Manitoba Nutrition Supply In Event of a Pandemic:

Analysis, Vulnerabilities and Risk Management Plans

University of Manitoba

Transport Institute

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SECTION 1 : PANDEMICS AND INFLUENZA

1.1 Epidemics and Pandemics

Although the terms pandemic and epidemic are both related to the spread of infectious diseases, there are differences. An epidemic is an outbreak of infection that spreads rapidly and affects many individuals in a given geographical area or population simultaneously. The number of people affected is generally more than originally anticipated. For example, an influenza virus present in Manitoba may be concentrated in densely populated pockets throughout the province, but does not spread internationally.

A pandemic refers to an epidemic disease of widespread occurrence around the world. An influenza pandemic is an event that occurs when an influenza virus changes form and becomes a new strain against which most people have little or no immunity. This new strain of influenza is easily spread from person to person, and poses a severe health risk around the globe. This illness could potentially affect large numbers of people throughout the world and cause a high rate of mortality. The general consensus amongst experts is that a pandemic is inevitable, and is not a question of if, but when and where it will arise. Despite major advances in technology and breakthroughs in medicine, it is still impossible to predict when the next pandemic will occur. The best method to decrease the magnitude of a pandemic, according to the World Health Organization (WHO) is through a combination of international surveillance, isolation and treatment of detected infections, the use of antiviral medications, social distancing (i.e. quarantine), and production of a vaccine.[1]

The following conditions are necessary for an influenza pandemic to occur:

- a new influenza A virus arising from a major genetic change, i.e. an antigenic shift
- a virulent virus with the capacity to cause serious illness and death
- a susceptible population with little or no immunity
- a virus that is transmitted efficiently from person to person.[2]

We are currently in a situation where one virus (H5N1) has fulfilled the first three conditions with only the last one yet to be achieved. Once the H5N1 virus is able to transmit itself successfully from human to human, the scene is set for the world to experience a potential pandemic.

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[1] Ungchusak, K. "Concerns Raised by Pandemic Influenza: A Technical Briefing on Strengthening Pandemic Influenza Preparedness and Response." World Health Assembly. (May 2005)

[2] Public Health Agency of Canada. "The Canadian Pandemic Influenza Plan for the Health Sector." (2006)

Based on expert assumptions as laid out in The Canadian Pandemic Influenza Plan for the Health Sector, it is believed that the next pandemic strain will originate outside of Canada, likely in Asia. Given the speed and frequency of modern-day travel, and our globalized economy, the pandemic strain will likely first appear within Canada three months after it first emerges in another part of the globe, and may appear at any given time of the year.[3]

That being said, the virus can originate anywhere, although Asia is listed as the most likely place of origin given the close proximity of humans and animals. Pandemics usually last between twelve to eighteen months, and more than one wave of illness may appear during this time.[4] Expectations are that the first wave will occur within 2 to 4 months of the virus arriving in Canada[5]. Pandemics typically occur in two or more waves, each lasting anywhere from between six to eight weeks.[6] Based on the 1918 Pandemic, it is assumed that once the virus first arrives in Canada, it will spread across the nation in a one to two month period.[7]

Based on data collected from past pandemics, it is estimated that over 70% of the population will be infected with the virus over the multiple waves, and unlike yearly influenza viruses, it may affect a different age group.[8] For example, during the 1918 Pandemic, the greatest infection rates were recorded amongst healthy people between the ages of 20 and 40, while most infections caused by the typical annual influenza virus occur amongst those over the age of 65. The impact of the pandemic cannot be predicted. It is estimated that during a mild to moderate pandemic, as seen by the past two pandemics, in absence of medical interventions such as vaccine and antiviral medicines, that up to "50% of those infected will seek outpatient care, 1% will be hospitalized and recover, and 0.4% will be fatal cases."[9] During a pandemic of severe magnitude, it is estimated that in the absence of vaccines and antivirals up to 10% of those infected will be hospitalized and 2% may die.[10]

1.2 Influenza

Influenza is a respiratory infection that is caused by a virus. The disease usually re-appears yearly, with a slight mutation called antigenic drift. Influenza A, B, and C are the three types of viruses that affect human populations. Influenza A strains pose a serious threat to humans because "of their wide host range, their rapid mutation rate,

[3] Public Health Agency of Canada. "The Canadian Pandemic Influenza Plan for the Health Sector." (2006)
[4] Ibid
[5] Ibid
[6] Ibid
[7] Ibid
[8] Ibid
[9] Ibid
[10] Ibid

and their capacity to cause serious disease."[11] Influenza A viruses can be divided into subtypes on the basis of their surface proteins: hemagglutinin (H) and neuraminidase (N). There are sixteen H subtypes, and nine N subtypes which can be paired with one another. Wild birds are natural hosts of all known subtypes of Influenza A. Human influenza viruses are not to be confused with avian influenza, which is an infectious disease of birds caused by Influenza A strains. Generally only bird species are susceptible to avian influenza viruses; human infections can occur although the level of risk is low. Humans who are exposed to sick birds are at most risk of contracting the virus. For example, although H5N1 is a highly pathogenic and contagious virus amongst birds, traditionally infections in humans are rare. Since 1997 however, the number of humans infected with the H5N1 virus has risen.

Influenza A viruses can be described as either low pathogenic (LPAI) or high pathogenic (HPAI), although most Influenza A viruses are LPAI. Mild symptoms in birds result in decreased egg production, change in physical appearance (i.e. ruffled feathers) and respiratory problems. Rapidly forming severe symptoms affect organs and tissues causing internal hemorrhaging. To date, H5 and H7 subtypes are believed to be the most HPAI. Even LPAI strains of H5 and H7 viruses have the potential of becoming HPAI.

Human infection associated with some HPAI virus have resulted in mild symptoms (H7N3, H7N7) to severe symptoms (H7N7, H5N1) often resulting in death. Influenza symptoms in humans have been observed as typical infections (i.e. sore throat, runny nose, cough), while others have been observed as more severe (i.e. respiratory distress). As stated earlier, most cases of infection involving humans are related to direct contact with diseased or dead birds.

There are numerous differences between seasonal and pandemic influenza. These differences are shown in Table 1.1.

[11] Faci, S.A. "Emerging and Re-Emerging Infectious Disease: Influenza as a Prototype of the Host-Pathogen Balancing Act." Cell 124. (February 2006) p.668

Table 1.1: Comparison of Seasonal and Pandemic Influenza

Comparison of Seasonal and Pandemic Influenza	
Seasonal Influenza	**Pandemic Influenza**
Outbreaks occur at regular intervals yearly (generally late fall/winter)	Occurred 3 times in the last century (1918, 1957, 1968)
Some immunity gained through previous exposure.	There is no previous exposure and there is little to no immunity against the strain.
People most at risk include the elderly the young and those with underlying health concerns	Healthy people are susceptible to the virus
Vaccine developed based on known flu strains and available for annual flu season	Vaccine probably would not be available in the early stages of a pandemic, and when available will only be accessible to a few countries
Antivirals are usually available regularly	Antivirals may be in limited supply and only available to a few countries
Average worldwide deaths 250,000 – 500,000	Number of deaths could be quite high (e.g pandemic of 1918 – 20 to 50 million deaths)
Causes minimal disruptions to society (e.g., some absenteeism for school or work)	Will likely have a large impact on society (e.g. closure/major interruptions of essential service such public transportation, education facilities, police)

1.3 History of Pandemics

The influenza pandemic of 1918-1919 (H1N1) otherwise known as the "Spanish flu" has been cited as the most devastating human health-related event in recorded world history. This strain of influenza is believed to be "an avian virus that adapted to humans through a series of point mutations."[12] Initially the origins of the virus were believed to have been in China, however the first outbreaks of the virus occurred about the same time in North America[13] (Detroit, South Carolina and San Quentin prison). This information has led a number of experts to believe the strain originated in the United States. The movement of men and armies to Europe to serve in World War I is thought to have served as a likely vessel for the transmission of the influenza virus. In the end, it is estimated that 20 to 50 million people worldwide succumbed to the virus including 30,000 to 50,000 casualties in Canada.[14] Unlike the seasonal flu which typically affects the old and the young, the greatest number of fatalities was observed in those between the ages of 20 to 40.[15]

A second pandemic flu occurred in 1957-58. H2N2, an influenza A subtype, was first identified in the Yunan Province in China in February 1957.[16] In total, this strain was

[12] Faci, S.A. "Emerging and Re-Emerging Infectious Disease: Influenza as a Prototype of the Host-Pathogen Balancing Act." Cell 124. (February 2006)
[13] Potter, C.W. "A History of Influenza." The Society for Applied Microbiology. Vol.91 572-579. (2001)
[14] Public Health Agency of Canada. "The Canadian Pandemic Influenza Plan for the Health Sector." (2006)
[15] Ibid
[16] Potter, C.W. "A History of Influenza." The Society for Applied Microbiology. Vol.91 572-579. (2001)

responsible for fatally infecting 1 to 2 million people worldwide.[17] The mortality rate was estimated as 1 in 4000, and affected the very young and the elderly.[18] The virus was mostly transmitted along oceanic shipping lanes, and worldwide infection occurred six months after the virus was first identified. The first outbreaks occurred in September 1957, while infection rates peaked in October. By December 1957 the situation appeared to improve, however a second wave of the illness occurred in January and February 1958. When compared to the high infection rate of the 1918 pandemic, relatively few humans were affected with the H2N2 virus.

The third pandemic of the twentieth century, Hong Kong influenza (H3N2), occurred in 1968-69. The H3N2 strain caused approximately 700,000 deaths worldwide.[19] Unlike the H1N1 virus which affected healthy young adults, the age groups most affected by the disease were the very young, very old, and those with underlying health conditions (ex. diabetes).

Previous pandemic occurrences have revealed that these events are:

- "…highly unpredictable and highly variable in terms of severity, mortality and patterns of spread;
- …most have originated in Asia. An exponential increase in the number of cases and geographic spread can occur within a matter of weeks;
- Biological surveillance for changes in the virus and surveillance among humans for respiratory illness are crucial as early warning systems;
- Some public health interventions (quarantine, travel restrictions) have delayed the spread but could not stop it; nevertheless, delay of spread is important to allow medical services to develop a vaccine;
- Vaccines can have a significant impact but global manufacturing capacity is limited and takes too long…"[20]

1.4 Global Influenza Preparedness Plan

The 2005 WHO "Global Influenza Preparedness Plan" was written to replace the former "Influenza Pandemic Plan: The Role of WHO and Guidelines for National and Regional planning" which was released in 1999. The new version of the report "redefines the phases of increasing public risk associated with the emergence of a new influenza virus subtype that may pose a pandemic threat and then goes on to recommend action for national authorities, and outlines measures to be taken by WHO during each phase"[21]

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[17] Ibid
[18] Ibid
[19] Faci, S.A. "Emerging and Re-Emerging Infectious Disease: Influenza as a Prototype of the Host-Pathogen Balancing Act." Cell 124.
[20] World Heath Organization. "Avian Influenza: Responding to the Pandemic Threat." (2005)
[21] World Health Organization. "WHO Global Influenza Preparedness Plan: The Role of WHO and Recommendations for National Measures Before and During Pandemics." (2005)

(See Table 1.2). This new version has 3 periods (Inter-pandemic, Pandemic Alert, and Pandemic) and 6 phases (1 to 6) as determined by the WHO. These periods and phases are used by the WHO to determine international pandemic activity levels. The number following the decimal point in Table 1.2 shows the Canadian pandemic activity level during that particular phase with sub-indicators for each level as follows:

0 – No activity observed in Canada.
1 – Single case(s) observed in Canada (i.e., no clusters).
2 – Localized or widespread activity observed in Canada.

As of 2005, fifty countries have written a pandemic preparedness plan, each one ranging in comprehensiveness and completeness.[22] Each plan is unique to that country and is based on its government's agenda, and financial resources. The WHO has no mechanism in place to verify each of the plans individually, however they have provided a checklist of steps to influenza pandemic planning. This tool enables governments to evaluate their pandemic plans as well as identify and ratify gaps in their plans. WHO stresses that the key to reducing the impact of an influenza pandemic is to have international harmonization of preparedness plans.

Table 1.2: Phases of a Pandemic

Phases of a Pandemic		
Phase	**Definition**	**Example(s)**
Period: Inter-pandemic		
1.0	No new virus subtypes have been detected in humans. An influenza virus subtype that has caused human infection may be present in animals located outside of Canada. If present in animals, the risk of human infection and/or disease is considered to be low.	Highly pathogenic H7N3 detected in poultry outside of Canada.
1.1	No new virus subtypes have been detected in humans. An influenza virus subtype that has caused human infection is present in animals in Canada but the risk of human infection and/or disease is considered to be low.	Highly pathogenic H7N3 detected in a poultry flock in Canada.
2.0	No new virus subtypes have been detected in humans. However, an animal influenza virus subtype that poses substantial risk to humans is circulating in animals located outside of Canada.	Highly pathogenic H5N1 detected in poultry flocks outside of Canada.
2.1	No new virus subtypes have been detected in humans. However, an animal influenza virus subtype that poses substantial risk to humans is circulating in animals in Canada	Highly pathogenic H5N1 detected in poultry flocks inside of Canada.

[22] Stohr, K. "Global Pandemic Preparedness." WHO Global Influenza Programme. (2005)

Period: Pandemic Alert		
3.0	Outside Canada human infection(s) with a new subtype are occurring, but no human-to-human spread or, at most, rare instances of spread to a close contact has been observed. No cases identified in Canada	Outside Canada sporadic human cases are occurring in connection to an avian flu outbreak.
3.1	Single human cases(s) with a new subtype detected in Canada. The virus is not known to be spreading from human-to-human or, at most, rare instances of spread to a close contact have been observed.	Case imported into Canada from area outside Canada experiencing an avian outbreak. Case arising in Canada "de novo" or in association with an avian outbreak in Canada.
4.0	Outside Canada small cluster(s) with limited human-to-human transmission are occurring but spread is highly localized, suggesting that the virus is not well adapted to humans. No cases identified with these cluster(s) have been detected in Canada.	Outside Canada small cluster(s) of human cases with a novel virus are occurring in connection to an avian outbreak.
4.1	Single human case(s) with the virus that has demonstrated limited human-to-human transmission detected in Canada. No cluster(s) identified in Canada.	Detection of an imported case in Canada that is infected with the novel virus known to be causing small clusters of human cases outside Canada.
4.2	Small localized clusters with limited human-to-human transmission are occurring in Canada, but spread is highly localized suggesting that the virus is not well adapted to humans.	Detection of a localized cluster of cases in Canada linked to an imported case or from cases arising in Canada.
5.0	Outside Canada larger cluster(s) are occurring but human-to-human spread still localized, suggesting that the virus is becoming increasingly better adapted to humans but may not yet be fully transmissible (substantial pandemic risk). No cases identified with these clusters have been detected in Canada.	Outside Canada larger cluster(s) of human cases with a novel virus are occurring.
5.1	Single human case(s) with the virus that is better adapted to humans detected in Canada. No cluster(s) identified in Canada.	Detection of an imported case in Canada that is infected with the virus known to be causing larger clusters of human cases outside Canada.
5.2	Larger localized cluster(s) with limited human-to-human transmission are occurring in Canada but human-to-human spread still localized, suggesting that the virus is becoming increasingly better adapted to humans but may not yet be fully transmissible.	Detection of a large but localized cluster of cases in Canada linked to an imported case OR from cases arising in Canada.

Period: Pandemic		
6.0	Outside Canada increased and sustained transmission in the general population has been observed. No cases have been detected in Canada.	Countries outside of Canada have reported sustained transmission of the new virus in their population.
6.1	Single human case(s) with the pandemic virus detected in Canada. No cluster(s) identified in Canada.	Detection of an imported case in Canada that is infected with the pandemic virus.
6.2	Localized or widespread pandemic activity observed in the Canadian population.	Large numbers of clinical cases being rapidly identified in Canada with no history of travel to an affected area.

1.5 Characteristics of Avian Influenza (H5N1)

In recent years, one highly pathogenic influenza A subtype, H5N1, has caused great global concern as this virus has the potential to cause a pandemic. Initially, the H5N1 virus circulated amongst birds without causing any symptoms of disease. Since 2004, a highly pathogenic strain of the virus has been spreading throughout Asia and has caused a high infection rate amongst domestic poultry and wild birds.[23] As well, for the first time, this strain appears to have been successfully transmitted from poultry to migratory birds, and is causing disease amongst that population.[24]

H5N1 was first observed in Scottish poultry population in 1959. At an unknown time, the virus established itself in Asia, causing very few symptoms in domestic bird populations. By 1996 however, it became evident that a highly pathogenic form of the virus was present in Asia poultry. This strain was so virulent that it could kill chickens within a 48 hour period, with a death rate of nearly 100 per cent.[25] In 1997, the first human infections of the H5N1 were recorded in Hong Kong. Swift action was taken by the government to control the emergence of this disease, and a widespread culling of poultry was ordered. In late 2003, the virus re-appeared again in Asia, first in Korea. Since 2003, the virus has emerged in 18 different countries, and has been found in other mammals such as pigs, tigers, and cats. The first recorded H5N1-related human deaths occurred in 2004 in Thailand and Vietnam.[26]

[23] Faci, S.A. "Emerging and Re-Emerging Infectious Disease: Influenza as a Prototype of the Host-Pathogen Balancing Act." Cell 124. (February 2006)
[24] Faci, S.A. "Emerging and Re-Emerging Infectious Disease: Influenza as a Prototype of the Host-Pathogen Balancing Act." Cell 124. (February 2006)
[25] Ibid
[26] Ibid

At this time, the H5N1 virus has achieved the first three conditions necessary for a pandemic to occur, meaning that the virus needs only to be transmitted efficiently human-to-human for an influenza pandemic to unfold. Table 1.3 presents the number of H5N1 human infections, and number of deaths caused by the virus, as documented by the WHO. In countries where individuals have contracted the virus, the mortality rate is well above 50%. For example, since 2003, one hundred and thirteen humans in Indonesia have been infected with the H5N1 virus, and ninety-one of these people have perished, with a death rate of over 80%. This is particularly alarming, as previously stated, since only 1 to 2% of those infected with the 1918 H1N1 strain died from the virus.[27] There is still not sufficient evidence to suggest whether this strain of H5N1 will successfully evolve to directly affect humans.

