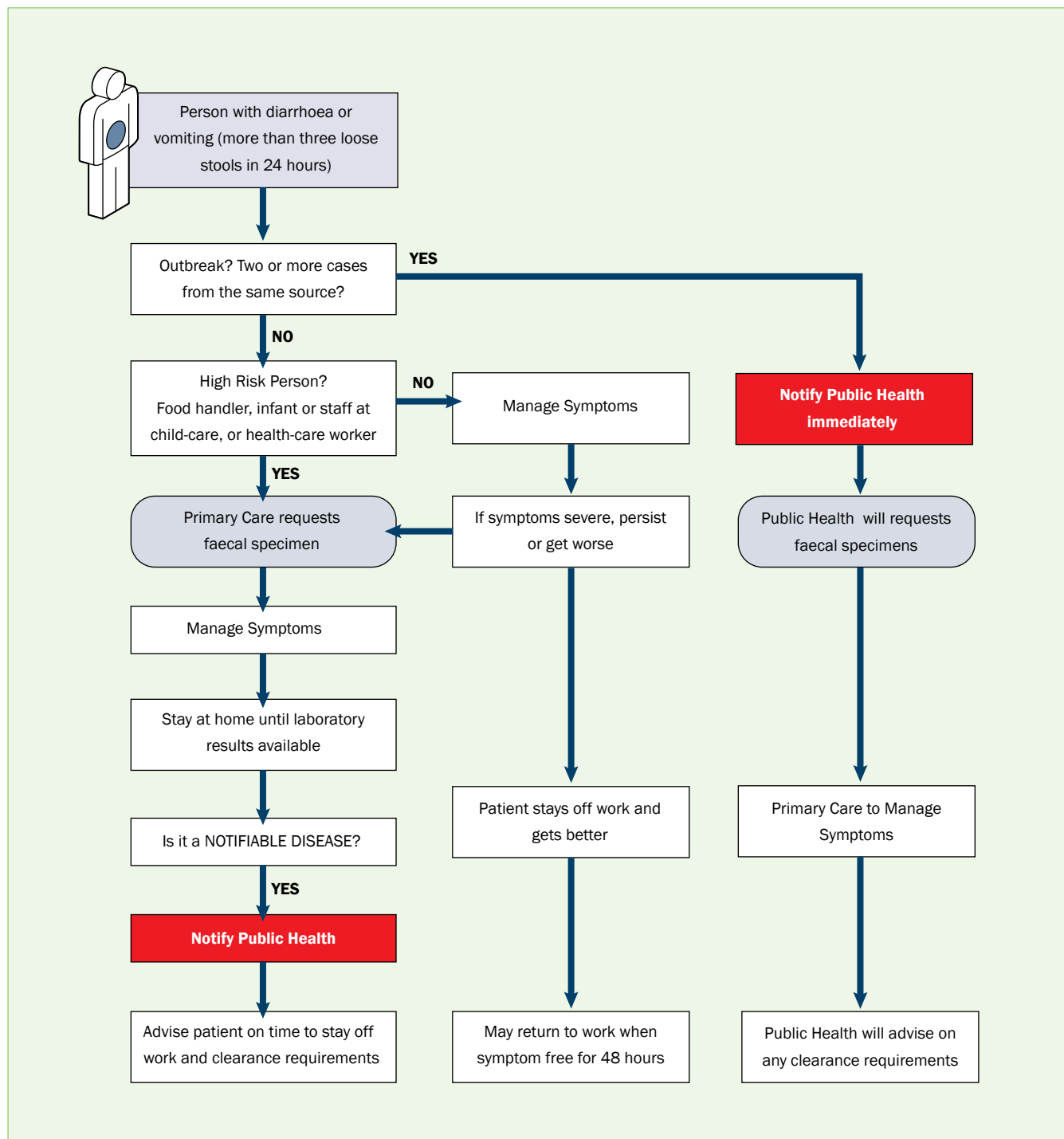


Chart provided by Public Health South

Table 4: Exclusion and clearance requirements for notifiable diseases

Disease	Exclusion and clearance requirements for cases	Exclusions apply to:
<i>Campylobacter</i> <i>Cryptosporidium</i> <i>Giardia</i> <i>Yersinia</i>	Exclude until free of all symptoms for 24 hours No clearance specimens required	Food handlers Staff of health care facilities or early childcare facilities children aged under 5 years attending child care centres other adults or children at higher risk due to illness or disability
Acute gastroenteritis including norovirus*	Exclude until free of all symptoms for 48 hours No clearance specimens required	
<i>Salmonella</i> (excluding <i>S. Typhi</i> & <i>S. Paratyphi</i>)	Exclude until satisfy clearance criteria Two consecutive negative faecal specimens required The specimens must be taken at least 24 hours apart and if on antibiotics at least 48 hours after course is finished	Food handlers
	Exclude until symptom free for 24 hours No clearance specimens required	Staff of health care facilities or early childcare facilities Children aged under 5 years attending childcare centres Other adults or children at higher risk due to illness or disability
<i>Salmonella Typhi</i> & <i>Salmonella Paratyphi</i>	Exclude until satisfy clearance criteria Two consecutive negative faecal specimens required The specimens must be taken at least 24 hours apart and if on antibiotics at least 48 hours after course is finished and no earlier than a month after the onset of symptoms	Food handlers Staff of health care facilities or early childcare facilities Children aged under 5 years attending childcare centres Other adults or children at higher risk due to illness or disability School children until clearance criteria satisfied or as discussed with MOH
<i>Shigella</i> VTEC	Exclude until satisfy clearance criteria Two consecutive negative faecal specimens required The specimens must be taken at least 24 hours apart and if on antibiotics at least 48 hours after course is finished	Food handlers Staff of health care facilities or early childcare facilities Children aged under 5 years attending childcare centres Other adults or children at higher risk due to illness or disability
Hepatitis A	Until recommended by the Medical Officer of Health	All cases of Hepatitis A

* Not every case of acute gastroenteritis is notifiable – only those where there is a suspected common source or from a person in a high risk category (e.g. food handlers, early childhood worker, health care worker) or single cases of chemical, bacterial or toxic food poisoning such as botulism, toxic shellfish poisoning and any cases of verocytotoxic *E. coli* (VTEC).

Exclusion and clearance requirements for close contacts of cases will be managed by Public Health.

Chart provided by Public Health South



Appendices

Appendix 1:

Comparison of notifiable disease cases and rates for 2005 and 2006: Cases and rates per 100 000 population of notifiable diseases in New Zealand during 2005 and 2006.³

Disease	2005		2006		Change ^{b, c}
	Cases	Rates	Cases	Rates	
