



LAB#: F000000-0000-0
PATIENT: Sample Patient
ID: PATIENT-S-00004
SEX: Male
AGE: 3

CLIENT#: 12345
DOCTOR:
Doctor's Data, Inc.
3755 Illinois Ave.
St. Charles, IL 60174

Comprehensive Stool Analysis / Parasitology x3

MICROBIOLOGY

Bacteriology Culture				
Beneficial flora		Imbalances	Dysbiotic flora	
Bifidobacter	0+		Klebsiella pneumonia	4+
E. coli spp.	4+			
Lactobacillus spp.	0+			
Enterococcus spp.	4+			

Mycology (Yeast) Culture			
Normal flora		Dysbiotic flora	
		Candida albicans	3+

PARASITOLOGY / MICROSCOPY (TRICHROME STAIN & CONCENTRATION)

Sample 1			Sample 2			Sample 3		
No	Ova or Parasites		No	Ova or Parasites		No	Ova or Parasites	
	Many Yeast			Many Yeast			Many Yeast	
		Within			Ref. Range			Within
		Outside						Outside
Giardia Lamblia (EIA)	Neg			Neg		Cryptosporidium (EIA)	Neg	
								Ref. Range
								Neg

Beneficial flora: In a healthy balanced state of intestinal flora, the beneficial bacteria make up a significant proportion of the total microflora. The beneficial flora have many health-protecting effects in the gut including manufacturing vitamins, fermenting fibers, digesting proteins and the disaccharide lactose, and propagating anti-tumor and anti-inflammatory factors. Acidophilus, Bifidus, and Enterococcus produce lactic acid and short-chain fatty acids. The fermentation of fibers by beneficial bacteria and subsequent production of short chain fatty acids is crucial in lowering colonic pH and preventing the proliferation of microbial pathogens, including bacteria and yeast. Enterococcus has antibacterial activity against methicillin-resistant *S. aureus* (MRSA) and food-borne pathogens.

Parasitology: Intestinal parasites are abnormal inhabitants of the GI tract. Factors such as contaminated food and water supplies, day care centers, international travel, pets, carriers such as mosquitoes and fleas, and sexual transmission have contributed to an increased prevalence of intestinal parasites in the American population.

Date Collected: **12/27/2008** Comments:
 Date Received: **12/28/2008**
 Date Completed: **12/29/2008**



LAB#: F000000-0000-0
 PATIENT: Sample Patient
 ID: PATIENT-S-00004
 SEX: Male
 AGE: 3

CLIENT#: 12345
 DOCTOR:
 Doctor's Data, Inc.
 3755 Illinois Ave.
 St. Charles, IL 60174

CAMPYLOBACTER CULTURE

	Within	Outside	Ref. Range	
Campylobacter	Neg		Neg	<p>Campylobacter is a bacteria and a common cause of diarrheal disease, often accompanied by abdominal cramping, fever, and vomiting. Campylobacter infection is often associated with raw or undercooked poultry, unpasteurized milk, or contaminated water.</p>

DIGESTION / ABSORPTION

	Within	Outside	Ref. Range	
Elastase	>500		>200 µg/mL	<p>Elastase findings can be used for the diagnosis or the exclusion of exocrine pancreatic insufficiency. Correlations between low levels and chronic pancreatitis and cancer have been reported. Fat stain: Microscopic determination of fecal fat using Sudan IV staining is a qualitative procedure utilized to assess fat absorption and to detect steatorrhea. Meat/Vegetable fibers: The presence of meat and/or vegetable fibers in the stool may be due to a number of factors including, improper mastication, excessive protein intake, a reduction of gastric HCL secretion, or insufficient output of pancreatic enzymes. Carbohydrates: The presence of reducing substances in stool specimens can indicate carbohydrate malabsorption.</p>
Fat stain	None		None – Mod	
Muscle fibers	None		None – Rare	
Vegetable fibers	Rare		None – Few	
Carbohydrates	Neg		Neg	