Humans who are exposed to sick birds are at the most risk of contracting the virus. Most individuals that have contracted the disease have been healthy children and young adults.[28] Nearly all human cases involve exposure to infected or dead domestic poultry. There have been no confirmed cases of infection amongst poultry workers or cullers. As of September 1 2005, there has been one reported human-to-human transmission of the virus in Thailand.[29]

Table 1.3: Number of Laboratory Confirmed Human Cases (Deaths) of Influenza H5N1[30]

Country	**Total Cumulative Cases (deaths) (2003 to present)**	**Most Recent Cases (deaths) (2007 – March 18, 2007)**
Azerbaijan	8 (5)	0 (0)
Cambodia	7 (7)	1 (1)
China	30(20)	8 (6)
Djibouti	1 (0)	0 (0)
Egypt	47 (20)	29 (10)
Indonesia	129 (105)	52 (47)
Iraq	3 (2)	0 (0)
Lao PDR	2 (2)	2 (2)
Myanmar	1 (0)	1 (0)
Nigeria	1 (1)	1 (1)
Pakistan	1 (1)	1 (1)
Thailand	25 (17)	0 (0)
Turkey	12 (4)	0 (0)
Vietnam	106 (52)	13 (10)
Total	**373 (236)**	**108 (78)**

[27] Faci, A. Moyers, B. "H5N1: Killer Flu." Wide Angle. (September 2005)
[28] World Heath Organization. "Avian Influenza: Responding to the Pandemic Threat."
[29] Ibid
[30] Source: World Health Organization:
http://www.who.int/csr/disease/avian_influenza/country/cases_table_2008_03_18/en/index.html

1.6 Canada's General Medical Mitigation Strategy

The general consensus among the medical community is that vaccination is the best possible tool to protect humans during an influenza pandemic. In 2001 the Government of Canada contracted GlaxoSmithKline to produce a vaccine once a pandemic virus is identified. Canada is one of the few countries in the world that has this type of preparatory plan. In April of 2007, the first vaccine for humans against the H5N1 was approved in the United States.[31] During the preliminary stages of an influenza pandemic this vaccine could be used while a vaccine 'tailored' to the virus is being developed.[32]

When a vaccine is administered, a harmless virus is introduced into the patient. The body then produces antibodies against the invading virus, providing up to six months protection against the virus. If during this six month period, the patient is exposed to the virus, the antibodies created will help reduce symptoms of illness, or prevent the individual from getting sick.[33] Vaccines administered during previous influenza seasons provide no protection against a new pandemic strain. Unfortunately, it takes a minimum of four to six months for a vaccine against a new strain to be developed, which suggests that a vaccine will not be available during the start of pandemic influenza activity in Canada or internationally.[34] Currently, Canada's "pandemic vaccine production capacity is 8 million 15 micrograms (mg) doses per month."[35] Methods to increase Canada's production capacity are currently being explored.

During the onset of a pandemic, Canada's goal is to vaccinate its entire population on a priority basis. Those who will be first vaccinated include health care professionals, and high-risk groups which are determined by the epidemiology of the virus (i.e. certain age groups)[36]. In order to deal with the high demand for vaccines during a pandemic, measures have been taken to ensure Canadians' health and security, with fertilized hen eggs, which are used in the production of vaccines, being stockpiled.[37]

As suggested by the WHO, in anticipation of a pandemic influenza, governments around the world are stockpiling antiviral medication that could prove to be vital during the early stages of a pandemic. Antivirals are seen as an intermediate step during a pandemic, while a vaccine against the strain is being developed. If patients receive antivirals within 48 hours of the onset of symptoms it limits reproduction of the virus,

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[31] U.S. Food and Dug Administration. "FDA Approves First U.S. Vaccine for Humans Against the Avian Influenza Virus H5N1." (April 2007)

[32] Ibid

[33] Public Health Agency of Canada. "The Canadian Pandemic Influenza Plan for the Health Sector." (2006)

[34] Public Health Agency of Canada. "The Canadian Pandemic Influenza Plan for the Health Sector." (2006)

[35] Ibid

[36] Office of the Chief Medical Officer of Health. "Preparing for Pandemic Influenza in Manitoba: A Guide for the Public from the Office of the Chief Medical Officer of Health." (March 2006

[37] Ibid

however they do not provide immunity for the virus.[38] Antivirals are not guaranteed to alleviate all symptoms of illness however, as it is possible that viruses may potentially build up immunity against the drug.

There are two classes of antiviral drugs available in Canada that are used during regular influenza seasons, M2 ion channel inhibitors (i.e. amantadine) and neuraminidase inhibitors (i.e. zanamivir and oseltamivir). In 2004, a stockpile consisting of 1.6 million treatments of oseltamivir was established in Canada, although it has been recommended that the antiviral stockpile should be increased to 5.5 million treatment courses, to provide effective relief to those infected in the early stages of a pandemic.[39] An additional stockpile, making up 10% of the total stockpile, of zanamivir and oseltamivir solution should be created in order to treat children and those who are unable to swallow pills.[40] No firm strategy concerning the organization of antivirals during a pandemic in Canada is yet in place. The federal government is currently striving to address the following concerns to ensure a successful antiviral program is in place in the event of a pandemic:

- "A secure supply (i.e. stockpiles of effective drugs);
- A well-planned distribution and monitoring system under the direction of governments in collaboration with suppliers;
- A strategy enabling early access to treatment;
- Availability of rapid diagnostic tests for influenza;
- Enhanced surveillance for the detection of the virus, resistance of the virus to antivirals and drug-associated adverse events;
- Clinical guidelines for the appropriate use of antivirals;
- Study protocols to further assess the effectiveness of antivirals during a pandemic; and
- Effective communication and education materials on antivirals for health care workers and the public."[41]

It should be noted that although ten developing countries have accumulated antiviral stockpiles able to treat 20-40% of their population, most developing countries have not yet begun to stockpile these drugs.[42] The lack of available funds is the primary reason for their absence in this initiative.

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[38] Ibid
[39] Public Health Agency of Canada. "The Canadian Pandemic Influenza Plan for the Health Sector." (2006)
[40] Public Health Agency of Canada. "The Canadian Pandemic Influenza Plan for the Health Sector." (2006)
[41] Public Health Agency of Canada. "The Canadian Pandemic Influenza Plan for the Health Sector." (2006)
[42] Public Health Agency of Canada. "The Canadian Pandemic Influenza Plan for the Health Sector." (2006)

1.7 To Be (or Not To Be) Prepared?

Table 1.4 depicts four possible scenarios in management of or planning for supply chain interruptions. Organizations (e.g. business firms, government agencies, not-for-profit institutions, or even households) can assume either a proactive or reactive position in facing the disruptive event. While a reactive stance implies a lack of planning for the interruption, a proactive position includes developing an action plan to be deployed if the event occurs.

Table 1.4: Risk Management Versus Crisis Management

Approach	Interruption (e.g. Pandemic)	
	Occurs	Does not Occur
Proactive (Risk Management)	Prepared	Resources squandered
Reactive (Crisis Management)	Unprepared	Resources conserved

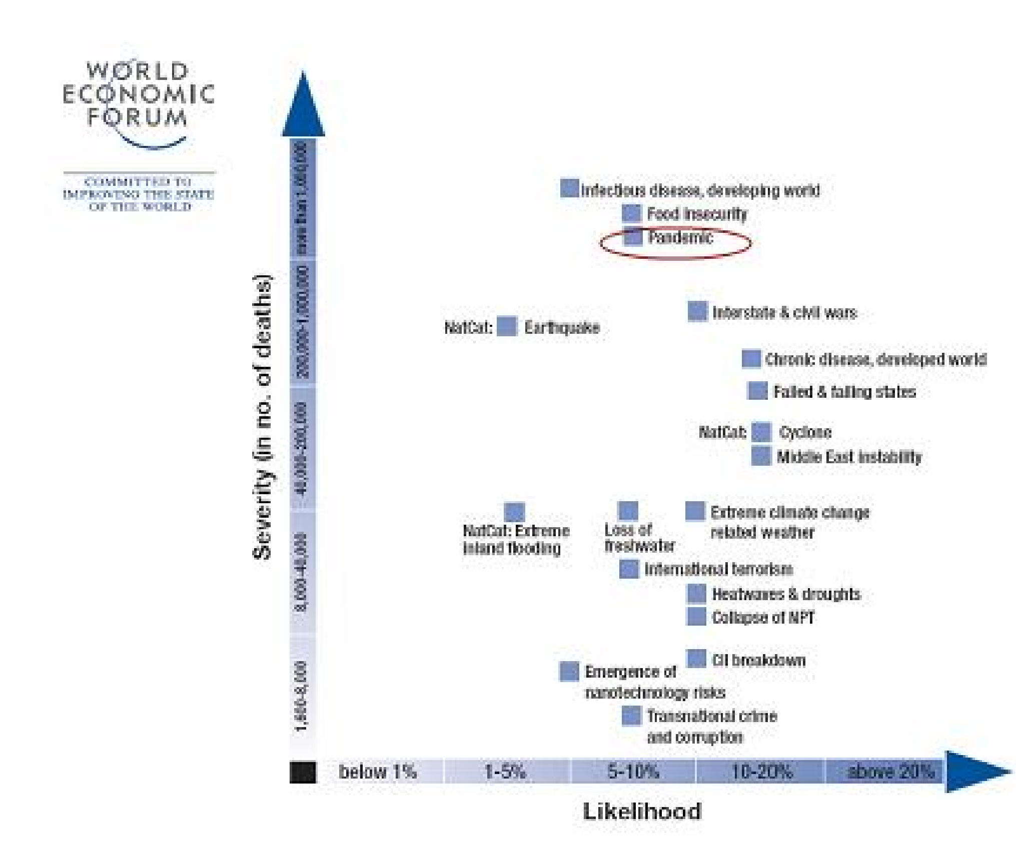
Using the reactive approach, the organization will be unprepared if the disruptive event occurs. The event triggers *crisis management*, during which time is likely to be lost trying to figure out what to do. However, if the event does not occur, then the organization has conserved resources. It takes time, money and talent to develop plans in anticipation of interruptions. By foregoing this planning, an organization can devote scarce resources to competing, serving customers, developing suppliers, training employees, interacting with constituents, etc.

On the other hand, the proactive approach helps an organization to "be prepared." This is the essence of *risk management*. A plan is developed in advance, to mitigate the impact of the interruption. If the disruptive event or interruption occurs, the organization will be better able to respond and recover. If the event does not occur, it could be argued the organization has squandered scarce resources that could have been used for some other purpose.

How can we determine whether a proactive or reactive approach is sensible in response to a possible pandemic event? As of March 11, 2008, the World Health Organization (WHO) has confirmed 372 cases of influenza A/H5N1—and 235 deaths. There have been no cases reported in Canada. Nonetheless, as noted above, experts generally agree a pandemic is coming—the question is when (and where) will it start?

The World Economic Forum rates 18 core global risks, in terms of *likelihood* of occurrence during 2008 and *severity* (number of deaths) if the event does occur. According to the Forum, there is a 5 to 10 percent chance that a pandemic disease will jump from animals to humans, with high mortality and transmission rates. If this pandemic happens, its impact is predicted to be very severe; causing more than one million human fatalities[43]. Figure 1.1 shows the likelihood and severity of the pandemic, in relation to the other core global risks.

Figure 1.1: Core Global Risks: Likelihood and Severity



The World Economic Forum further estimates that the pandemic will cost the global economy between $250 billion and $1 trillion dollars. The combination of a non-zero likelihood of occurrence and an extremely severe impact make pandemic planning and preparedness a worthy endeavor.

The report deals with a proactive approach to managing a pandemic event to mitigate and manage costs to Manitobans.

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[43] World Economic Forum (2008), *Global Risks 2008: A Global Risk Network Report*, January, Geneva, Switzerland. (www.weforum.org)

SECTION 2 : MAPPING THE MANITOBA NUTRITION SUPPLY CHAIN

2.1 Introduction

Supply chain maps are important aids in visualizing the relationships within supply chains and in making strategic, tactical and operational decisions related to effectiveness, efficiency and risk management. As discussed by Gardener and Cooper there is "not yet a universal set of conventions to represent a supply chain and to launch a discussion of the alternative approaches"[44]. This study uses one approach and provides supply chain maps for the most important food groups produced in Manitoba. The map describe the parts of the chain, such as, farming, logistics, manufacturing, logistics (post processor), retail and consumer level for the Manitoba food supply chain as well as the interlinkages amongst the parts.

The farming level is the portion of the supply chain that includes the first stage of the produce, beginning from the farm, the fish farms or the fishermen, honey producers, horticulturists, up to the elevator or collection/storage point. Mitigating pandemic risk at this level of the supply chain, other than at the large scale planning level is not within the scope of this study.

The logistics level comprises importers, exporters, packers, marketers and marketing groups or board, grain company's and their storage elevators, natural water springs, the municipal water supply, and all the related warehousing, inventory control and shipment processes.

The processing level is the portion of the supply chain (within the province unless mentioned otherwise) which includes processors of all kinds including on-farm processing, food and dairy processors, mills, feed mills, crushers, manufacturing units, bottling plants, abattoirs.

The logistics level (post processor) is the portion of the supply chain which takes the processed/manufactured food to the distribution channels. It includes wholesalers, butchers, supermarket regional distribution centres (RDC's), export of processed food.

The retail level of the supply chain consists of the independent retailers, the super markets, the farm shops, delivery dairies, and the retail butchers. The chain ends with the consumer[45].

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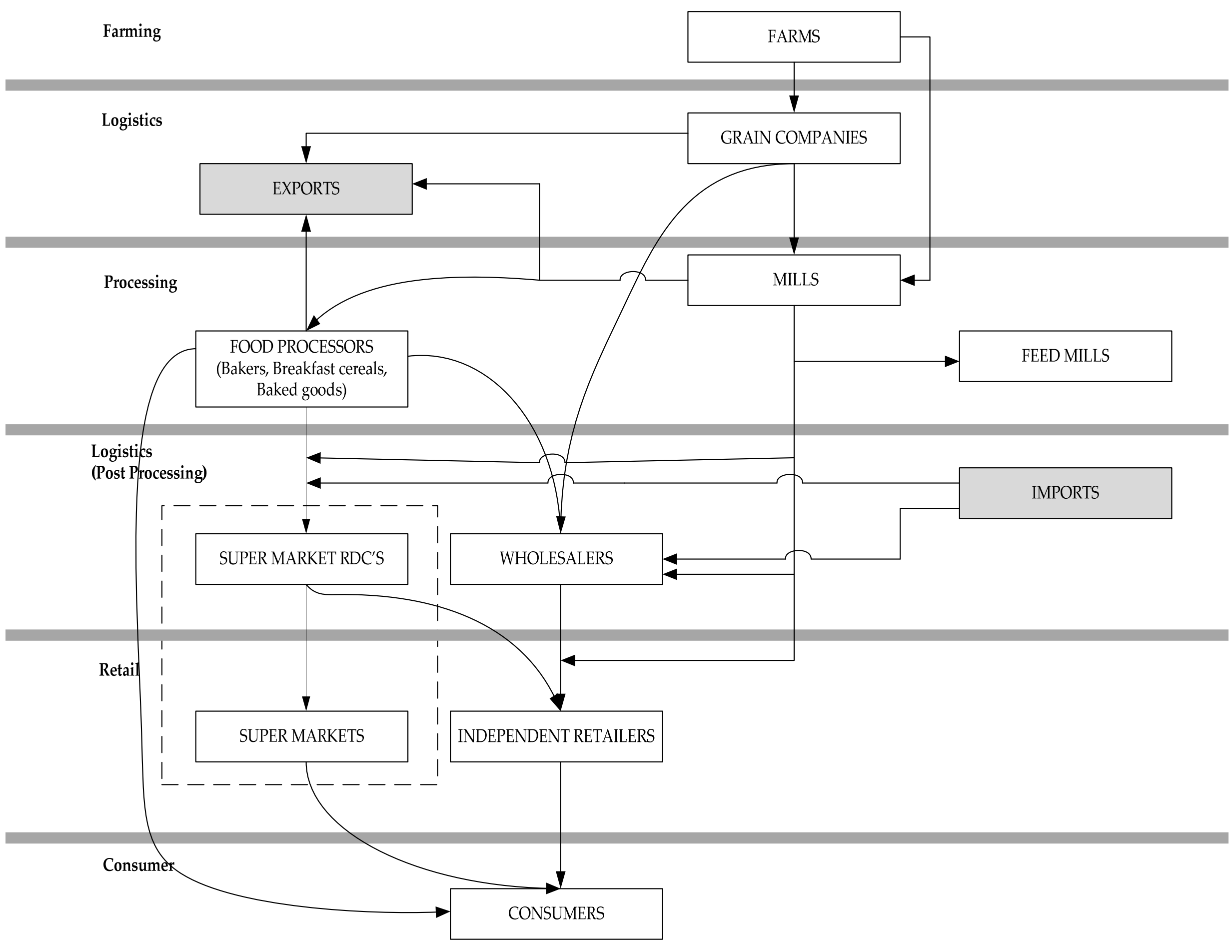
[44] John T. Gardner and Martha C. Cooper. *Strategic Supply Chain Mapping Approaches*. Journal of Business Logistics, Volume 2, No. 2, 2003. Page 3.

[45] Components of the supply chain such as restaurants were out of scope of the analysis. The food banks are shown in section 11.4.

Each map in Figures 2.1 through 2.12 shows the flow and interlinkages between the components. [46]

Figure 2.1: Grain/Cereal Products Food Supply Chain



[46] Note: Imports refer to imports to Manitoba from any region outside Manitoba. Similarly exports are exports to any region outside Manitoba. Processing is only Manitoba processing.