Campylobacteriosis	13836	337.6	15873	383.5	↑
Cryptosporidiosis	889	21.7	736	17.8	↓
Gastroenteritis ^a	557	13.6	931	22.5	↑
Giardiasis	1231	30.0	1214	29.3	↓
Salmonellosis	1382	33.7	1335	32.3	↓
Shigellosis	183	4.5	102	2.5	↓
VTEC/STEC infection	92	2.2	87	2.1	↓
Yersiniosis	407	9.9	487	11.8	↑

^a Cases of gastroenteritis from a common source or foodborne intoxication e.g. staphylococcal intoxication

^b ↓ Significant decrease, ↑ Significant increase, ↓ Not significant decrease, ↑ not significant increase

^c The Mantel-Haenszel chi-square test was used to determine statistical significance. P-values less than or equal to 0.05 are considered to be significant at the 95% level of confidence.

Appendix 2: Causative agents implicated in infectious diarrhoea.¹¹

Causative agent	Sources of infection	Incubation period	Symptoms
Campylobacter	Contaminated food or water, in particular undercooked chicken or other meats.	1 to 10 days (usually 2 to 5 days).	Watery or bloody diarrhoea, abdominal pain and nausea preceded by muscle pain, headache and fever. Symptoms may last 1 day to 1 week or longer (usually 5 days).
Salmonella	Undercooked food e.g. chicken, eggs and meat; food or water contaminated with faeces from an infected person or animal; or direct spread from an infected person or animal	6–48 hours (usually 12–36 hours).	Diarrhoea, abdominal pain, vomiting, nausea and fever lasting 1–7 days. Hospitalisation rate estimated at 22.1% cases fatality rate 0.8%.
E coli O157:H7	In New Zealand, most likely any food or water source contaminated by the faeces of a ruminant animal; or direct spread from an infected person.	3 to 9 days (mean 4 days) following ingestion of the bacteria.	Symptoms range from no symptoms to kidney disease and death. In more serious cases there is a period of bloody diarrhoea followed by HUS*. The elderly may suffer from TTP#.
Giardia / Cryptosporidium	Food or water contaminated with faeces from an infected person or animal; or direct spread from an infected person or animal.	Giardia: 1 to 3 weeks after infection. (mean about 7–10 days). Crypto: 1–12 days (mean about 7 days).	May be asymptomatic or cause GI upset. Serious disease may occur in the immunocompromised. Symptoms may last from 4 to 6 weeks, and consist of diarrhoea followed by flatulence, foul-smelling stools and cramps.
Shigella	Food or water contaminated with faeces from an infected person or animal.	12 hours to 4 days. In outbreaks incubation times of up to 36 hours are observed.	Abdominal pain, diarrhoea, fatigue, malaise and fever. Mucus and occasionally blood appear in the faeces. The illness may progress to the “colonic phase” within 1–3 days where the symptoms are intense cramps as well as frequent and painful bowel movements. Lasts for 3 to 14 days.
Yersinia	Food or water contaminated with faeces from an infected person or animal: farm animals (especially pigs), infected pets (puppies and kittens).	Approximately 7 days, range 1–11 days.	Abdominal pain, headache, fever, diarrhoea, nausea and vomiting. Often produces a watery/mucoid diarrhoea in children. Approximately 2/3 of cases report being ill for >1 week.