INFLAMMATION

	Within	Outside	Ref. Range	
Lysozyme*		1100	<=600 ng/mL	<p>Lysozyme is an enzyme secreted at the site of inflammation in the GI tract and elevated levels have been identified in IBD patients. Lactoferrin is a quantitative GI specific marker of inflammation used to diagnose and differentiate IBD from IBS and to monitor patient inflammation levels during active and remission phases of IBD. WBCs: Elevated stool levels of white blood cells occur following an infiltration of leukocytes within the intestinal lumen during an inflammatory process. Mucus in the stool may result from prolonged mucosal irritation or in response to parasympathetic excitability such as spastic constipation or mucous colitis.</p>
Lactoferrin	0.9		<7.3 µg/mL	
WBC	None		None – Rare	
Mucus	Neg		Neg	

IMMUNOLOGY

	Within	Outside	Ref. Range	
slgA*	120		51-204 mg/dL	<p>slgA: Secretory IgA is secreted by mucosal-associated lymphoid tissue and represents the first line of defense of the GI mucosa and is central to the normal function of the GI as an immune barrier. Elevated levels of slgA have been associated with an upregulated immune response.</p>

*For Research Use Only. Not for use in diagnostic procedures.



LAB#: F00000-0000-0
PATIENT: Sample Patient
ID: PATIENT-S-00004
SEX: Male
AGE: 3

CLIENT#: 12345
DOCTOR:
Doctor's Data, Inc.
3755 Illinois Ave.
St. Charles, IL 60174

SHORT CHAIN FATTY ACIDS

	Within	Outside	Ref. Range	
Acetate	47		36 - 74	%
Propionate	24		9 - 32	%
Butyrate	25		16 - 39	%
Valerate	5		1 - 8	%
Butyrate	2.7		0.8 - 3.8	mg/mL
Total SCFA's	10.9		4 - 14	mg/mL

Short chain fatty acids (SCFAs): SCFAs are the end product of the bacterial fermentation process of dietary fiber by beneficial flora in the gut and play an important role in the health of the GI as well as protecting against intestinal dysbiosis. Lactobacillus and Bifidus produce large amounts of short chain fatty acids, which decrease the pH of the intestines and therefore make the environment unsuitable for pathogens, including bacteria and yeast. Studies have shown that SCFAs have numerous implications in maintaining gut physiology. SCFAs decrease inflammation, stimulate healing, and contribute to normal cell metabolism and differentiation. Levels of **Butyrate** and **Total SCFA** in mg/g are important for assessing overall SCFA production, and are reflective of beneficial flora levels and/or adequate fiber intake.

INTESTINAL HEALTH MARKERS

	Within	Outside	Ref. Range	
RBC	None		None - Rare	
pH	6.2		6 - 7.8	
Occult Blood	Neg		Neg	
Yeast		Many	None - Rare	

RBC: Red blood cells in the stool may be associated with a parasitic or bacterial infection, or an inflammatory bowel condition such as Ulcerative Colitis. Colorectal cancer, anal fistulas, and hemorrhoids should also be ruled out. **Occult blood:** A positive occult blood indicates the presence of free hemoglobin found in the stool, which is released when red blood cells are lysed. **pH:** Fecal pH is largely dependent on the fermentation of fiber by the beneficial flora of the gut. **Yeast:** A positive microscopic yeast level indicates the presence of fungi such as Candida albicans in the stool.

MACROSCOPIC APPEARANCE

	Appearance	Expected	
Color	Red/Orange	Brown	
Consistency	Formed/Soft	Formed/Soft	

Color: Stool is normally brown because of pigments formed by bacteria acting on bile introduced into the digestive system from the liver. While certain conditions can cause changes in stool color, many changes are harmless and are caused by pigments in foods or dietary supplements. **Consistency:** Stool normally contains about 75% water and ideally should be formed and soft. Stool consistency can vary based upon transit time and water absorption.