Figure 2.2: Fat and Oil Food Supply Chain

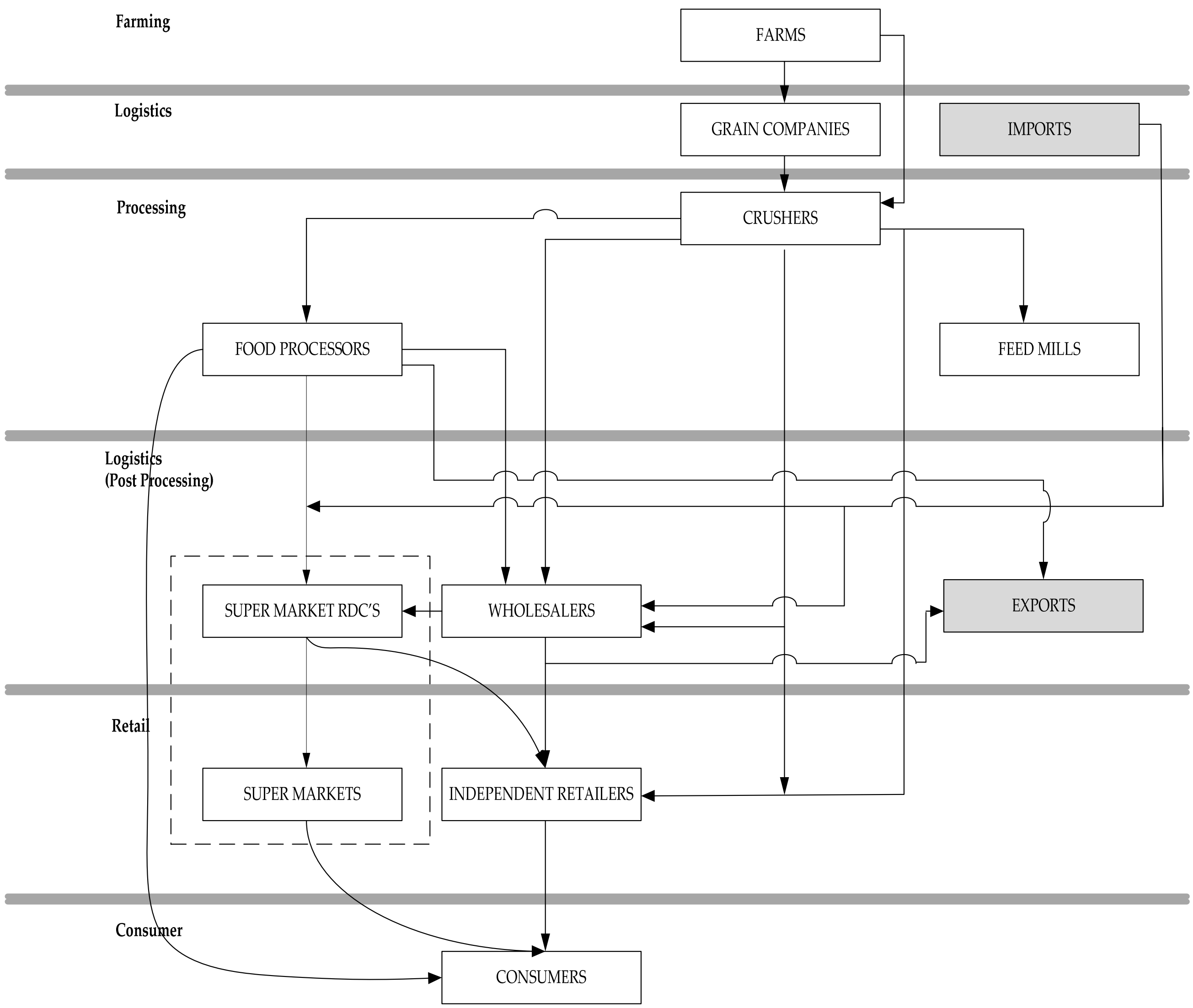


Figure 2.3: Sweets and Sugar Food Supply Chain

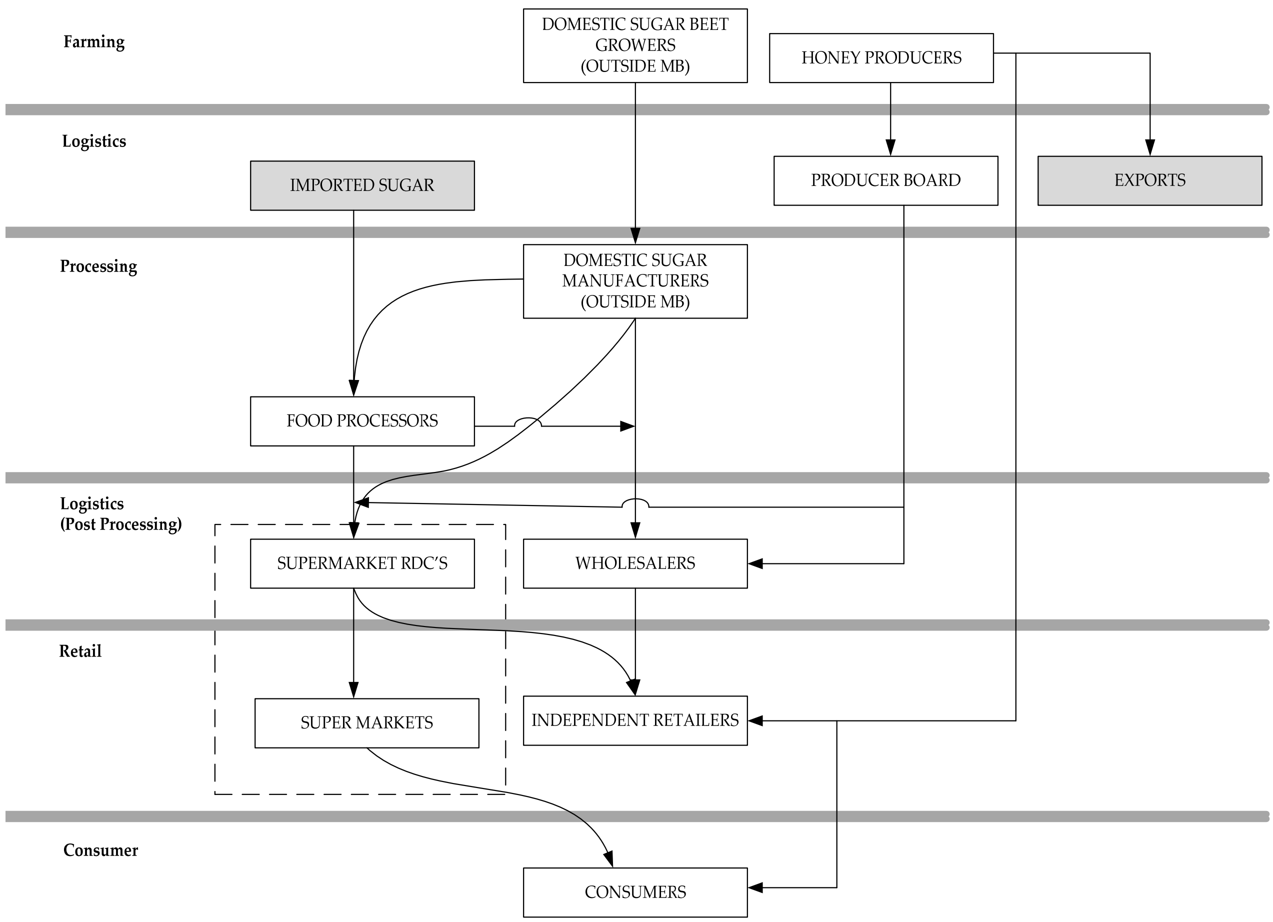


Figure 2.4: Pulses and Nuts Food Supply Chain

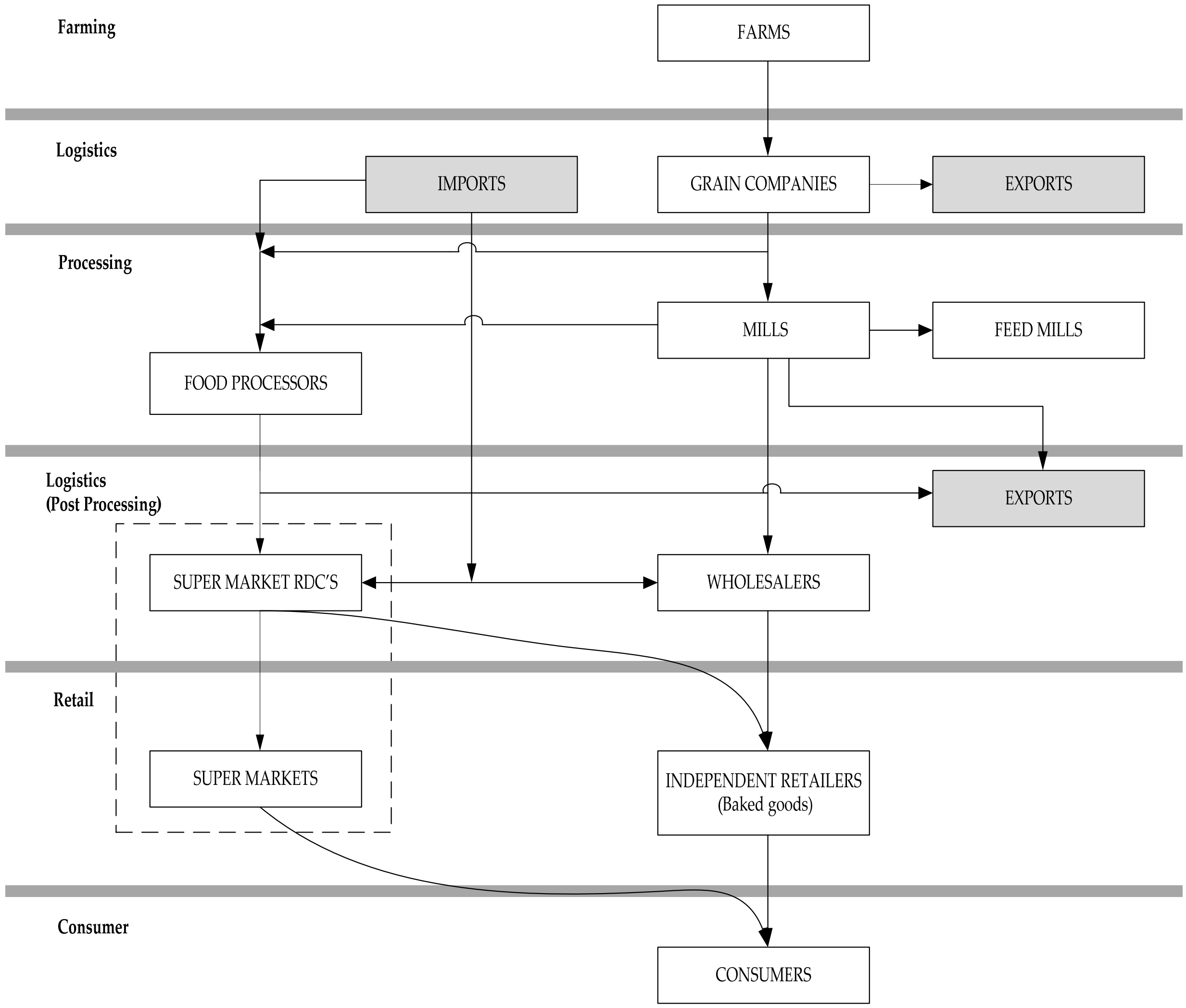


Figure 2.5: Meat and Poultry Food Supply Chain

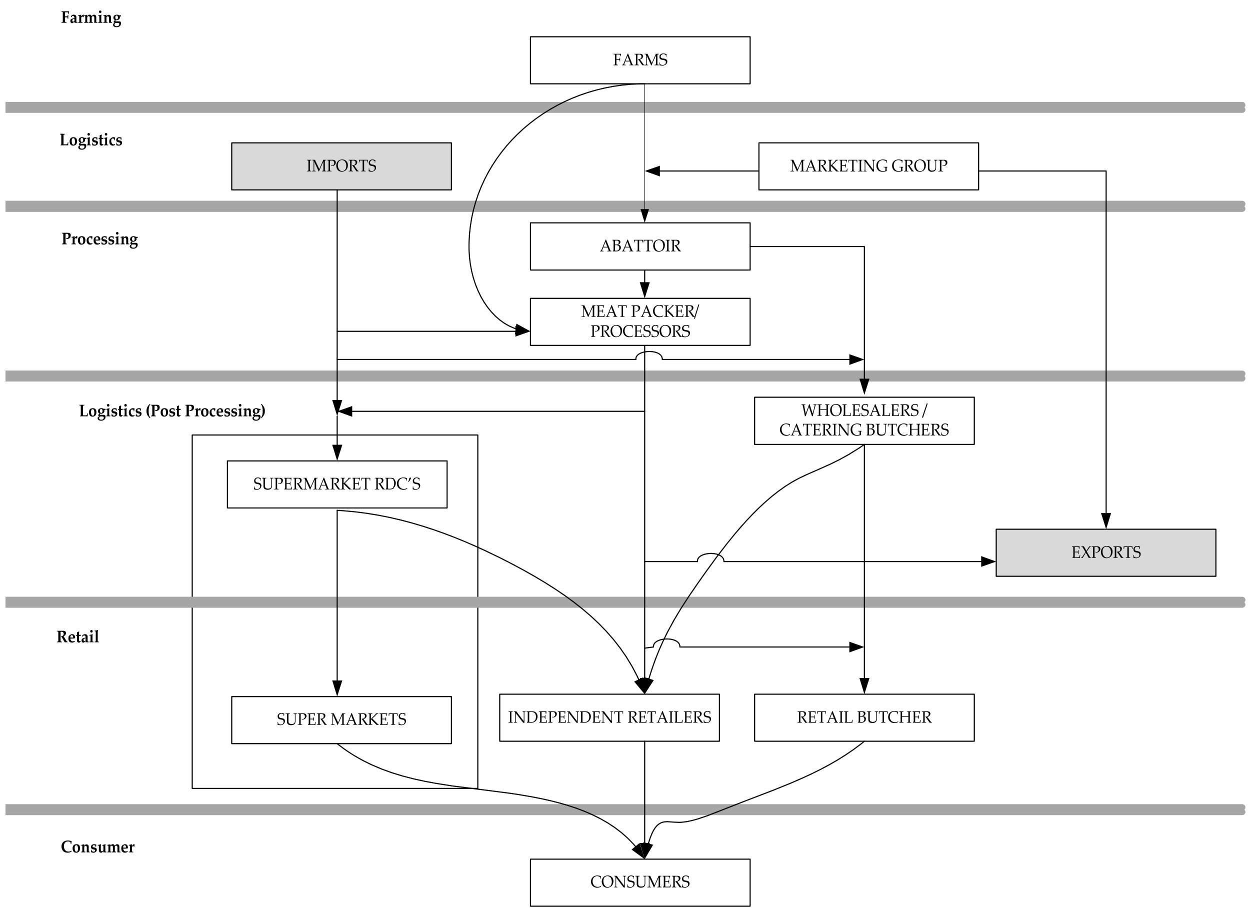


Figure 2.6: Fish Food Supply Chain

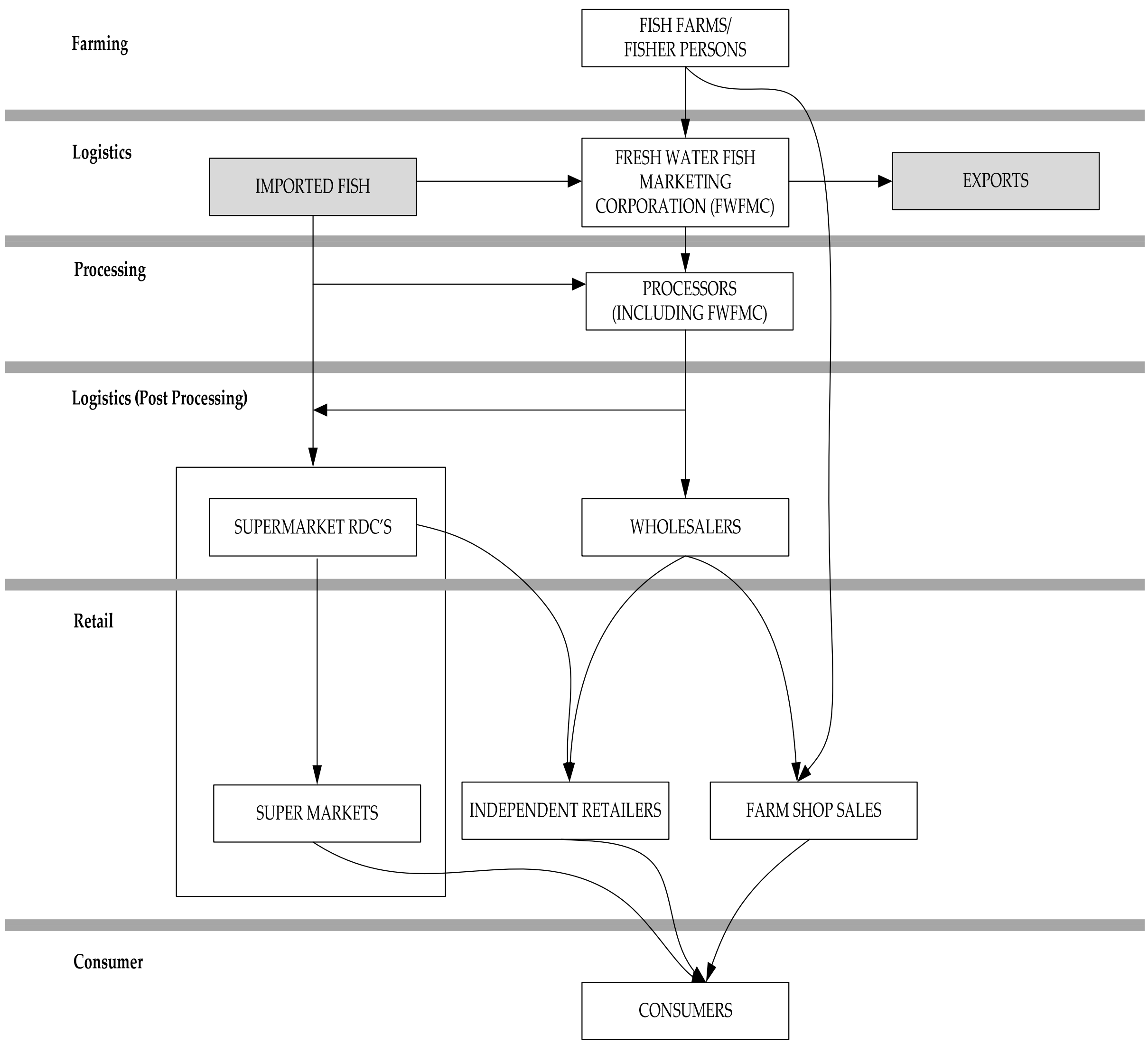


Figure 2.7: Dairy Food Supply Chain

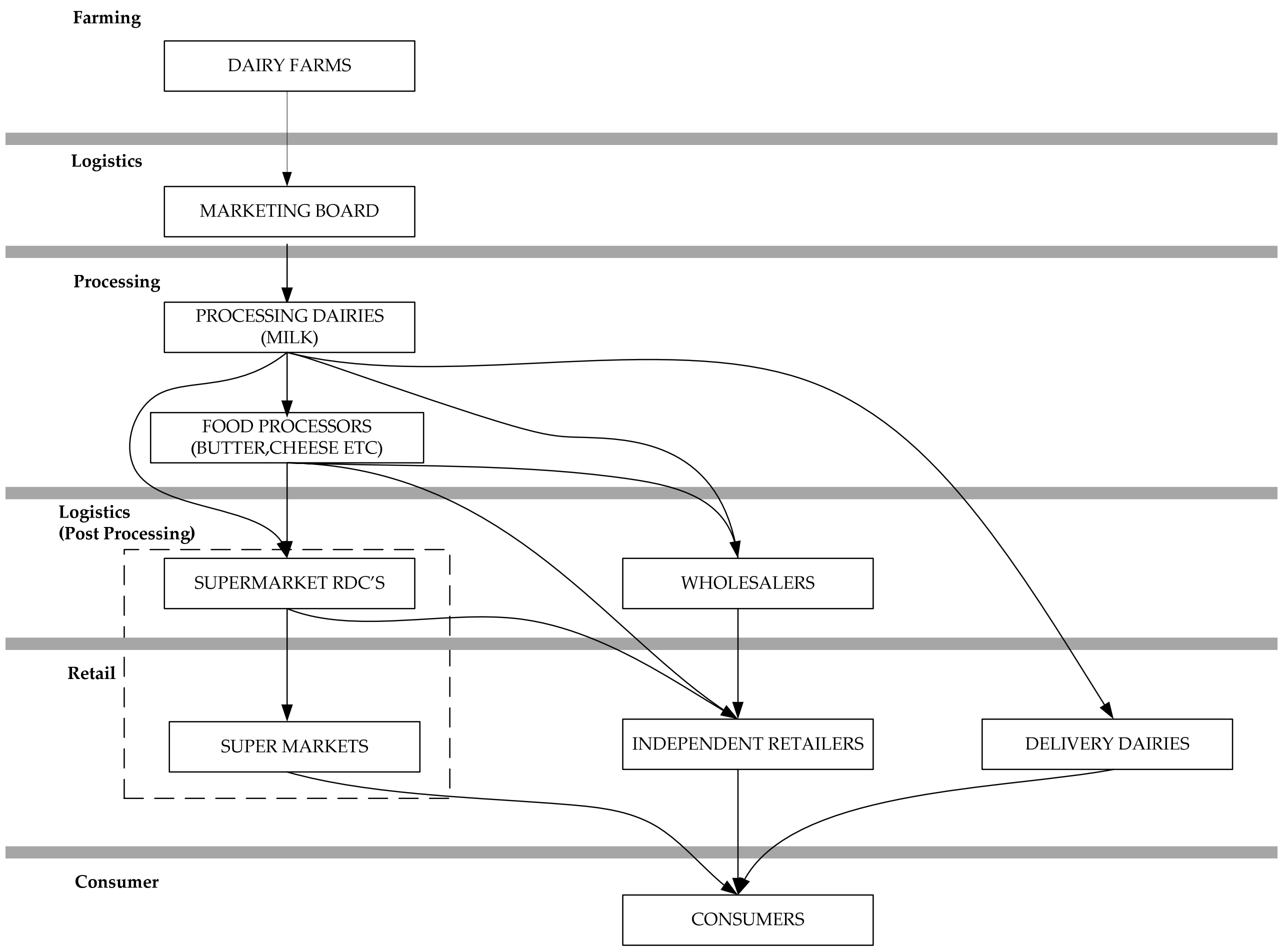