* HUS = haemolytic uraemic syndrome # TTP = thrombotic thrombocytopenic purpura

Organism Survival	Treatment
Survival in food better under refrigeration than at room temperature. Rapidly deactivated by heating to 55°C.	Usually none, but fluids may be given. Some cases warrant treatment with antibiotics. Erythromycin is the drug of choice, although resistant strains are emerging.
Salmonella can survive up to 28 days under refrigeration, even on the surface of vegetables which have become contaminated. Deactivated by heating to 70°C.	The infection is usually self-limiting although fluid replacement may be required. Antibiotic treatment seems to be either ineffective or results in relapse or prolonged faecal shedding. Certain groups, e.g. new born children, may benefit from antibiotic treatment.
Survives well in chilled and frozen foods (i.e. little change in hamburgers stored at -20°C for 9 months). Rapidly deactivated by heating to 71°C.	Usually none, but fluids may be given. Special management for HUS and TTP.
In general the cysts are stable and can last for long periods (months) in the environment. Heating cysts to 60–70°C for 10 min inactivates them. Alternatively heating to boiling for 3 min will achieve the same result.	Most cases are self-limiting, but antimicrobials may be indicated.
In general they survive best at low temperatures (subzero and refrigeration). Can survive storage in butter for more than 100 days at -20°C and 4°C. Rapidly inactivated at temperatures above 65°C.	Antibiotic treatment is not required in milder cases but may be needed. Resistance is common.
Can grow in the presence or absence of oxygen. Able to grow in refrigerator temperatures. Rapidly inactivated at 60°C.	Usually self limiting, antibiotics do not reduce the severity or duration of the illness. May be used in more serious manifestations of the disease.

Appendix 3: Instructions for the collection of faeces¹²

- Label the specimen jar carefully, with your name, age/date of birth and date of collection.
- Place a large clean container (e.g. disposable container) in the toilet bowl. Pass faeces directly into the container.
- Do not contaminate faeces with urine.
- Using a wooden spatula or similar, scoop enough of the faeces to at least half fill the specimen jar. If a specimen jar is not available, place a sample at least as large as a golf-ball into a clean jar.
- Dispose of excess faecal matter from container into the toilet, then place inside 2 plastic bags and dispose of in domestic waste.
- Screw the lid on the specimen jar firmly. Place in a zip-lock plastic bag.
- Wash your hands.
- Keep specimen cool but DO NOT FREEZE.