LAB#: F000000-0000-0
PATIENT: Sample Patient
ID: PATIENT-S-00004
SEX: Male
AGE: 3

CLIENT#: 12345
DOCTOR:
Doctor's Data, Inc.
3755 Illinois Ave.
St. Charles, IL 60174

YEAST SUSCEPTIBILITIES

Candida albicans

Prescriptive agents

Sensitive

Intermediate

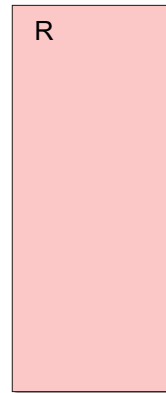
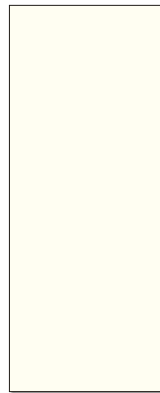
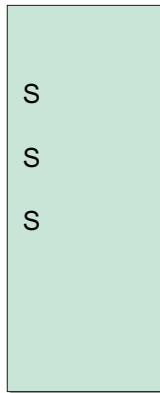
Resistant

Fluconazole

Itraconazole

Ketoconazole

Nystatin



Natural agents

Sensitive

Resistant

Berberine

Caprylic Acid

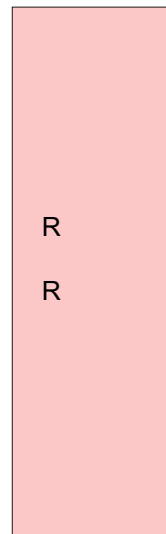
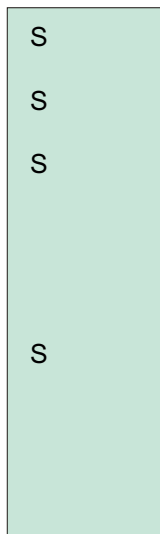
Goldenseal

Oregano

Tanalbit

Undecylenic Acid

Uva Ursi





LAB#: F000000-0000-0
PATIENT: Sample Patient
ID: PATIENT-S-00004
SEX: Male
AGE: 3

CLIENT#: 12345
DOCTOR:
Doctor's Data, Inc.
3755 Illinois Ave.
St. Charles, IL 60174

BACTERIAL SUSCEPTIBILITIES

Klebsiella pneumoniae ssp. pneumoniae

Prescriptive agents

Sensitive

Intermediate

Resistant

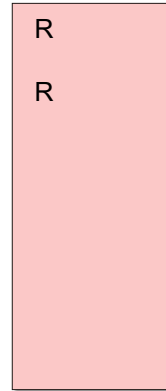
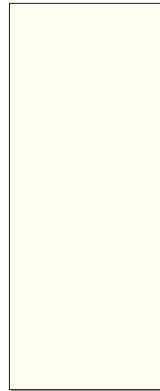
Amoxicillin

Ampicillin

Augmentin

Ciprofloxacin

Trimeth-sulfa



Natural agents

Sensitive

Resistant

Berberine

Black Walnut

Caprylic Acid

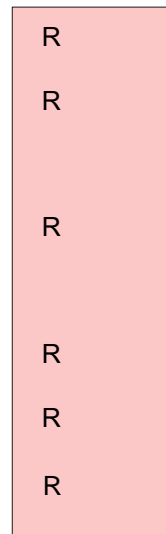
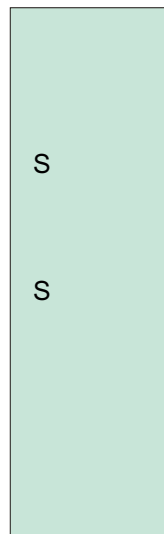
Cats Claw

Citrus Seed Extract

Goldenseal

Oregano

Uva Ursi



INTRODUCTION

This analysis of the stool specimen provides fundamental information about the overall gastrointestinal health of the patient. When abnormal microflora or significant aberrations in intestinal health markers are detected, specific interpretive paragraphs are presented. If no significant abnormalities are found, interpretive paragraphs are not presented.