Figure 2.8: Eggs Food Supply Chain

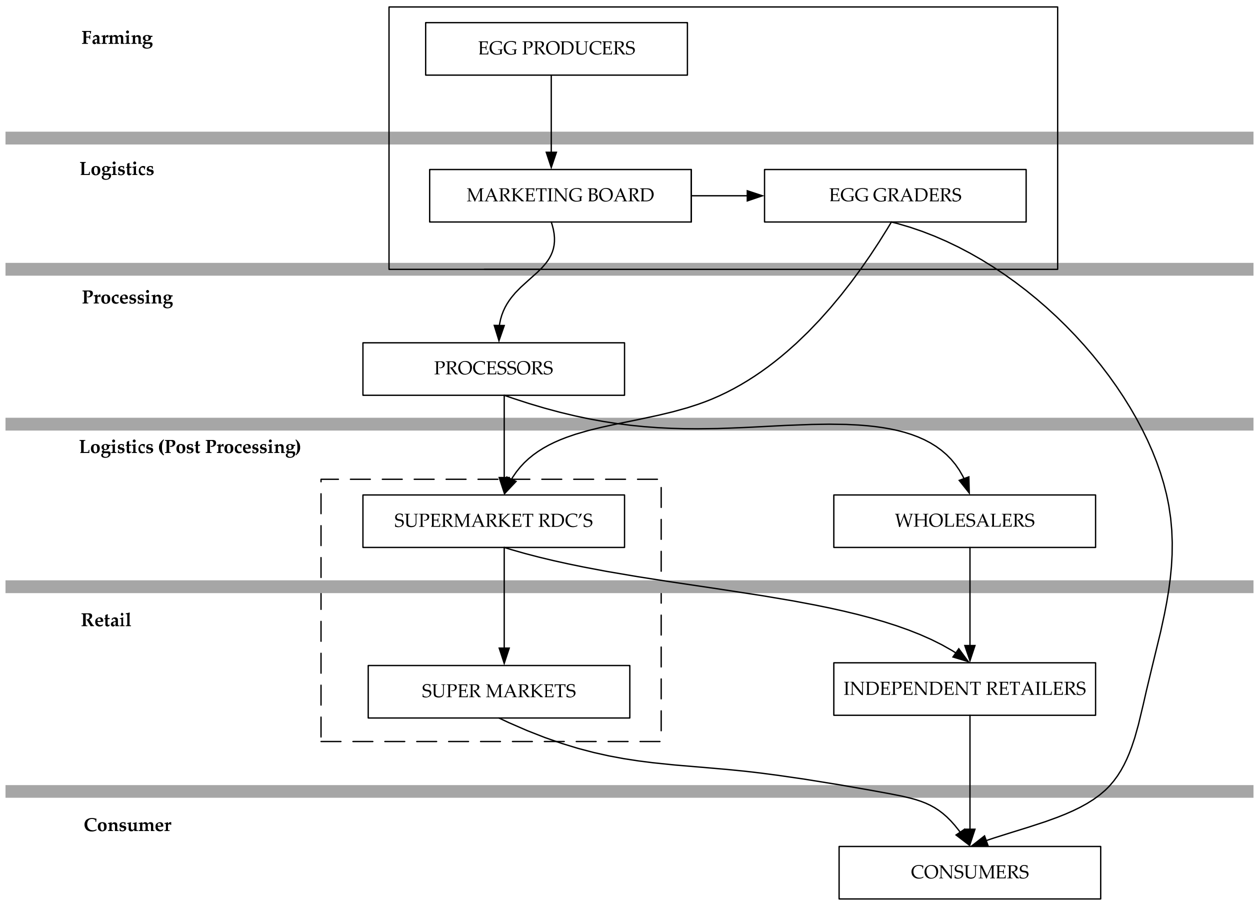
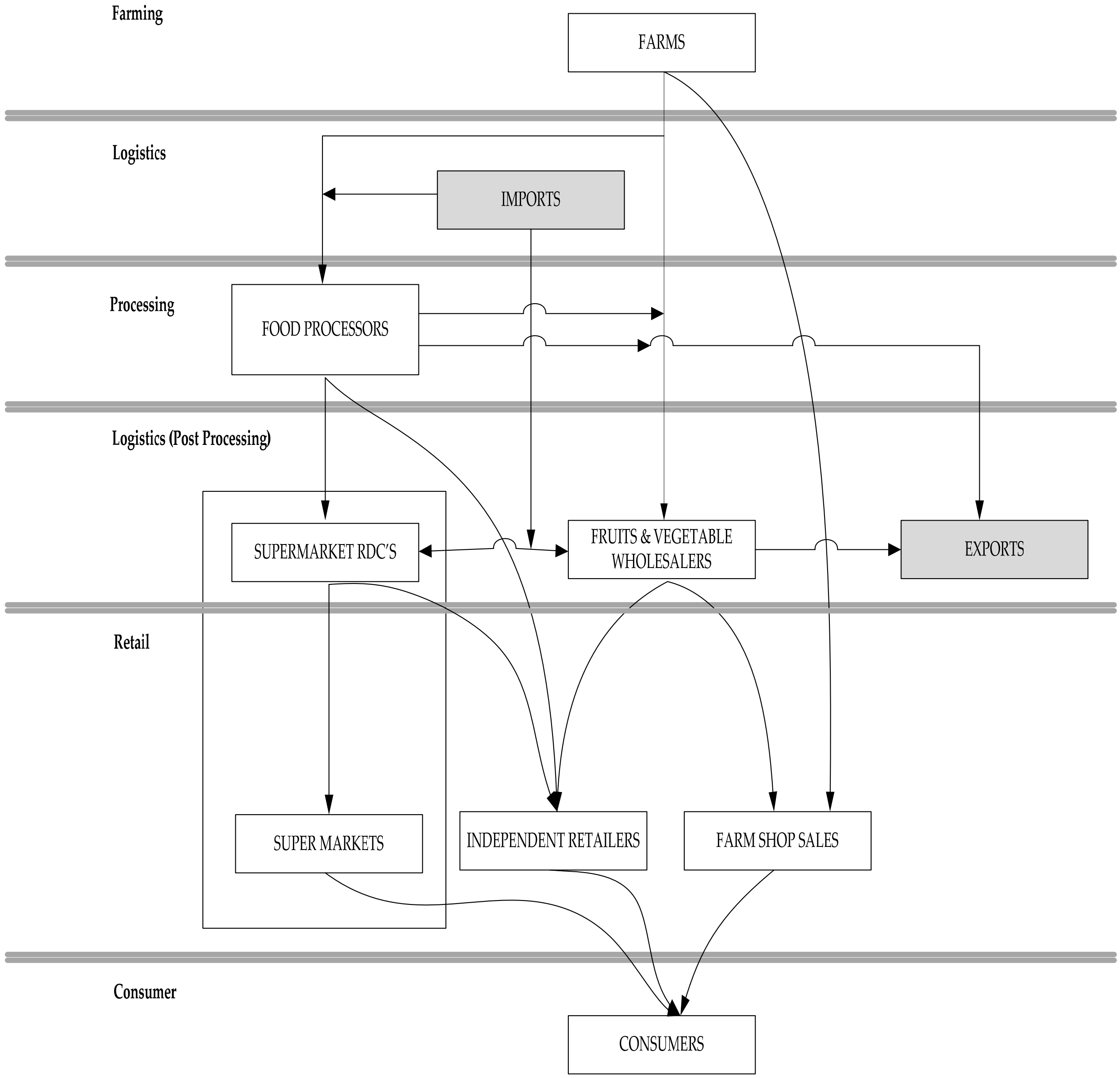
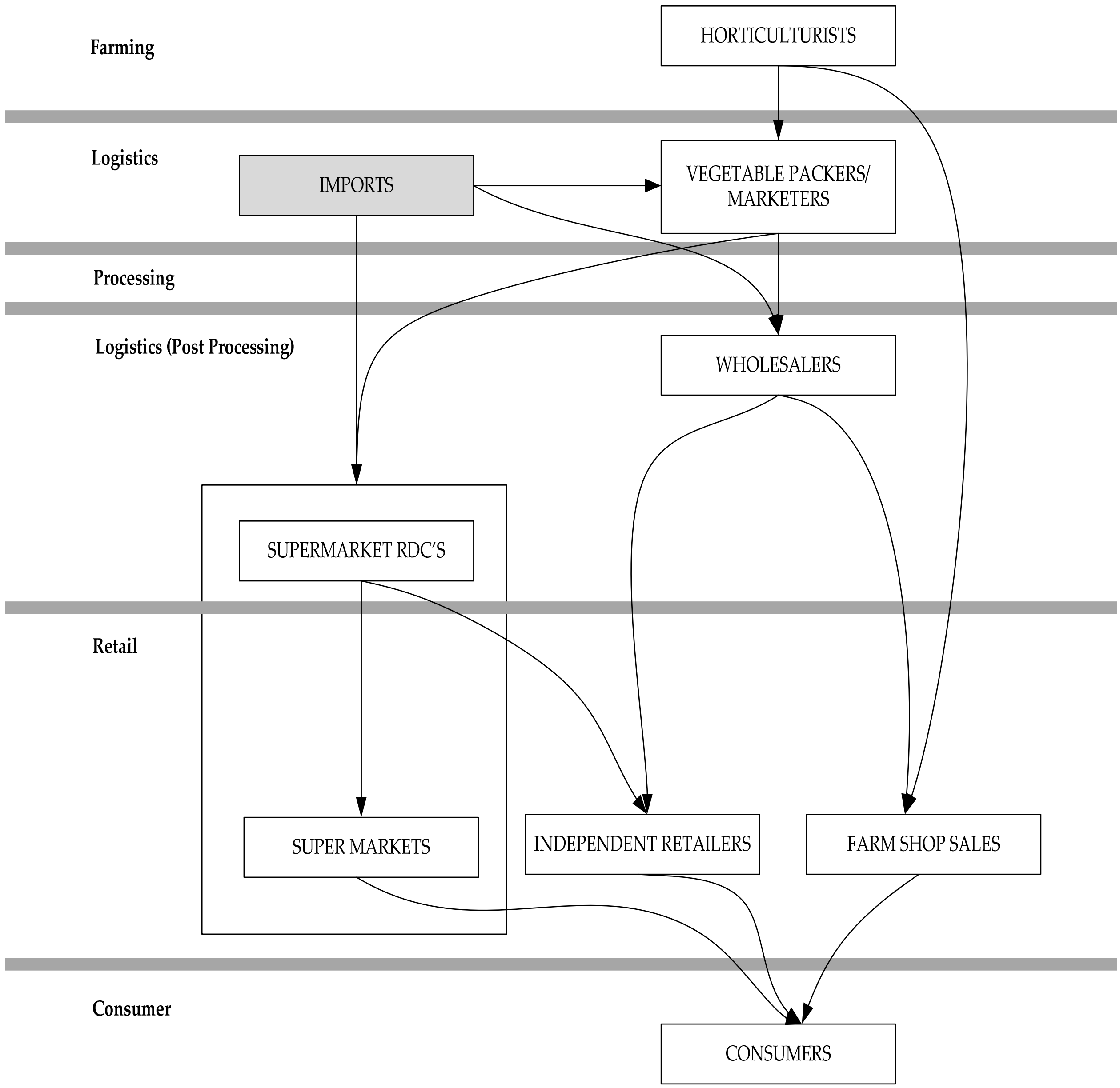


Figure 2.9: Starchy[47] Vegetable Food Supply Chain



[47] Starchy vegetables are such as potatoes, beets, carrots, rutabagas and parsnips.

Figure 2.10: Non-Starchy[48] Vegetables Food Supply Chain



[48] Non starchy vegetables are vegetables such as lettuce, spinach, chard and fresh peas where the nutrient portion generally grows above ground.