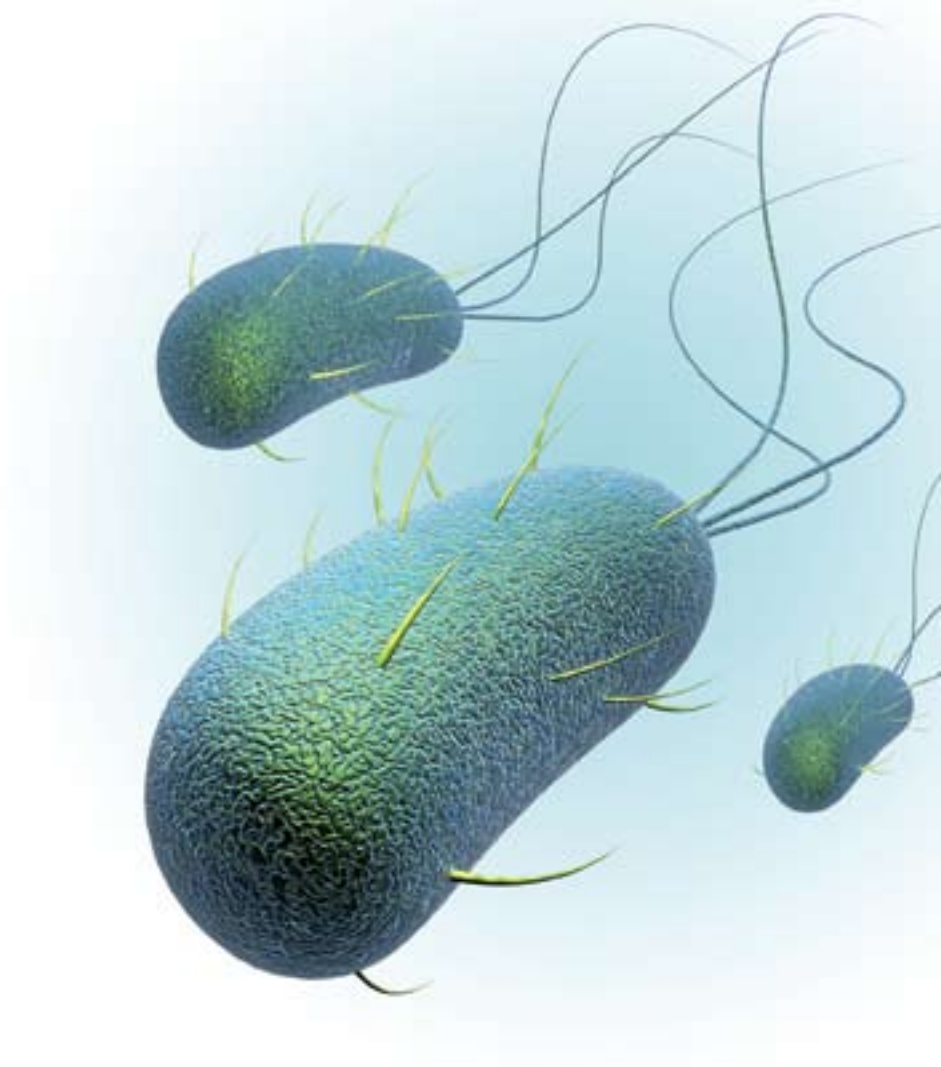
Appendix 4: Natural Toxins in Food¹³

Some food sources contains naturally occurring toxins, some common foods may contains toxins which may cause gastrointestinal symptoms. Commonly eaten foods that may contain natural toxins include:

Food	Toxin	Symptoms of toxicity	Precautions
Apple and pear seeds Apricot and peach kernels	Amygdalin (cyanogenic glycoside)	Stomach discomfort General illness Can be fatal	Eat no more than 1–2 apricot kernels per day. Young children should avoid swallowing seeds.
Parsnip	Furocoumarins	Stomach ache Painful skin reactions	Avoid parsnip that are damaged or mouldy. Levels of toxin drop with cooking. Discard cooking water.
Potatoes	Glycoalkaloids	Severe stomach ache Death (rarely)	Do not eat potato sprouts or green potatoes, they remain toxic even when cooked. Store potatoes in the dark, to minimize production of glycoalkaloids (green potatoes).
Kidney beans	Lectins	Severe stomach ache Vomiting Diarrhoea	Kidney beans must be soaked (for 5 hours) prior to cooking. As few as 4–5 raw beans can produce symptoms.
Rhubarb	Oxalic acid	Twitching, cramps, decrease in breathing and heart action, vomiting, diarrhoea, pain, coma	Severity of symptoms dependent upon dose. Large quantities of rhubarb would need to be consumed to cause death.
Zucchini	Cucurbitacins	Vomiting, stomach cramps, diarrhoea and collapse.	Very occasionally occurs in home grown zucchini, rarely found in commercially grown zucchini. Discard zucchini with unpleasant smell or bitter taste.
Cassava	Linamarin (cyanogenic glycoside)	Stomach discomfort General illness Can be fatal	Grinding cassava to a fine powder effectively removes the toxin.
Bamboo shoots	Taxiphyllin (cyanogenic glycoside)	Stomach discomfort General illness Can be fatal	Degrades easily with prolonged boiling to safe levels.

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