Beneficial Flora

One or more of the beneficial bacteria are low in this specimen. Beneficial flora include Lactobacillus, Bifidus, Enterococcus sp., and beneficial E. coli. The beneficial flora have many health-protecting effects in the gut, and as a consequence are crucial to the health of the whole organism. Some of the roles of the beneficial flora include digestion of proteins and the disaccharide lactose, manufacture of vitamins and essential fatty acids, increasing the number of immune system cells, breaking down bacterial toxins and converting flavinoids into anti-tumor and anti-inflammatory factors [1]. Lactobacillus, Bifidus, and Enterococcus sp. secrete lactic acid as well as other acids including acetate, propionate, butyrate, and valerate. This causes a subsequent decrease in intestinal pH, which is crucial in preventing an enteric proliferation of microbial pathogens including bacteria and yeast. Many GI pathogens thrive in alkaline environments. Lactobacillus acidophilus also secretes the antifungal and antimicrobial agents lactocidin, lactobacillin, acidolin, and hydrogen peroxide [2]. The beneficial flora of the GI have thus been found useful in the inhibition of microbial pathogens [3], prevention and treatment of antibiotic associated diarrhea [4], prevention of traveler's diarrhea [5], enhancement of immune function [6], and inhibition of the proliferation of Candida albicans [7,8].

Enterococcus sp. Are prominent non-anaerobic beneficial bacteria in the gastrointestinal tract. They are fermentative yet not gas producing bacteria that can survive in relatively harsh environments. Most importantly, Enterococcus sp. Provide antimicrobial activity against methicillin-resistant Staphylococcus aureus (MRSA), and impede the growth of food-borne pathogens. S. aureus strains, which are resistant to multiple antibiotics, have dramatically increased hospital associated infections. There is concern that the pharmaceutical industry cannot keep up the MRSA strains, therefore maintenance of healthy levels of Enterococcus sp. is important for antimicrobial activity against MRSA.

In a healthy balanced state of intestinal flora, the beneficial flora make up a significant proportion of the total non-anaerobic microflora. Healthy levels of each of the beneficial bacteria are indicated by either a 3+ or 4+ (0 to 4 scale). However, some individuals have low levels of beneficial bacteria and an overgrowth of nonbeneficial (imbalances) or even pathogenic microorganisms (dysbiosis). Often attributed to the use of antibiotics, individuals with low beneficial bacteria may present with chronic symptoms such as irregular transit time, irritable bowel syndrome, bloating, gas, chronic fatigue,

headaches, autoimmune diseases (e.g. rheumatoid arthritis), and sensitivities to a variety of foods [1]. Treatment may include the use of probiotic supplements containing various strains of Lactobacillus, Bifidobacter, and Enterococcus and/or consumption of cultured or fermented foods including yogurt, kefir, miso, tofu, tempen and tamari sauce. Polyphenols in green and ginseng tea have been found to increase the numbers of beneficial bacteria [9]. If dysbiosis is present, treatment may also include the removal of pathogenic bacteria, yeast, or parasites.

1. Percival M. Intestinal Health. Clin Nutr In 1997;5(5):1-6.
2. Fuller R. Probiotics in human medicine. Gut 1991;32:439-442.
3. Siitonen S, Vapaatalo H, Salminen S, et al. Effect of Lactobacilli GG yoghurt in prevention of antibiotic associated diarrhea. Ann Med 1990; 22:57-59.
4. Oksanen P, Salminen S, Saxelin M, et al. Prevention of travelers' diarrhea by Lactobacillus GG. Ann Med 1990;22:53-56.
5. Perdigon G, Alvarez M, et al. The oral administration of lactic acid bacteria increases the mucosal intestinal immunity in response to enteropathogens. J Food Prot 1990;53:404-410.
6. Valeur, N, et al. Colonization and immunomodulation by Lactobacillus reuteri ATCC 55730 in the human gastrointestinal tract. Appl Environ. Microbiol. 2004 Feb;70(2):1176-81.
7. Elmer G, Surawicz C, and McFarland L. Biotherapeutic agents - a neglected modality for the treatment and prevention of intestinal and vaginal infections. JAMA 1996; 275(11):870-876.
8. Fitzsimmons N and Berry D. Inhibition of Candida albicans by Lactobacillus acidophilus: evidence for involvement of a peroxidase system. Microbio 1994; 80:125-133
9. Weisburger JH. Proc Soc Exp Biol Med 1999;220(4):271-5.