Figure 2.11: Drinking Water Supply Chain

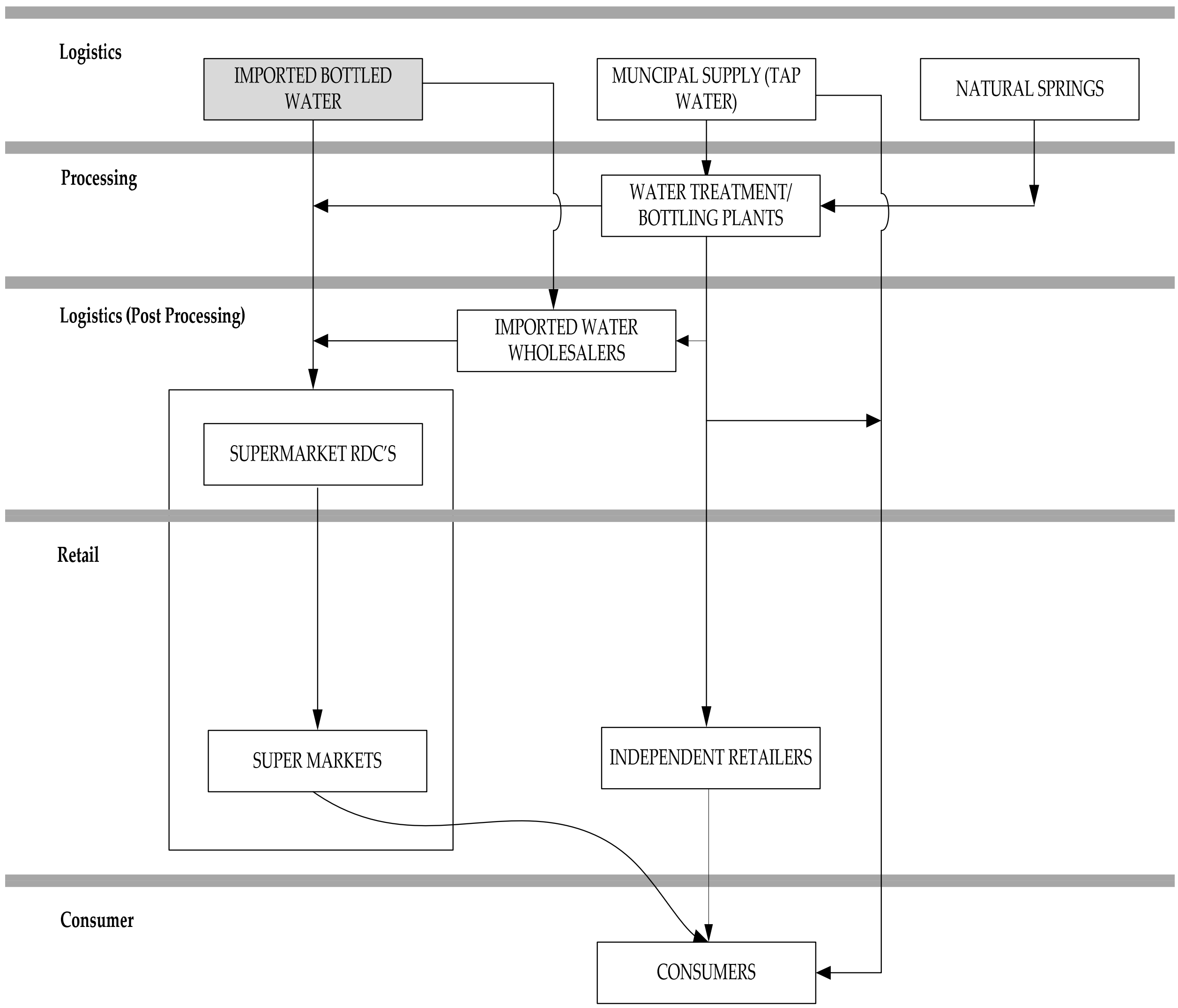
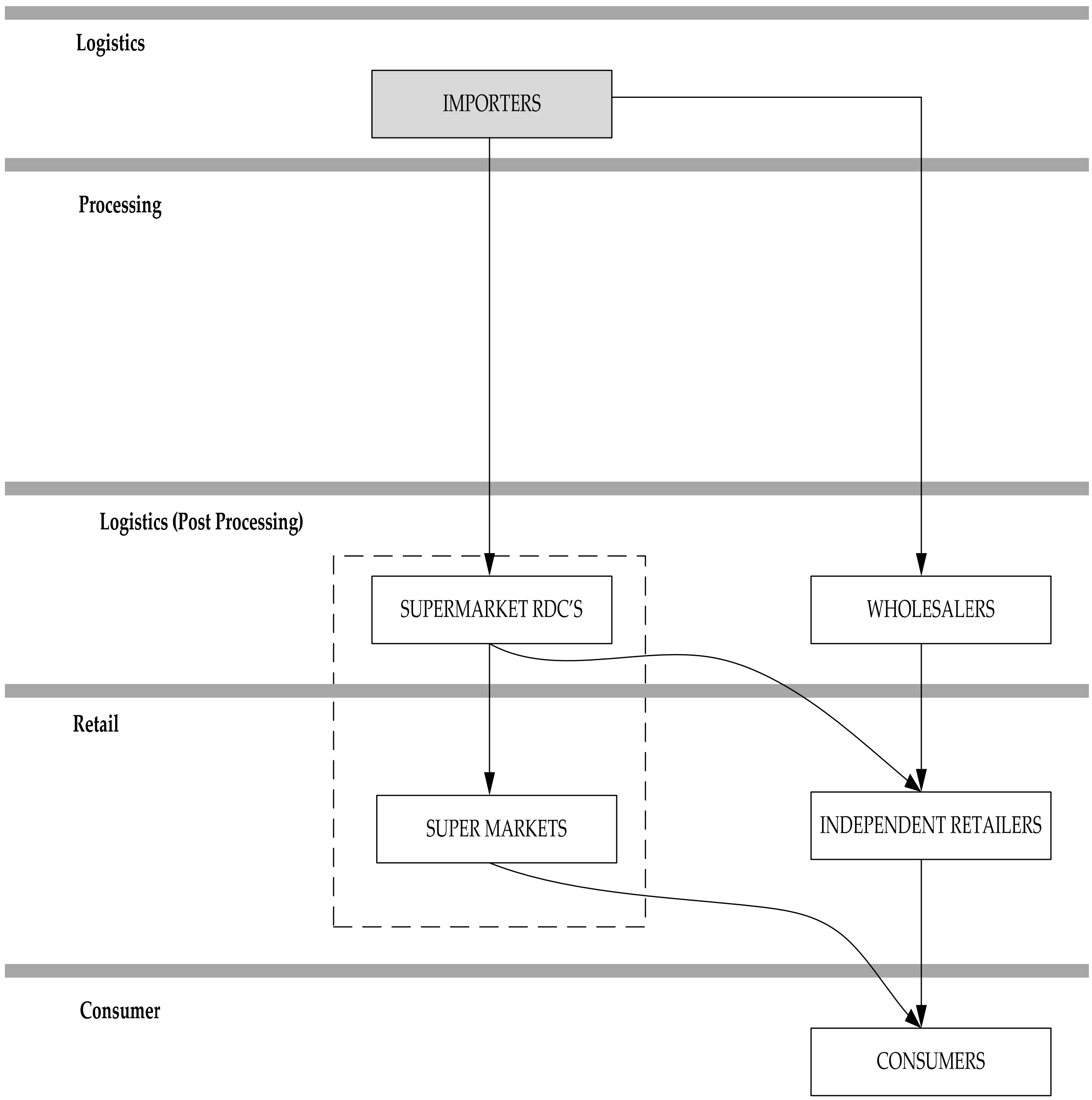


Figure 2.12: Infant Formula Food Supply Chain

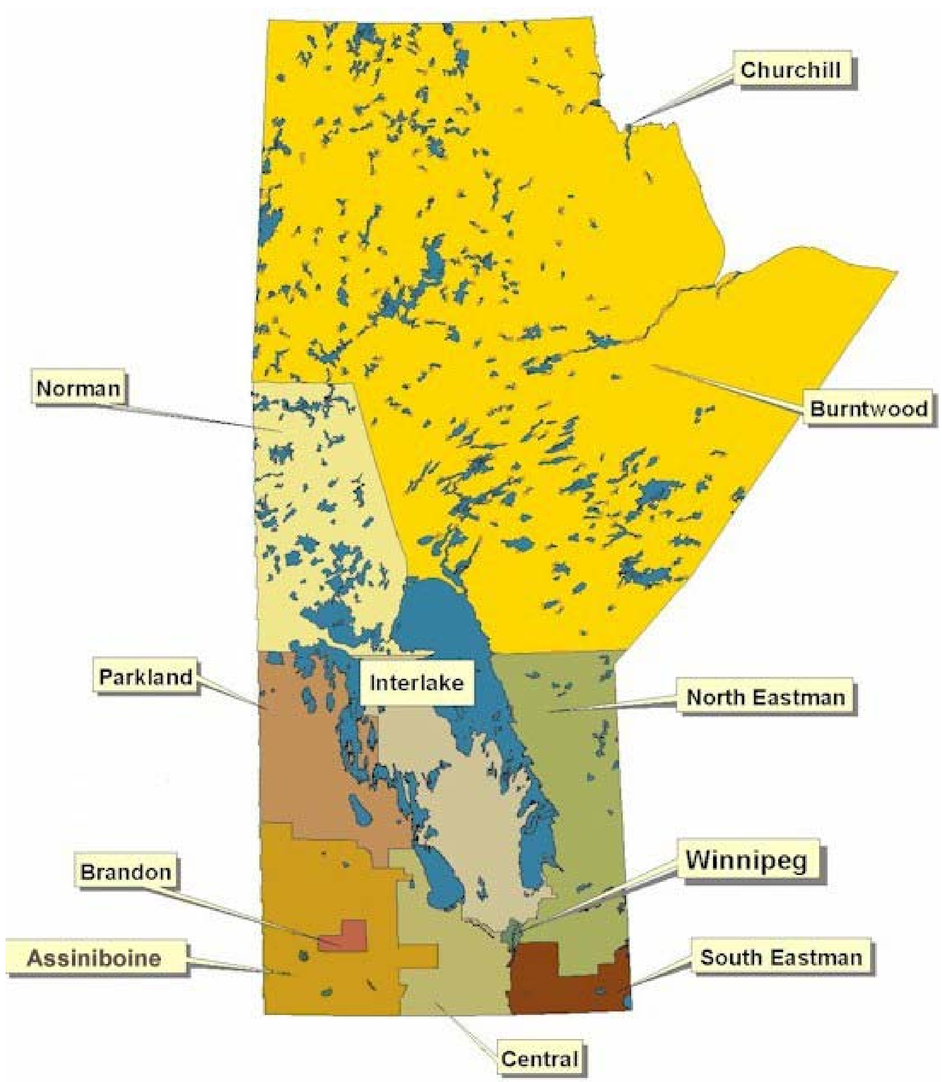


SECTION 3 : MANITOBA NUTRITIONAL REQUIREMENTS

3.1 Introduction

This section of the report assesses the nutrition requirements of Manitobans. In keeping with health planning to which nutrition is inextricably linked the analysis uses Regional Health Authorities (RHAs) as a geographic basis where sub-provincial detail is required. The eleven RHAs in Manitoba vary in geographic size and population from individual cities to entire regions of the province. Figure 3.1 displays the RHA's in Manitoba.

Figure 3.1 : Map of Manitoba's Regional Heath Authorities (RHA)



For the purpose of the pandemic plan, the *Northern* Manitoba pandemic planning area consists of the Churchill, Burntwood and Norman RHAs which can be serviced primarily through Thompson. The *Western* pandemic planning area of Manitoba consists of the Parkland, Brandon and Assiniboine RHAs. The *Capital* pandemic planning area consists of the Interlake, Winnipeg, Central, South Eastman and North Eastman RHAs.

The daily nutritional requirements of humans vary from person to person based on a number of different factors. The most common method to account for this variation is to split the population into age cohorts. In this analysis, the age cohorts used are the same as used in the Dietary Reference Intakes (DRI) published by Health Canada[49]. As this data excludes infants and pregnant and nursing females which have different nutritional requirements, further cohorts were created for these groups using Manitoba Health data. The result is a series of demographic groups as shown in Tables 3.1 through 3.3.

Table 3.1: Demographic Cohorts, Based on Age

0 – 6 Months
7 – 12 Months
1 – 3 Years
4 – 8 Years
9 – 13 Years
14 – 18 Years
19 – 30 Years
31 – 50 Years
51 – 70 Years
Over 70 Years

Table 3.2: Demographic Cohorts, Based on Age and Gender

Male	Female
0 - 6 Months	0 - 6 Months
7 – 12 Months	7 – 12 Months
1 – 3 Years	1 – 3 Years
4 – 8 Years	4 – 8 Years
9 – 13 Years	9 – 13 Years
14 – 18 Years	14 – 18 Years
19 – 30 Years	19 – 30 Years
31 – 50 Years	31 – 50 Years
51 – 70 Years	51 – 70 Years
Over 70 Years	Over 70 Years

Manitoba Health provided data related to the various populations of women who were pregnant, breast feeding, feeding with formula, using a combination of formula and breast milk, infants that were on orders of "Nothing Per Oral" (NPO), and "Unknown" feeding habits. The feeding methods used by women were collected shortly before they

[49] Health Canada. "Dietary Reference Intakes Tables." (August, 2006)
<http://www.hc-sc.gc.ca/fn-an/nutrition/reference/table/index_e.html#rvv>

left the hospital after giving birth. These populations were used to divide the female population into 3 sub-categories; Female, Pregnant, and Nursing.

Table 3.3: Female Sub-Cohorts

Female	= Female (Total Population) – Pregnant - Nursing
Pregnant	= Women who are pregnant
Nursing	= Breast Feeding + 10% Combination

In calculating the nutrition requirements of women who are nursing, 10% of the population of women who use a combination of formula and breast feeding were included along with the population that indicated they would be breast feeding. According to Manitoba Health, women who are using a "Combination" method of both breast milk and formula often switch completely to formula soon after leaving the hospital. The 10% "Combination" sample that was included in the category of "Nursing" was used to represent those women who had not transitioned to an all-formula based diet.

The populations collected for Pregnancy and Nursing were divided into the age groups of 0-18 (years), 19-30, and Over 30. These were added to the demographic age categories of 14-18 years, 19-30 years, and 31-50 years respectively.

3.2 Demographics of Manitobans: Age

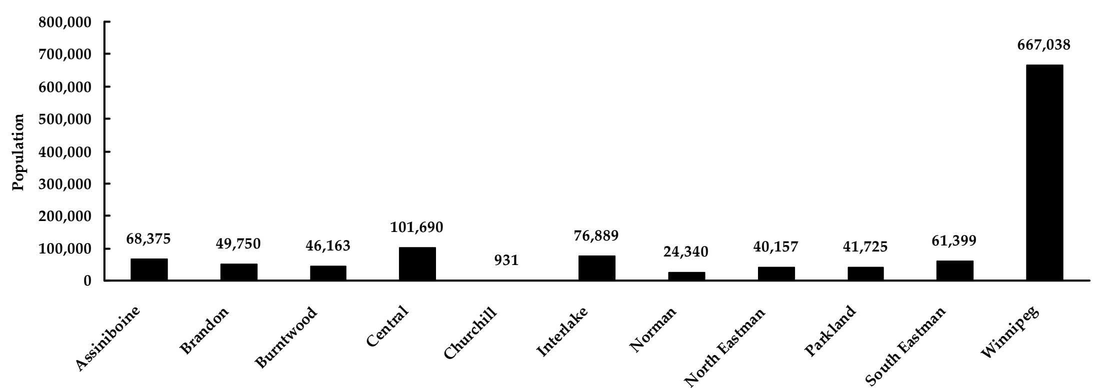
Based on data from Manitoba Health, Manitoba had a population of 1,178,457 persons as of June 2006[50]. The Winnipeg RHA has the largest population, at 667,038. The Winnipeg RHA is basically the City of Winnipeg. The next largest RHAs in terms of population are Central (101,690), Interlake (76,889), and Assiniboine (68,375). The smallest RHA is Churchill (931). The remaining six RHA's range in population from 24,340 to 61,339. The population of each RHA is listed in Table 3.4 and Figure 3.2..

[50] Manitoba Health, *RHA Age Cohort and Gender Matrix*, a custom matrix assembled by Manitoba health containing the populations of the various RHA's.

Table 3.4: Population by RHA (June 1, 2006)

Region (RHA)	Population#	% of Province
Assiniboine	68,375	5.80%
Brandon	49,750	4.22%
Burntwood	46,163	3.92%
Central	101,690	8.63%
Churchill	931	0.08%
Interlake	76,889	6.52%
Norman	24,340	2.07%
North Eastman	40,157	3.41%
Parkland	41,725	3.54%
South Eastman	61,399	5.21%
Winnipeg	667,038	56.60%
Province	**1,178,457**	
Northern	*71,434*	
Western	*159,850*	
Capital	*947,173*	

Figure 3.2: Population of Manitoba (June 1, 2006), Distributed by RHA



The distribution of demographic traits varies by region. The RHA of Burntwood has a higher concentration of "young" individuals compared to the rest of the province. Similarly, Assiniboine has a greater concentration of "older" people.

As some population segments have specific nutritional requirements (e.g. infants 0-6 months have higher fat requirements than all other demographics), the distribution of the segments is a factor in the nutritional needs of individual RHAs. However, because the distribution is fairly consistent and the population is heavily concentrated in Winnipeg, there is not a significant effect on the overall provincial nutrition requirements. The distribution of the various demographic segments amongst the various RHA's is presented in Table 3.5 and 3.6.

Table 3.5: Population by Age Cohort by RHA - Up to Age 14

	0 - 6 Months	**% of Prov. Popn.**	**7 – 12 Months**	**% of Prov. Popn.**	**1 - 3 Years**	**% of Prov. Popn.**	**4 – 8 Years**	**% of Prov. Popn.**	**9 – 13 Years**	**% of Prov. Popn.**	**Province Popn.**
Assiniboine	393	0.57%	350	0.51%	2,141	3.13%	3,943	5.77%	4,646	6.79%	68,375
Brandon	347	0.70%	324	0.65%	1,899	3.82%	2,932	5.89%	3,115	6.26%	49,750
Burntwood	562	1.22%	586	1.27%	3,159	6.84%	5,026	10.89%	5,131	11.11%	46,163
Central	727	0.71%	719	0.71%	4,537	4.46%	7,719	7.59%	8,249	8.11%	101,690
Churchill	11	1.18%	9	0.97%	46	4.94%	65	6.98%	78	8.38%	931
Interlake	428	0.56%	405	0.53%	2,479	3.22%	4,588	5.97%	5,675	7.38%	76,889
Norman	184	0.76%	207	0.85%	1,246	5.12%	2,104	8.64%	2,138	8.78%	24,340
North Eastman	242	0.60%	200	0.50%	1,432	3.57%	2,635	6.56%	3,120	7.77%	40,157
Parkland	241	0.58%	271	0.65%	1,479	3.54%	2,671	6.40%	2,860	6.85%	41,725
South Eastman	405	0.66%	465	0.76%	2,704	4.40%	4,846	7.89%	5,228	8.51%	61,399
Winnipeg	3,573	0.54%	3,681	0.55%	21,377	3.20%	37,750	5.66%	42,326	6.35%	667,038
Province	**7,113**	**0.60%**	**7,217**	**0.61%**	**42,499**	**3.61%**	**74,279**	**6.30%**	**82,566**	**7.01%**	**1,178,457**
Northern	*757*	*1.06%*	*802*	*1.12%*	*4,451*	*6.23%*	*7,195*	*10.07%*	*7,347*	*10.29%*	*71,434*
Western	*981*	*0.61%*	*945*	*0.59%*	*5,519*	*3.45%*	*9,546*	*5.97%*	*10,621*	*6.64%*	*159,850*
Capital	5,375	0.57%	5,470	0.58%	32,529	3.43%	57,538	6.07%	64,598	6.82%	947,173

Table 3.6: Population by Age Cohort by RHA - Age 14 and Older

	14 – 18 Years	**% of Prov. Popn.**	**19 - 30 Years**	**% of Prov. Popn.**	**31 - 50 Years**	**% of Prov. Popn.**	**51 - 70 Years**	**% of Prov. Popn.**	**Over 70 Years**	**% of Prov. Popn.**	**Province Popn.**
Assiniboine	5,152	7.53%	9,126	13.35%	17,227	25.19%	15,967	23.35%	9,430	13.79%	68,375
Brandon	3,503	7.04%	9,460	19.02%	13,707	27.55%	9,603	19.30%	4,860	9.77%	49,750
Burntwood	4,886	10.58%	8,393	18.18%	12,222	26.48%	5,345	11.58%	853	1.85%	46,163
Central	8,426	8.29%	16,035	15.77%	27,102	26.65%	18,904	18.59%	9,272	9.12%	101,690
Churchill	60	6.44%	156	16.76%	312	33.51%	164	17.62%	30	3.22%	931
Interlake	5,862	7.62%	9,971	12.97%	21,913	28.50%	18,375	23.90%	7,193	9.36%	76,889
Norman	2,131	8.76%	3,837	15.76%	6,831	28.06%	4,443	18.25%	1,219	5.01%	24,340
North Eastman	3,154	7.85%	5,326	13.26%	11,167	27.81%	9,631	23.98%	3,250	8.09%	40,157
Parkland	3,124	7.49%	5,545	13.29%	10,405	24.94%	9,492	22.75%	5,637	13.51%	41,725
South Eastman	5,224	8.51%	10,047	16.36%	17,406	28.35%	10,874	17.71%	4,200	6.84%	61,399
Winnipeg	44,733	6.71%	110,142	16.51%	200,170	30.01%	138,302	20.73%	64,984	9.74%	667,038
Province	**86,255**	**7.32%**	**188,038**	**15.96%**	**338,462**	**28.72%**	**241,100**	**20.46%**	**110,928**	**9.41%**	**1,178,457**
Northern	*7,077*	*9.91%*	*12,386*	*17.34%*	*19,365*	*27.11%*	*9,952*	*13.93%*	*2,102*	*2.94%*	*71,434*
Western	*11,779*	*7.37%*	*24,131*	*15.10%*	*41,339*	*25.86%*	*35,062*	*21.93%*	*19,927*	*12.47%*	*159,850*
Capital	44,733	6.71%	110,142	16.51%	200,170	30.01%	138,302	20.73%	64,984	9.74%	667,038

The largest age cohort in Manitoba is the 31-50 Years stratum, with 338,462 people (28.72% of the provincial population). This is followed by 51-70 Years (241,100; 20.46%)

and 19-30 Years (188,038; 15.96%). Infants (12 months or less) make up about 1.2% of the Manitoba population. The concentration of infants as a share of the population is higher in northern Manitoba than elsewhere in the province. In Burntwood 2.49% of the population are infants. In Churchill 2.05% of the population are infants, while in Norman infants are 1.61% of the provincial population.