Dysbiotic Flora

In a healthy balanced state of intestinal flora, the beneficial bacteria make up a significant proportion of the total microflora. However, in many individuals there is an imbalance or deficiency of beneficial flora and an overgrowth of non-beneficial or even pathogenic microorganisms (dysbiosis). This can be due to a number of factors including: consumption of contaminated water or food; daily exposure of chemicals that are toxic to beneficial bacteria; the use of antibiotics, oral contraceptives or other medications; poor fiber intake and high stress levels [1].

A number of toxic substances can be produced by the dysbiotic bacteria including amines, ammonia, hydrogen sulfide, phenols, and secondary bile acids which may cause inflammation or damage to the brush border of the intestinal lining [2]. If left unchecked, long-term damage to the intestinal lining may result in leaky gut syndrome, allergies, autoimmune disease (e.g rheumatoid arthritis), irritable bowel syndrome, fatigue, chronic headaches, and sensitivities to a variety of foods [1]. In addition, pathogenic bacteria can cause acute symptoms such as abdominal pain, nausea, diarrhea, vomiting, and fever in cases of food poisoning.

Bacterial sensitivities to a variety of prescriptive and natural agents have been provided for the pathogenic bacteria that were cultured from this patient's specimen. This provides the practitioner with useful information to help plan an appropriate treatment regimen. Supplementation with probiotics or consumption of foods (yogurt, kefir, miso, tofu, tamari sauce) containing strains of *Lactobacillus* and *Bifidus* can help restore healthy flora levels [1]. Polyphenols in green and ginseng tea have been found to increase the numbers of beneficial bacteria [3]. Hypochlorhydria may also predispose an individual to bacterial overgrowth, particularly in the small intestine [4]. Nutritional anti-inflammatories can aid in reversing irritation to the GI lining. These include quercetin, vitamin C, curcumin, gamma-linoleic acid, omega-3 fatty acids (EPA, DHA), and aloe vera. Other nutrients such as zinc, beta-carotene, pantothenic acid, and L-glutamine provide support for regeneration of the GI mucosa [5]. A comprehensive program may be helpful in individuals in whom a dysbiotic condition has caused extensive GI damage.

1. Lispi E. Digestive Wellness. New Canaan,CT: Keats Publishing;1996.
2. Mitsuoka T. Intestinal flora and aging. Nutr Rev 1992;50(12):438-46.
3. Weisburger JH. Tea and health: the underlying mechanisms. Proc Soc Exp Biol Med 1999;220(4):271-5.
4. Pereira SP, Gainsborough N, Dowling RH. Drug-induced hypochlorhydria causes high duodenal bacterial counts in the elderly. Ailment Pharmacol Ther 1998;12(1)99-104.
5. Murray MT. Stomach Ailments and Digestive Disturbances. Rocklin, CA: Prima Publishing; 1997.

Dysbiotic Yeast

Yeast was cultured from this stool specimen and the amount is considered to be dysbiotic. A positive yeast culture and sensitivity to prescriptive and natural agents is helpful in determining which anti-fungal agents to use as part of a therapeutic plan for chronic yeast syndrome. When investigating the presence of yeast, disparity may exist between culturing and microscopic examination. Yeast grows in colonies and is typically not uniformly dispersed throughout the stool. This may lead to undetectable or low levels of yeast identified by microscopy, despite a significant amount of yeast cultured. Conversely, microscopic examination may reveal a significant amount of yeast present, but no yeast cultured. Yeast does not always survive transit through the intestines rendering it unviable for culturing. Therefore, both microscopic examination and culture are helpful in determining if abnormally high levels of yeast are present.