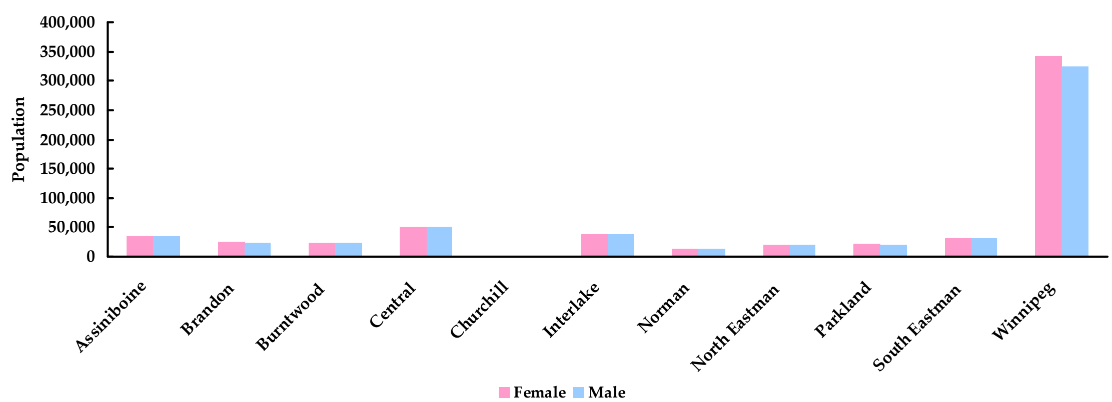
3.3 Demographics of Manitobans: Gender

Within Manitoba, the provincial population is distributed fairly equally between males and females in all RHA's. Overall, approximately 50.7% of the population is female, while the remaining 49.3% is male. The largest gender gap occurs in Brandon, where approximately 52.1% of the population is female and 47.9% is male. The summary of gender split of the population by RHA is shown in Table 3.7 and Figure 3.3.

Table 3.7: Population by RHA, by Gender

RHA	Female	% of Popn.	Male	% of Popn.	Province
Assiniboine	34,352	50.2%	34,023	49.8%	68,375
Brandon	25,896	52.1%	23,854	47.9%	49,750
Burntwood	22,627	49.0%	23,536	51.0%	46,163
Central	50,721	49.9%	50,969	50.1%	101,690
Churchill	455	48.9%	476	51.1%	931
Interlake	38,067	49.5%	38,822	50.5%	76,889
Norman	12,038	49.5%	12,302	50.5%	24,340
North Eastman	19,711	49.1%	20,446	50.9%	40,157
Parkland	20,919	50.1%	20,806	49.9%	41,725
South Eastman	30,375	49.5%	31,024	50.5%	61,399
Winnipeg	342,307	51.3%	324,731	48.7%	667,038
Province	**597,468**	**50.7%**	**580,989**	**49.3%**	**1,178,457**
Northern	*35,120*	*49.16%*	*36,314*	*50.84%*	*71,434*
Western	*81,167*	*50.78%*	*78,683*	*49.22%*	*159,850*
Capital	*481,181*	*50.80%*	*465,992*	*49.20%*	*947,173*

Figure 3.3: Population of Manitoba (June 1, 2006), Grouped by Gender

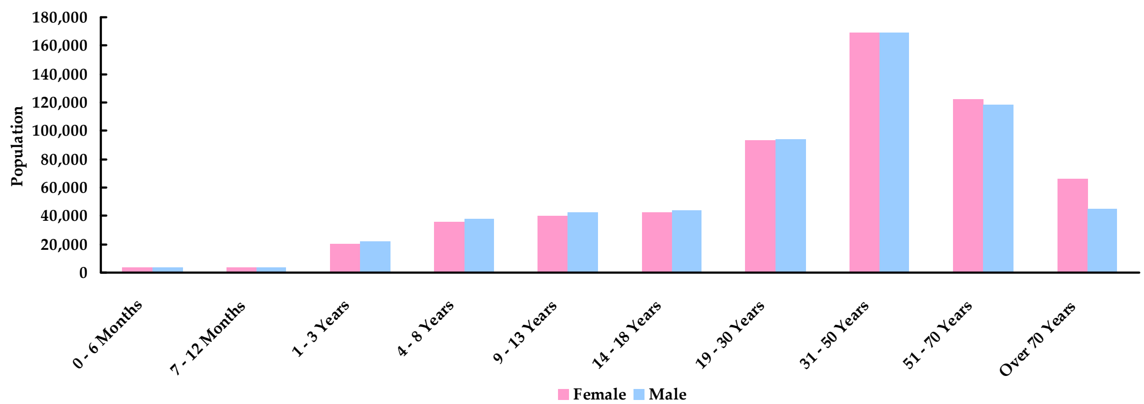


The distribution of males and females is fairly equal throughout the different age cohorts as shown in Table 3.8 and Figure 3.4. The exception is within the cohort "Over 70 Years". The prior cohort (51-70 Years) is fairly evenly distributed between 50.7% females and 49.3% males. This changes in the cohort of Over 70 years, which shifts to 59.5% female and 40.5% male.

Table 3.8: Population by Age and Gender

Age	Female	% of Age Stratum's Popn.	Male	% of Age Stratum's Popn.	Province
0 – 6 Months	3,471	48.8%	3,642	51.2%	7,113
7 – 12 Months	3,526	48.9%	3,691	51.1%	7,217
1 – 3 Years	20,770	48.9%	21,729	51.1%	42,499
4 – 8 Years	36,073	48.6%	38,206	51.4%	74,279
9 - 13 Years	40,316	48.8%	42,250	51.2%	82,566
14 – 18 Years	42,274	49.0%	43,981	51.0%	86,255
19 – 30 Years	93,695	49.8%	94,343	50.2%	188,038
31 – 50 Years	169,052	49.9%	169,410	50.1%	338,462
51 – 70 Years	122,247	50.7%	118,853	49.3%	241,100
Over 70 Years	66,044	59.5%	44,884	40.5%	110,928
Province	**597,468**	**50.7%**	**580,989**	**49.3%**	**1,178,457**

Figure 3.4: Population of Manitoba (June 1, 2006), Grouped by Age



3.4 Demographics of Manitobans: Pregnant/Nursing Females

The percentage of women who are either pregnant or nursing within Manitoba is quite small (about 4.1% of the female population). The RHA distributions of females who are either pregnant, nursing, or neither pregnant or nursing is presented in Table 3.9.

Table 3.9: Female Sub-Cohorts by RHA

RHA	Female (Neither)	% of Prov. Popn.	Pregnant	% of Prov. Popn.	Nursing	% of Prov. Popn.	Province
Assiniboine	33,158	96.5%	787	2.3%	407	1.2%	34,352
Brandon	24,606	95.0%	877	3.4%	413	1.6%	25,896
Burntwood	20,902	92.4%	1,505	6.7%	220	1.0%	22,627
Central	48,128	94.9%	1,536	3.0%	1,057	2.1%	50,721
Churchill	428	94.1%	19	4.2%	8	1.8%	455
Interlake	36,701	96.4%	956	2.5%	410	1.1%	38,067
Norman	11,339	94.2%	538	4.5%	161	1.3%	12,038
North Eastman	18,957	96.2%	547	2.8%	207	1.1%	19,711
Parkland	20,138	96.3%	595	2.8%	186	0.9%	20,919
South Eastman	28,931	95.2%	886	2.9%	558	1.8%	30,375
Winnipeg	329,580	96.3%	9,109	2.7%	3,618	1.1%	342,307
Province	**572,868**	**95.9%**	**17,355**	**2.9%**	**7,245**	**1.2%**	**597,468**
Northern	*32,669*	*93.02%*	*2,062*	*5.87%*	*389*	*1.11%*	*35,120*
Western	*77,902*	*95.98%*	*2,259*	*2.78%*	*1,006*	*1.24%*	*81,167*
Capital	*462,297*	*96.08%*	*13,034*	*2.71%*	*5,850*	*1.22%*	*481,181*

The greatest number of pregnant and nursing females are in the Capital area with 77% of the Manitoba total of 24,600. The Northern area accounts for 10% of the population of pregnant or nursing females in Manitoba. The Western area contributes the remaining 13%.

In compiling the provincial demographics, pregnancy and nursing typically only occurs within 3 age categories - 14-18 years, 19-30 years, and 31-50 years. Limiting the pregnancy or nursing group to these age categories may slightly overstate the nutrition requirements of these age cohorts since a small percentage of women outside the 14-50 age group do become pregnant. However, the population in these categories is likely to be small and the nutrition requirements would not differ greatly from their current grouping. The majority of women who are either pregnant or nursing are found in the 19-30 Years demographic (10,520 and 4,439 respectively). This is followed by the 31-50 Years demographic and the 14-18 Years demographic. The summary of females who are pregnant, nursing, or neither Pregnant or nursing ("Female") by age cohort is found in Table 3.10.

Table 3.10: Female Sub-Cohorts by Age

Demographic	Female: Neither	% of Prov. Popn.	Pregnant	% of Prov. Popn.	Nursing	% of Prov. Popn.	Province Popn.
0 - 6 Months	3,471	100.0%	0	0.0%	0	0.0%	3,471
7 - 12 Months	3,526	100.0%	0	0.0%	0	0.0%	3,526
1 - 3 Years	20,770	100.0%	0	0.0%	0	0.0%	20,770
4 - 8 Years	36,073	100.0%	0	0.0%	0	0.0%	36,073
9 - 13 Years	40,316	100.0%	0	0.0%	0	0.0%	40,316
14 - 18 Years	40,699	96.3%	1,281	3.0%	294	0.7%	42,274
19 - 30 Years	78,736	84.0%	10,520	11.2%	4,439	4.7%	93,695
31 - 50 Years	160,986	95.2%	5,554	3.3%	2,512	1.5%	169,052
51 - 70 Years	122,247	100.0%	0	0.0%	0	0.0%	122,247
Over 70 Years	66,044	100.0%	0	0.0%	0	0.0%	66,044
Province	**572,868**	**95.9%**	**17,355**	**2.9%**	**7,245**	**1.2%**	**597,468**

3.5 Nutrition Requirements

In calculating the nutrition requirements for Manitobans, sixteen different nutritional components were evaluated. This included four nutrients categories, (protein, carbohydrates, fibre, and fat), five minerals, (calcium, iron, zinc, sodium, and potassium), and seven vitamins, (vitamin A, vitamin C, vitamin B6, folate, thiamin, riboflavin, and niacin). Nutritional requirement vectors were created based on the daily nutritional requirements of the various demographic cohorts described previously, based on the daily requirements of the Dietary Reference Tables produced by Health Canada (Please see Appendix A for a listing of the nutrition requirement vectors),[51] coupled with the population of the applicable demographic cohorts in each RHA.

[51] Health Canada. "Dietary Reference Intakes Tables." (August, 2006) <http://www.hc-sc.gc.ca/fn-an/nutrition/reference/table/index_e.html#rvv>

Based on these calculations, the total daily nutritional need of Manitoba residents is shown in Table 3.11.

Table 3.11: Total Daily Nutritional Requirements for the Province [52]

Nutrient/Mineral/Vitamin	Total Provincial Daily Requirement
Protein	54,449 (kg)
Carbohydrates (Carbs)	153,809 (kg)
Fibre	33,428 (kg)
Fat	35,361 (kg)
Calcium	1,252,516 (g)
Iron	12,652 (g)
Zinc	10,451 (g)
Sodium	1,624,683 (g)
Potassium	5,326,579 (g)
Vitamin A	2,907,270,841 (IU)
Vitamin C	85,989 (g)
Vitamin B6	1,520 (g)
Folate	437 (g)
Thiamin	1,255 (g)
Riboflavin	1,305 (g)
Niacin	16,424,171 (NE)

In assembling the total nutritional requirements, the units of measurement of the nutrients, minerals, and vitamins were converted into larger units of measurement for ease (grams became kilograms, milligrams and micrograms became grams, etc.). Two of the vitamins are measured in unique units. Vitamin A is measured in International Units (IU), which are used to measure select nutrients and vitamins based on biological effect, rather than by nutrient/vitamin weight. Niacin is measured in units of "Niacin Equivalents" (NE). In addition to receiving niacin directly from niacin rich products, the body can also synthesize niacin from Tryptophan.[53] Because of this, niacin intakes can be made up of both "pure" and "synthesized" sources. The daily requirement for niacin is measured in NE, in which 1 NE = 1 mg niacin or 60 mg Tryptophan. (For more information regarding the function and sourcing of vitamins and minerals, please see Appendix B)

Generally the nutritional needs are influenced more by overall total population, rather than by the distribution of the population. That's not to say that the nutritional requirements can be based solely on the total population, as there are some deviations in the distribution by RHA and gender. The daily nutritional requirements of each RHA have been displayed in Tables 3.12 through 3.14.

[52] The calculations in this section are based on Manitoba Health population data as of June 1, 2006.
[53] Mann, Jim., Truswell, A. Stewart. *Essentials of Human Nutrition*. 3rd ed. New York: Oxford University Press, 2007 (page 188)

Table 3.12: Total Daily Nutrient Requirements by RHA

Nutrients	Protein (kg)	Carbs (kg)	Fibre (kg)	Fat (kg)
Assiniboine	3,186	8,917	1,922	2,052
Brandon	2,305	6,504	1,406	1,493
Burntwood	1,976	6,027	1,312	1,385
Central	4,612	13,297	2,879	3,051
Churchill	42	121	27	28
Interlake	3,574	10,027	2,181	2,307
Norman	1,088	3,181	691	730
North Eastman	1,853	5,238	1,140	1,205
Parkland	1,928	5,440	1,170	1,252
South Eastman	2,777	8,022	1,753	1,842
Winnipeg	31,108	87,035	18,947	20,015
Province	**54,449**	**153,809**	**33,428**	**35,361**
Northern	*3,106*	*9,329*	*2,030*	*2,143*
Western	*7,419*	*20,861*	*4,498*	*4,797*
Capital	*43,924*	*123,619*	*26,900*	*28,420*

Based on nutrition requirements, the greatest need for nutrition on a kilogram basis is carbohydrates.

Table 3.13: Total Daily Mineral Requirements by RHA

Minerals	Calcium (g)	Iron (g)	Zinc (g)	Sodium (g)	Potassium (g)
Assiniboine	73,969	709	611	93,349	310,318
Brandon	52,581	542	441	68,572	224,712
Burntwood	46,951	512	388	63,395	201,374
Central	107,416	1,081	891	139,573	456,054
Churchill	960	10	8	1,287	4,143
Interlake	82,673	810	687	105,836	348,603
Norman	25,413	265	211	33,514	108,404
North Eastman	43,035	423	357	55,268	181,550
Parkland	44,884	435	370	56,818	188,571
South Eastman	64,569	660	538	84,774	275,193
Winnipeg	710,065	7,205	5,947	922,298	3,027,657
Province	**1,252,516**	**12,652**	**10,451**	**1,624,683**	**5,326,579**
Northern	*73,324*	*787*	*607*	*98,196*	*313,921*
Western	*171,434*	*1,686*	*1,422*	*218,739*	*723,601*
Capital	*1,007,758*	*10,179*	*8,420*	*1,307,749*	*4,289,057*

Potassium, sodium, and calcium are the minerals with the greatest requirement throughout Manitoba (5,326,579 g, 1,624,683 g, and 1,252,516 g respectively)

Table 3.14: Total Daily Vitamin Requirements by RHA

Vitamins	Vitamin A (IU)	Vitamin C (g)	Vitamin B6 (g)	Folate (g)	Thiamin (g)	Riboflavin (g)	Niacin (NE)
Assiniboine	170,068,421	5,038	90	26	73	76	959,549
Brandon	122,802,191	3,647	64	19	53	55	693,819
Burntwood	106,972,320	3,063	54	16	46	48	606,982
Central	247,905,934	7,258	129	37	107	111	1,397,145
Churchill	2,265,381	67	1	0	1	1	12,740
Interlake	190,910,524	5,641	100	29	82	86	1,077,282
Norman	58,493,362	1,702	30	9	25	26	330,799
North Eastman	99,127,153	2,920	52	15	43	44	559,651
Parkland	102,975,652	3,045	55	15	44	46	581,790
South Eastman	149,475,168	4,363	77	22	64	67	842,334
Winnipeg	1,656,274,736	49,244	868	249	716	744	9,362,080
Province	**2,907,270,841**	**85,989**	**1,520**	**437**	**1,255**	**1,305**	**16,424,171**
Northern	*167,731,063*	*4,832*	*85*	*25*	*72*	*75*	*950,521*
Western	*395,846,264*	*11,730*	*209*	*60*	*170*	*177*	*2,235,158*
Capital	*2,343,693,515*	*69,426*	*1,226*	*352*	*1,012*	*1,052*	*13,238,492*

Tables 3.15 through 3.17 show nutritional requirements by gender.