Microscopic yeast

Microscopic examination has revealed yeast in this stool sample. The microscopic finding of yeast in the stool is helpful in identifying whether the proliferation of fungi, such as *Candida albicans*, is present. Yeast is normally found in very small amounts in a healthy intestinal tract. While small quantities of yeast (reported as rare or few) may be normal, yeast observed in higher amounts (moderate to many) is considered abnormal.

An overgrowth of intestinal yeast is prohibited by beneficial flora, intestinal immune defense (secretory IgA), and intestinal pH. Beneficial bacteria, such as *Lactobacillus* colonize in the intestines and create an environment unsuitable for yeast by producing acids, such as lactic acid,

which lowers intestinal pH. Also, lactobacillus is capable of releasing antagonistic substances such as hydrogen peroxide, lactocidin, lactobacillin, and acidolin.

Many factors can lead to an overgrowth of yeast including frequent use of antibiotics (leading to insufficient beneficial bacteria), synthetic corticosteroids, oral contraceptives, and diets high in sugar. Although there is a wide range of symptoms which can result from intestinal yeast overgrowth, some of the most common include brain fog, fatigue, recurring vaginal or bladder infections, sensitivity to smells (perfumes, chemicals, environment), mood swings/depression, sugar and carbohydrate cravings, gas/bloating, and constipation or loose stools.

A positive yeast culture (mycology) and sensitivity to prescriptive and natural agents is helpful in determining which anti-fungal agents to use as part of a therapeutic treatment plan for chronic yeast syndrome. However, culturing of yeast is not always possible, due to the fact that yeast does not always survive transit through the intestines. Additionally, yeast colonizes in groups and is not dispersed uniformly throughout the stool. Yeast may therefore appear (microscopically) to be inconsistently concentrated in some stool specimens, even when collected from the same bowel movement.

Lysozyme

The level of lysozyme, a biomarker of inflammation, is elevated in this specimen. Lysozyme is an enzyme that catalyzes the hydrolysis of specific glycosidic bonds in mucopolysaccharides that constitute the cell wall of gram-positive bacteria. Lysozyme is an antibacterial defense present in the G.I. tract and is secreted by granulocytes, macrophages, Paneth cells, and Brunner's Glands as well as normal colonic crypt cells [1]. The main source for fecal lysozyme is the intestinal granulocytes.

Moderate elevations in fecal lysozyme are commonly associated with significant overgrowth of enteropathogens such as yeasts or dysbiotic bacteria. Markedly elevated levels of fecal lysozyme have been identified in colonic inflammatory bowel disease (IBD), such as Crohn's disease and ulcerative colitis as well as other non-IBD G.I. diseases with diarrhea, compared to healthy controls [2,3]. In Crohn's disease, excess lysozyme may be a result of active secretions of macrophages in the lamina propria, and monocytic cells in the granulomas (sites of G.I. inflammation) [4]. In ulcerative colitis, it has been postulated that elevations in fecal lysozyme may be secondary to intestinal loss of granulocytes and their secretory granules [5]. Additionally, Paneth cell metaplasia, a phenomenon that occurs with various inflammatory conditions of the large intestine, may be a minor contributor to fecal lysozyme elevations [5]. Paneth cells are part of the intestinal epithelial lining found in the deepest part of intestinal crypts which are the crypts of Lieberkühn. Paneth cells contain lysozyme in their secretory granules, and combined with their phagocytic capability, help to regulate intestinal microbial flora [5].

Lysozyme is helpful in the determination of colonic inflammatory activity rather than small bowel disease [2]. Slightly elevated levels of lysozyme may be treated with anti-inflammatory agents or by removing the antagonist, such as enteroinvasive microorganisms or allergens. Moderate to high levels of lysozyme (>2,000) may indicate an active inflammatory bowel condition which often

requires further testing such as colonoscopy. To rule out IBD, check fecal lactoferrin levels (elevated with IBD).

1. Saito H, Ksajima T, Masuda A, et al. Lysozyme localization in human gastric and duodenal epithelium. *Cell Tissue Res* 1988; 251:3-7-313.
2. Van der Sluys Veer A, Brouwer J, Biemond I, et al. Fecal lysozyme in assessment of disease activity in inflammatory bowel disease. *Dig Dis & Sci.* 1998;43(3):590-5.
3. Klass HJ, Neale G. Serum and faecal lysozyme in inflammatory bowel disease. *Gut* 1978;19:233-9.
4. Geboes K, Van den Oord JJ, Rutgeerts P, et al. Immunohistochemical identification of lysozyme in pseudopyloric gland metaplasia in Crohn's disease. *Hepatogastroenterology* 1986;90:1121-8.
5. Stamp GWH, Poulosom R, Chung LP, et al. Lysozyme gene expression in inflammatory bowel disease. *Gastroenterol* 1992;103:532-538.

Klebsiella species

Klebsiella is closely related to the genera *Enterobacter* and *Serratia* and is often isolated in small numbers in many healthy individuals. This gram negative bacterium is considered dysbiotic in the amount of 3 - 4+. Klebsiellae are ubiquitous in nature. In humans, they may colonize the skin, oral cavity, pharynx, or gastrointestinal tract. Klebsiellae may be regarded as normal flora in many parts of the colon, intestinal tract and biliary tract but the gut is also the main reservoir of opportunistic strains. They may also colonize sterile wounds and urine.

This bacterium has the potential to cause intestinal, lung, urinary tract, and wound infections in susceptible individuals, but *Klebsiella* overgrowth is commonly asymptomatic. *K. pneumoniae*, in particular, may cause diarrhea and some strains are enterotoxigenic. Infection has been linked to ankylosing spondylitis as well as myasthenia gravis (antigenic cross-reactivity), and these patients usually carry larger numbers of the organism in their intestines than healthy individuals. *Klebsiella* is also an infamously known nosocomial infectious agent, partially due to the ability of organisms to spread rapidly. *Klebsiella* accounts for approximately 8% of all hospital-acquired infections, placing it among the top 8 pathogens in hospitals. Extraintestinal infection typically involves the respiratory or urinary tracts, but may infect other areas such as the biliary tract, and surgical wound sites. *K pneumoniae* and *K oxytoca* are the two members of this genus responsible for most extraintestinal human infections. Klebsiellae cause as many as 14% of cases of primary bacteremia, second only to *Escherichia coli* as a cause of gram-negative sepsis.

Treatment of these species has become a major problem in most hospitals because of resistance to multiple antibiotics and potential transfer of plasmids to other organisms. Proper hand washing is crucial to prevent transmission from patient to patient via medical personnel. Contact isolation should be used for patients colonized or infected with highly antibiotic-resistant *Klebsiella* strains.

For the otherwise healthy individual, antimicrobial therapy is often unnecessary. *Klebsiella* thrives on a diet high in starch, so a low-starch diet may be helpful. A further caution is that *Klebsiella* thrives on FOS. Treatment should be based on susceptibility testing.

Celkan T et al. Bacteremia in childhood cancer. *J Trop Pediatr*, 48(6):373 - 7, 2002.

Levy I et al. Nosocomial infections after cardiac surgery in infants and children: incidence and risk factors. *J Hosp Infect*, 53(2):111-6, 2003.

Murray PR, Baron EJ, Pfaller MA, Tenover FC, Tenover RH. *Manual of Clinical Microbiology*, 6th edition. Washington, DC: ASM Press; 1995.