Table 3.15: Total Daily Nutrient Requirements for Manitoba, by Male, Female, Pregnant and Nursing

Nutrient	Protein (kg)	Carbs (kg)	Fibre (kg)	Fat (kg)
Total Male	28,745	75,144	19,334	17,433
Total Female	23,957	74,106	13,398	17,190
Total Pregnant	1,232	3,037	486	521
Total Nursing	514	1,521	210	217
Total Daily Nutritional Requirement	**54,449**	**153,809**	**33,428**	**35,361**

Table 3.16: Total Daily Mineral Requirements for Manitoba,
by Male, Female, Pregnant and Nursing

Mineral	Calcium (g)	Iron (g)	Zinc (g)	Sodium (g)	Potassium (g)
Total Male	615,528	4,817	5,799	802,725	2,620,449
Total Female	611,915	7,300	4,373	785,058	2,587,612
Total Pregnant	17,739	469	192	26,033	81,569
Total Nursing	7,333	65	87	10,868	36,950
Total Daily Nutritional Requirement	**1,252,516**	**12,652**	**10,451**	**1,624,683**	**5,326,579**

Table 3.17: Total Daily Vitamin Requirements for Manitoba,
by Male, Female, Pregnant and Nursing

Vitamin	Vitamin A (IU)	Vitamin C (g)	Vitamin B6 (g)	Folate (g)	Thiamin (g)	Riboflavin (g)	Niacin (NE)
Total Male	1,582,578,281	45,285	756	213	639	687	8,508,606
Total Female	1,253,497,090	38,089	717	210	582	582	7,480,010
Total Pregnancy	44,464,458	1,469	33	10	24	24	312,390
Total Nursing	31,294,683	868	14	4	10	12	123,165
Total Daily Nutritional Requirement	**2,911,834,512**	**85,711**	**1,520**	**437**	**1,255**	**1,305**	**16,424,171**

As shown in tables 3.15 through 3.17[54], different genders have different nutritional needs. For example males have a greater need for protein and fibre than females, while females have a greater need for iron. Similarly, the need for zinc is greater among males, though not at the same proportion as iron is for females. The need for the remaining minerals, calcium, sodium, and potassium, is roughly proportional to the population of each sub-category. Overall, the daily requirement of vitamins is greater for males than females. Proportionally, there is an increase in the need of vitamin B6 and folate by pregnant females.

Overall, the population of Manitoban males has the greatest total need for nutrients. However, females who are either pregnant or nursing have the greatest daily need for most nutrients, minerals, and vitamins on an individual basis.

Tables 3.18 through 3.23 provide information on nutrition requirements on an overall basis by age stratum. When comparing the various cohorts by age, the nutritional needs are almost always greater as age increases. This is due to two reasons. First, the populations of the older cohorts are much larger due to their greater age bracket (e.g.

[54] The individual nutritional requirements are provided in the Appendix C.

compare the populations of 0-6 months to 19-30 years). Secondly, the individual nutrition requirements are often greater among teenagers and adults. The exceptions are found in nutritional components that contribute to growth and reproduction. The need for "growth" components is often greater during adolescence, while the need for nutritional components involved in reproductive functions often decreases in older cohorts.

Table 3.18: Total Daily Nutrient Requirements for Manitoban Males by Age Cohort

Nutrient	**Protein (kg)**	**Carbs (kg)**	**Fibre (kg)**	**Fat (kg)**
0 - 6 Months	33	219	23	113
7 - 12 Months	41	351	28	111
1 - 3 Years	282	2,825	413	652
4 - 8 Years	726	4,967	955	1,146
9 - 13 Years	1,437	5,493	1,310	1,268
14 - 18 Years	2,287	5,718	1,671	1,319
19 - 30 Years	5,283	12,265	3,585	2,830
31 - 50 Years	9,487	22,023	6,438	5,082
51 - 70 Years	6,656	15,451	3,566	3,566
Over 70 Years	2,514	5,835	1,347	1,347
Province	**28,745**	**75,144**	**19,334**	**17,433**

The total need for nutrients by Manitoba males is greatest among the cohort of 31-50 Years. The decrease in need in the older cohorts is due to the decrease in population.

Table 3.19: Total Daily Mineral Requirements for Manitoban Males by Age Cohort

Mineral	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**	**Potassium (g)**
0 - 6 Months	765	1	7	437	1,457
7 - 12 Months	997	41	11	1,366	2,584
1 - 3 Years	10,865	152	65	21,729	65,187
4 - 8 Years	30,565	382	191	45,847	145,183
9 - 13 Years	54,925	338	338	63,375	190,125
14 - 18 Years	57,175	484	484	65,972	206,711
19 - 30 Years	94,343	755	1,038	141,515	443,412
31 - 50 Years	169,410	1,355	1,864	254,115	796,227
51 - 70 Years	142,624	951	1,307	154,509	558,609
Over 70 Years	53,861	359	494	53,861	210,955
Province	**615,528**	**4,817**	**5,799**	**802,725**	**2,620,449**

Among mineral requirements for Manitoba males, there is a relatively large increase in the need for iron among 4-8 year olds. As well, approximately half of the nutritional need for zinc by Manitoba males, is based on the requirements of the 19-30 Years and 31-50 Years cohorts.

Table 3.20: Total Daily Vitamin Requirements for Manitoban Males by Age Cohort

Vitamin	Vitamin A (IU)	Vitamin C (g)	Vitamin B6 (g)	Folate (g)	Thiamin (g)	Riboflavin (g)	Niacin (NE)
0 - 6 Months	4,854,786	146	0.4	0.2	1	1	7,284
7 - 12 Months	6,152,897	185	1	0.3	1	1	14,764
1 - 3 Years	21,729,000	326	11	3	11	11	130,374
4 - 8 Years	50,928,598	955	23	8	23	23	305,648
9 - 13 Years	84,500,000	1,901	42	13	38	38	507,000
14 - 18 Years	131,943,000	3,299	57	18	53	57	703,696
19 - 30 Years	283,029,000	8,491	123	38	113	123	1,509,488
31 - 50 Years	508,230,000	15,247	220	68	203	220	2,710,560
51 - 70 Years	356,559,000	10,697	202	48	143	155	1,901,648
Over 70 Years	134,652,000	4,040	76	18	54	58	718,144
Province	**1,582,578,281**	**45,285**	**756**	**213**	**639**	**687**	**8,508,606**

Table 3.21: Total Daily Nutrient Requirements for Manitoban Females by Age Cohort

Nutrient	Protein (kg)	Carbs (kg)	Fibre (kg)	Fat (kg)
0 - 6 Months	32	208	22	108
7 - 12 Months	39	335	26	106
1 - 3 Years	270	2,700	395	623
4 - 8 Years	685	4,689	902	1,082
9 - 13 Years	1,371	5,241	1,048	1,209
14 - 18 Years	1,872	5,291	1,058	1,221
19 - 30 Years	3,622	10,236	1,968	2,362
31 - 50 Years	7,405	20,928	4,025	4,830
51 - 70 Years	5,623	15,892	2,567	3,667
Over 70 Years	3,038	8,586	1,387	1,981
Province	**23,957**	**74,106**	**13,398**	**17,190**

The majority of the Female nutrient requirements in the "older" cohorts (14-18 through Over 70) follows the population distribution of these cohorts. The exception is the need for fibre, as fibre requirements decrease with age.

Table 3.22: Total Daily Mineral Requirements for Manitoban Females by Age Cohort

Mineral	Calcium (g)	Iron (g)	Zinc (g)	Sodium (g)	Potassium (g)
0 - 6 Months	729	1	7	417	1,388
7 - 12 Months	952	39	11	1,305	2,468
1 - 3 Years	10,385	145	62	20,770	62,310
4 - 8 Years	28,858	361	180	43,288	137,077
9 - 13 Years	52,411	323	323	60,474	181,422
14 - 18 Years	52,909	610	366	61,049	191,285
19 - 30 Years	78,736	1,417	630	118,104	370,059
31 - 50 Years	160,986	2,898	1,288	241,479	756,634
51 - 70 Years	146,696	978	978	158,921	574,561
Over 70 Years	79,253	528	528	79,253	310,407
Province	**611,915**	**7,300**	**4,373**	**785,058**	**2,587,612**

Among the daily mineral requirements for females, there is a sharp spike in the need for calcium once past the age of 9.

Table 3.23: Total Daily Vitamin Requirements for Manitoban Females by Age Cohort

Vitamin	Vitamin A (IU)	Vitamin C (g)	Vitamin B6 (g)	Folate (g)	Thiamin (g)	Riboflavin (g)	Niacin (NE)
0 - 6 Months	4,626,843	139	0.3	0.2	1	1	6,942
7 - 12 Months	5,877,842	176	1	0.3	1	1	14,104
1 - 3 Years	20,770,000	312	10	3	10	10	124,620
4 - 8 Years	48,085,309	902	22	7	22	22	288,584
9 - 13 Years	80,632,000	1,814	40	12	36	36	483,792
14 - 18 Years	94,950,767	2,645	49	16	41	41	569,786
19 - 30 Years	183,691,088	5,905	102	31	87	87	1,102,304
31 - 50 Years	375,580,338	12,074	209	64	177	177	2,253,804
51 - 70 Years	285,202,251	9,169	183	49	134	134	1,711,458
Over 70 Years	154,080,652	4,953	99	26	73	73	924,616
Province	**1,253,497,090**	**38,089**	**717**	**210**	**582**	**582**	**7,480,010**

Overall, the daily requirement of vitamins remains the same among women past 14-18 years. The fluctuations in overall needs are largely based on the populations of each cohort.

Table 3.24: Total Daily Nutrient Requirements for Pregnant Manitoban Females by Age Cohort

Nutrient	Protein (kg)	Carbs (kg)	Fibre (kg)	Fat (kg)
0 - 18 Years	91	224	36	38
19 - 30 Years	747	1,841	295	316
Over 30 Years	394	972	156	167
Province	**1,232**	**3,037**	**486**	**521**

In general, the nutrition requirements during pregnancy per female are greater than the typical male. With some exceptions, the daily nutritional requirements are the same among each of the three age cohorts. The total provincial daily nutritional requirements pregnant women largely follows the population of each demographic. (Please see Appendix C for listing of daily nutritional requirements).

Table 3.25: Total Daily Mineral Requirements for Pregnant Manitoban Females

Total Daily Mineral Requirements for Manitoban Females (Pregnant), By Demographic (June 1, 2006)					
Mineral	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**	**Potassium (g)**
0 - 18 Years	1,665	35	15	1,922	6,021
19 - 30 Years	10,520	284	116	15,780	49,444
Over 30 Years	5,554	150	61	8,331	26,104
Province	**17,739**	**469**	**192**	**26,033**	**81,569**

Proportionally, the need for calcium and zinc is greater among the cohort of 0-18 Years. However, over half of the daily mineral requirements are due to the sizable population in the 19-30 Years cohort.

Table 3.26: Total Daily Vitamin Requirements for Pregnant Manitoban Females

Total Daily Vitamin Requirements for Manitoban Females (Pregnant), By Demographic (June 1, 2006)							
Vitamin	**Vitamin A (IU)**	**Vitamin C (g)**	**Vitamin B6 (g)**	**Folate (g)**	**Thiamin (g)**	**Riboflavin (g)**	**Niacin (NE)**
0 - 18 Years	3,202,500	102	2	1	2	2	23,058
19 - 30 Years	27,004,840	894	20	6	15	15	189,360
Over 30 Years	14,257,118	472	11	3	8	8	99,972
Province	**44,464,458**	**1,469**	**33**	**10**	**24**	**24**	**312,390**

Among the cohort of 0-18 years, the need for vitamin A and vitamin C is less than that of the other two cohorts. The "small" need for vitamins is due to the small population of pregnancies, rather than a lower individual nutrition requirement. On an individual basis, the requirement for vitamins is much greater than that of females who are not pregnant.

Table 3.27: Total Daily Nutrient Requirements for Nursing Manitoban

Nutrient	Protein (kg)	Carbs (kg)	Fibre (kg)	Fat (kg)
0 - 18 Years	21	62	9	9
19 - 30 Years	315	932	129	133
Over 30 Years	178	528	73	75
Province	**514**	**1,521**	**210**	**217**

The daily need for carbohydrates is greatest among females who are nursing.

Table 3.28: Total Daily Mineral Requirements for Nursing Manitoban Females

Mineral	Calcium (g)	Iron (g)	Zinc (g)	Sodium (g)	Potassium (g)
0 - 18 Years	382	3	4	441	1,499
19 – 30 Years	4,439	40	53	6,659	22,639
Over 30 Years	2,512	23	30	3,768	12,811
Province	**7,333**	**65**	**87**	**10,868**	**36,950**

Proportionally the need for minerals is greater among nursing females in the 0-18 years cohort. Overall, the 19-30 years cohort has the highest need of minerals among the nursing cohorts. This is due to the large difference in population sizes.

Table 3.29: Total Daily Vitamin Requirements for Nursing Manitoban Females

Vitamin	Vitamin A (IU)	Vitamin C (g)	Vitamin B6 (g)	Folate (g)	Thiamin (g)	Riboflavin (g)	Niacin (NE)
0 - 18 Years	1,176,000	34	1	0.1	0.4	0.5	4,998
19 - 30 Years	19,234,187	533	9	2	6	7	75,463
Over 30 Years	10,884,496	301	5	1	4	4	42,704
Province	**31,294,683**	**868**	**14**	**4**	**10**	**12**	**123,165**

The daily requirement for vitamin A and vitamin C is greater among the cohorts of 19-30 Years and Over 30 Years. The small population of nursing females results in an extremely low requirement of folate province-wide (less than 4 grams).

SECTION 4 : NUTRITION PRODUCED IN MANITOBA

4.1 Introduction

As part of the study, information was obtained from firms with involvement in the Manitoba nutrition supply chain. The data collection involved processors, abattoirs, and some wholesaler/processors that both wholesale and process food[55]. Based on data from Manitoba Agriculture, Food and Rural Initiatives as well as data obtained from third party providers, in total 283 such firms were identified. Tables 4.1 and 4.2 present the population split by type of firm, firm size, and by RHA.

Table 4.1: Total Number of Firms in Population by Type and Size

	Firm type		
Firm size:	Processor	Abattoirs	Wholesaler/ Processor
Small	199	25	0
Medium	29	3	2
Large	19	1	0
Unique[56]	2	3	0
Province	**249**	**32**	**2**

Table 4.2: Number of Firms in Population by Type and RHA

	Firm type		
RHA:	Processor	Abattoirs	Wholesaler/ Processor
Assiniboine	42	11	0
Brandon	8	2	0
Burntwood	0	0	0
Central	55	8	0
Churchill	1	0	0
Interlake	18	2	0
Norman	2	1	0
N. Eastman	8	1	0
Parkland	11	4	0
S. Eastman	22	3	0
Winnipeg	82	0	2
Province	**249**	**32**	**2**
Northern	*3*	*1*	*0*
Western	*61*	*17*	*0*
Capital	*185*	*14*	*2*

[55] As well, firms that move, distribute and retail food were surveyed as described in Section 7.
[56] Unique firms are those firms that are large and unlike any typical firms. They can not be used to compare to other firms in weighting the data to the provincial whole.

From this population, 35 firms were selected and interviewed in person using the survey shown in Appendix D. The objective was to add depth to the data collected. The remaining firms were contacted in advance, by telephone. Of these, approximately 170[57] firms agreed to complete a survey related to their production of food and subsequently received a survey package in the mail (see Appendix E). This added breadth to the analysis. However, not all who initially agreed to complete the survey actually returned a completed document. In total, an additional 11 surveys from potential respondents in the processor, abattoir or wholesaler categories were received. The number of survey respondents by firm size is shown in Tables 4.3 and 4.4.

Table 4.3: Number of Firms Interviewed in Person by Type and Size

	Firm type		
Firm size[58]:	Processor	Abattoirs	Wholesaler/ Processor
Small	5	2	0
Medium	13	0	2
Large	9	0	0
Unique	1	3	0
Province	**28**	**5**	**2**

Table 4.4: Number of Firms Responding to the Mail Out Survey by Type and Size

	Firm type		
Firm size:	Processor	Abattoirs	Wholesaler/ Processor
Small	6	2	0
Medium	2	1	0
Large	0	0	0
Province	**8**	**3**	**0**

[57] Many of these firms were later classified into different categories. For example, many turned out to be retailers and meat shops and were changed to retailer status because they were not the initial point of production. This strategy was used to decrease the risk of double counting of production.
[58] Small firms are defined as firms with 0-14 employees, medium firms are firms with 15-50 employees and large firms have more than 51 employees.

Table 4.5 shows the total number of firms that responded by RHA.

Table 4.5: Total Firms in the Sample by Type and RHA

RHA:	Firm type: Processor	Abattoirs	Wholesaler/ Processor
Assiniboine	3	2	0
Brandon	2	1	0
Burntwood	0	0	0
Central	9	2	0
Churchill	0	0	0
Interlake	0	1	0
Norman	0	0	0
North Eastman	0	0	0
Parkland	1	1	0
South Eastman	4	1	0
Winnipeg	17	0	2
Province	**36**	**8**	**2**
Northern	*0*	*0*	*0*
Western	*6*	*4*	*0*
Capital	*30*	*4*	*2*

The in person surveys were conducted between July and November 2007. The initial recruitment for the mail out survey occurred during November 2007 with the final cut off for surveys to be received at UMTI offices on December 31, 2007.

In survey designs which are intended to proxy behavior in the general population, one challenge is to ensure the final distribution of surveys reflect that of the target group. Usually this task is accomplished by the use of strata quotas in the data collection process. However, in instances where there is a great potential for self-selection bias (as in the case of mail-out surveys), data are often weighted post-field to re-establish the intended distribution found in the target population. The particulars of the use of this process in this study are shown in Appendix F. The weights reflect the population of firms relative to the respondents to the surveys. For example, a small grain company in the Central RHA would be considered to have traits similar to those of other small companies of the same specifications. In cases were there were no survey respondents available for the weighting process, "virtual companies" were constructed with production data drawn from Statistics Canada data.

Once the survey data was extrapolated to proxy the target populations, companies production data was categorized and quantified with the ultimate objective being to produce information in a format consistent with nutrition needs as described in Section 3. This next section discusses the food and nutrition produced in Manitoba based on the weighted survey data.

4.2 Food Production in Manitoba

Respondents provided varying detail related to the types of foods produced. Post collection these were grouped into major food categories as presented in Table 4.6.

Table 4.6: Major Food Categories Produced in Manitoba

Bread and Baked Goods
Dairy Foods and Other Related Products
Fish
Pulses
Grains and Oilseeds
Potatoes
Combination Dishes
Eggs
Meat and Poultry
Fruits and Vegetables
Sweets and Sugars

These major groups will be rolled up to form more specific types of products that contribute to the overall food production in Manitoba. Table 4.7 itemizes some of the food sub-categories that were measured.

Table 4.7: Food Sub-Categories Measured

Food Category	**Sub-categories processed in Manitoba**
Bread and Baked Goods	Bread, Buns, Baked Goods, Biscuits
Dairy Foods and Other Related Products	Milk, Cheese, Powdered Dairy
Fish	Fresh Fish, Frozen Fish
Pulses	Peas, Beans, Lentils, Legumes
Grains and Oilseeds	Cereal, Seeds, Nuts, Canola Oil, Oats, Flax
Potatoes	Potatoes, Potato products
Combination Dishes	Various combination foods
Eggs	All eggs for retail and industrial use
Meat and Poultry	Beef, Pork, Lamb, Bison, Poultry
Fruits and Vegetables	Starch and Non-starch Vegetables (excluding potatoes), Fruits
Sweets and Sugars	Honey

Table 4.8 presents the extrapolated total annual food production of Manitoba processing firms by category.

Table 4.8: Total Annual Food Production in Manitoba by Category

Food Category	Amount (kg)
Bread and Baked Goods	49,300,000
Dairy Foods and Other Related Products	213,100,000
Fish	18,100,000
Pulses	305,400,000
Grains and Oilseeds	543,600,000
Potatoes	986,000,000
Combination Dishes	45,400,000
Eggs	58,500,000
Meat and Poultry	354,900,000
Fruits and Vegetables	25,800,000
Sweets and Sugars	8,400,000
Province	**2,608,700,000**

Manitoba produces approximately 2.6 billion kilograms of food annually. The largest sector, which equals nearly one billion kilograms annually, is the potato industry. The next biggest area is the grains sector, consisting of about 543 million kilograms, followed by the meat processing total of 354 million kilograms. The breakdown of products within the latter two categories, as well as in the fruits and vegetables sector, is presented in Figures 4.1 through 4.3

Figure 4.1: Distribution of Annual Grain and Oilseed Production by Weight

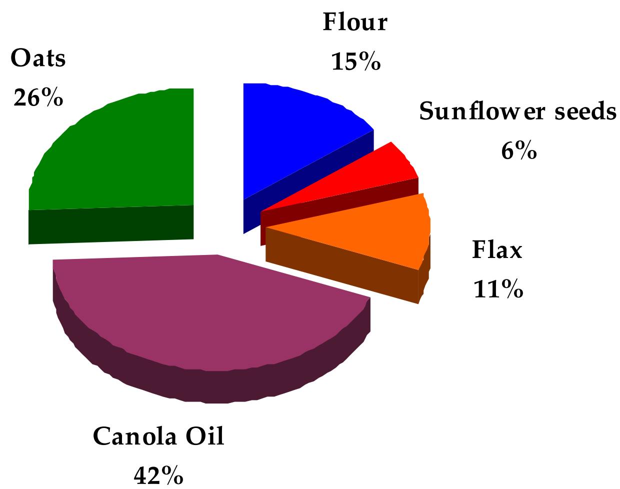
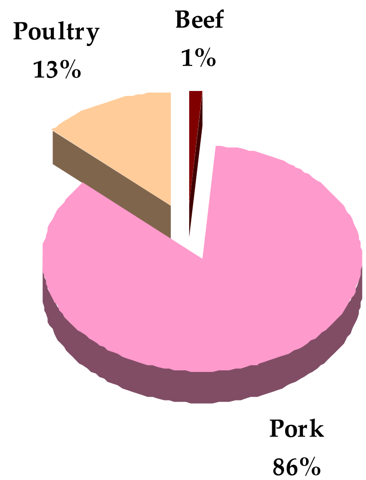


Figure 4.1 shows the breakdown of the 543 million kilograms of grain and oilseed production in the province. Items such as puffed cereal and nuts, and other various grains, have not been included because they account for less than 1% of the total annual production. As seen in the chart, canola oil accounts for 42% of the processing

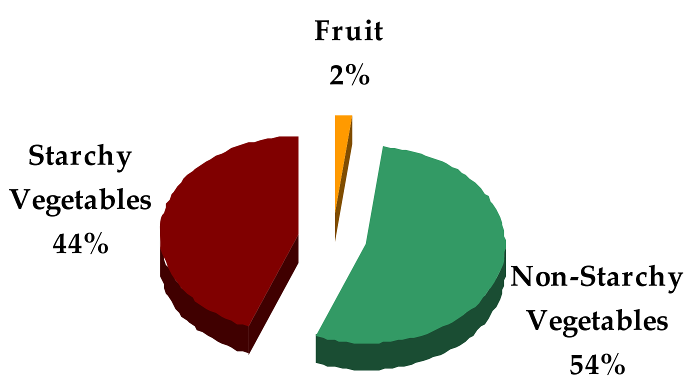
production in the grain and oilseeds sector. Oats and flour are also major contributors to grain and oilseeds processing in Manitoba.

Figure 4.2: Distribution of Annual Meat and Poultry Production



The principal meat item produced in the province is pork. Hog production accounts for 86% of all meat processing by weight. The poultry group consists of turkey, chicken, and goose production and totals 13% of the provincial meat production. Beef only accounts for 1% of the meat processed in Manitoba. As in the grain industry, there are other types of meats missing from the chart (lamb and bison for example), but are not included because they account for less than 1% of the total meat production.

Figure 4.3: Distribution of Annual Fruit and Vegetable Production



Starchy vegetables such as carrots, turnips, beets, squash, and corn and non-starchy vegetables such as cucumber, cabbage, and peppers have different nutritional profiles and consequently have been treated separately. Potatoes have not been included in the above figure, and are treated separately due to their dominance in Manitoba vegetable production. Starchy vegetables represent 44% of production, while non-starchy vegetables account for 54%. Fruit, predominantly berries, only accounts for 2% of the produce grown in the province.

4.3 Food Production in RHAs

When constructing a pandemic plan it is important to consider not only what is being produced in Manitoba, but also where it is being produced. Food processing is not evenly distributed throughout the province. While Manitoba is geographically very large, the population is mostly concentrated in the southern regions where the land is arable. Thus it is not surprising that most of the food production occurs in the southern areas of the province, particularly in the RHAs of Winnipeg, Central, Brandon, and Assiniboine.

Winnipeg is by far the most populated RHA but is not the largest region in terms of nutrition production. The Central region is the leader in food production at 1.2 billion kilograms annually. As shown in Table 4.9 the Central region constitutes nearly half of the total food production, by weight, in the province. The Assiniboine region ranks second, producing 726 million kilograms of food. Winnipeg produces 328 million kilograms of food. North Eastman and Norman[59] are the least productive areas generating 800,000 kilograms, and 859,000 kilograms, respectively.

Tables 4.9 through 4.13 show the food production by major food category for the Central, Assiniboine, Winnipeg, and South Eastman, and Brandon regions.

Table 4.9: Food Production Central RHA

Food Category	Amount (kg)
Bread and Baked Goods	0
Dairy Foods and Other Related Products	360,000
Fish	69,100,000
Pulses	0
Grains and Oilseeds	303,400,000
Potatoes	374,200,000
Combination Dishes	451,400,000
Eggs	0
Meat and Poultry	0
Fruits and Vegetables	1,300,000
Sweets and Sugars	3,500,000
RHA Total	**1,203,260,000**

[59] There is negligible processed food production in the Churchill RHA.

Table 4.10: Food Production Assiniboine RHA

Food Category	**Amount (kg)**
Bread and Baked Goods	460,000
Dairy Foods and Other Related Products	0
Fish	0
Pulses	0
Grains and Oilseeds	122,600,000
Potatoes	516,500,000
Combination Dishes	0
Eggs	0
Meat and Poultry	84,300,000
Fruits and Vegetables	1,800,000
Sweets and Sugars	700,000
RHA Total	**726,360,000**

Table 4.11: Food Production Winnipeg RHA

Food Category	**Amount (kg)**
Bread and Baked Goods	42,900,000
Dairy Foods and Other Related Products	92,500,000
Fish	18,100,000
Pulses	2,000,000
Grains and Oilseeds	38,600,000
Potatoes	18,200,000
Combination Dishes	45,500,000
Eggs	35,100,000
Meat and Poultry	12,900,000
Fruits and Vegetables	17,500,000
Sweets and Sugars	5,000,000
RHA Total	**328,300,000**

Table 4.12: Food Production South Eastman RHA

Food Category	**Amount (kg)**
Bread and Baked Goods	1,500,000
Dairy Foods and Other Related Products	10,100,000
Fish	0
Pulses	0
Grains and Oilseeds	4,400,000
Potatoes	0
Combination Dishes	0
Eggs	17,600,000
Meat and Poultry	32,400,000
Fruits and Vegetables	1,000,000
Sweets and Sugars	0
RHA Total	**67,000,000**

Table 4.12 displays the food produced in the South Eastman RHA. This region is the third largest meat producing area of Manitoba (after Brandon and Assiniboine), and has the largest poultry industry.

Table 4.13: Food Production Brandon RHA

Food Category	Amount (kg)
Bread and Baked Goods	2,721,000
Dairy Foods and Other Related Products	40,000,000
Fish	0
Pulses	0
Grains and Oilseeds	0
Potatoes	0
Combination Dishes	0
Eggs	5,850,000
Meat and Poultry	214,131,000
Fruits and Vegetables	0
Sweets and Sugars	0
RHA Total	**262,702,000**

Table 4.13 shows the breakdown of food production in the Brandon RHA. The majority of food produced in Brandon is in the meat category and nearly all of meat production (99%) is pork. Brandon is also the main source of pork production throughout the province.

Tables 4.14 through 4.17 show the food production in the smaller producing regions.

Table 4.14: Food Production Parkland RHA

Food Category	Amount (kg)
Bread and Baked Goods	960,000
Dairy Foods and Other Related Products	0
Fish	0
Pulses	0
Grains and Oilseeds	0
Potatoes	0
Combination Dishes	0
Eggs	0
Meat and Poultry	2,400,000
Fruits and Vegetables	500,000
Sweets and Sugars	2,100,000
RHA Total	**5,960,000**

The Parkland region, as shown in Table 4.14, is a fairly small processed food production area. Of the nearly 6 million kilograms of food produced, most of it consists of meats (2.4 million kilograms) and honey (2.1 million kilograms).

Table 4.15: Food Production Interlake RHA

Food Category	Amount (kg)
Bread and Baked Goods	250,000
Dairy Foods and Other Related Products	700,000
Fish	0
Pulses	0
Grains and Oilseeds	3,900,000
Potatoes	0
Combination Dishes	0
Eggs	0
Meat and Poultry	7,300,000
Fruits and Vegetables	1,000,000
Sweets and Sugars	700,000
RHA Total	**13,850,000**

Table 4.16: Food Production North Eastman RHA

Food Category	Amount (kg)
Bread and Baked Goods	170,000
Dairy Foods and Other Related Products	0
Fish	0
Pulses	0
Grains and Oilseeds	0
Potatoes	0
Combination Dishes	0
Eggs	0
Meat and Poultry	130,000
Fruits and Vegetables	500,000
Sweets and Sugars	0
RHA Total	**800,000**

The North Eastman RHA processes food production is shown in Table 4.16. Fruits and vegetables are the largest contributor from the region, consisting of just over 500,000 kilograms.

Table 4.17: Food Production Norman RHA

Food Category	Amount (kg)
Bread and Baked Goods	28,000
Dairy Foods and Other Related Products	700,000
Fish	0
Pulses	0
Grains and Oilseeds	0
Potatoes	0
Combination Dishes	0
Eggs	0
Meat and Poultry	131,000
Fruits and Vegetables	0
Sweets and Sugars	0
RHA Total	**859,000**

The Norman RHA is a small contributor to the total provincial food production, as shown in Table 4.17. The main industry is dairy products which generates 700,000 kilograms of product annually.

For all practical purposes there is no significant processed food production in Churchill or Burntwood RHAs.

Table 4.18 summarizes the production of food on a pandemic planning area basis.

Table 4.18: Food Production by Category on a Pandemic Planning Area Basis

	Northern	*Western*	*Capital*
Food Category	*Amount (kg)*		
Bread and Baked Goods	*28,000*	*4,141,000*	*44,820,000*
Dairy Foods and Other Related Products	*700,000*	*40,000,000*	*103,660,000*
Fish	*0*	*0*	*87,200,000*
Pulses	*0*	*0*	*2,000,000*
Grains and Oilseeds	*0*	*122,600,000*	*350,300,000*
Potatoes	*0*	*516,500,000*	*392,400,000*
Combination Dishes	*0*	*0*	*496,900,000*
Eggs	*0*	*5,850,000*	*52,700,000*
Meat and Poultry	*131,000*	*300,831,000*	*52,730,000*
Fruits and Vegetables	*0*	*2,300,000*	*21,300,000*
Sweets and Sugars	*0*	*2,800,000*	*9,200,000*
Planning Area Total	***859,000***	***994,022,000***	***1,613,210,000***

Clearly the bulk of production is in the south, with the Capital pandemic planning area of greater importance than the Western pandemic planning area. Table 4.18 provides further elaboration of the differences.

4.4 Regional Concentration of Foods

Table 4.19 shows the share of total provincial production for the major food categories.

Table 4.19: Percent of Total Manitoba Food Production by RHA[60]

Name	Winnipeg	Brandon	Assiniboine	Central	Parkland	Interlake	North Eastman	South Eastman	Norman	Province
Bread and Baked Goods	86.87%	5.51%	0.94%	0.73%	1.94%	0.51%	0.34%	3.11%	0.06%	**100.0%**
Dairy Foods and Other Related Products	43.41%	18.77%	0.00%	32.42%	0.00%	0.33%	0.00%	4.74%	0.33%	**100.0%**
Fish	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.0%**
Pulses	0.66%	0.00%	0.00%	99.34%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.0%**
Grains and Oilseeds	7.10%	0.00%	22.56%	68.83%	0.00%	0.71%	0.00%	0.80%	0.00%	**100.0%**
Potatoes	1.84%	0.00%	52.38%	45.78%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.0%**
Combination Dishes	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.0%**
Eggs	60.00%	10.00%	0.00%	0.00%	0.00%	0.00%	0.00%	30.00%	0.00%	**100.0%**
Meat and Poultry	3.63%	60.34%	23.75%	0.37%	0.67%	2.04%	0.04%	9.12%	0.04%	**100.0%**
Fruits and Vegetables	67.71%	0.00%	6.85%	13.70%	1.96%	3.91%	1.96%	3.91%	0.00%	**100.0%**
Sweets and Sugars	58.40%	0.00%	8.32%	0.00%	24.96%	8.32%	0.00%	0.00%	0.00%	**100.0%**

Four RHAs provide the majority of food in the province. These regions include Winnipeg, Central, Assiniboine, and Brandon.

Winnipeg is the only RHA that has a share of production in each category. It also boasts the highest production in 7 of the 11 major categories. Among these are Breads and Baked Goods (86%), Dairy Foods and Other Related Products (43%), Fish (100%), Combination Dishes (100%), Eggs (60%), Fruits and Vegetables (68%), and Sweets and Sugars (58%).

Central has the highest food production by weight in the province, but only holds the top share in two of the categories, Pulses (99%) and Grains and Oilseeds (69%). This region also produces a great deal of potatoes (46%) which is second only to the Assiniboine RHA which produces 52% of the potatoes in Manitoba. Figures 4.4 and 4.5 show the shares of Grain and Oilseed and Potato production, respectively, in Manitoba.

[60] The Regional Health Authorities of Burntwood and Churchill are not included in the report because no food processing businesses were listed for these regions.

Figure 4.4: Share of Grain and Oilseed Production

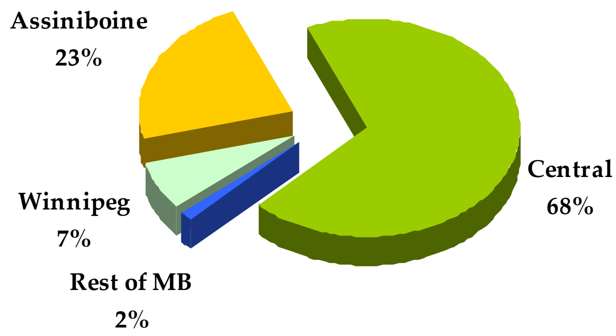
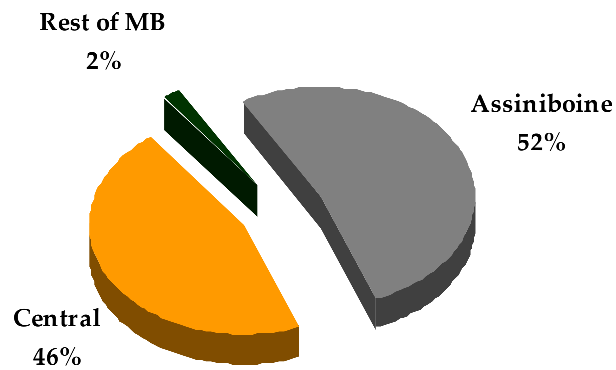
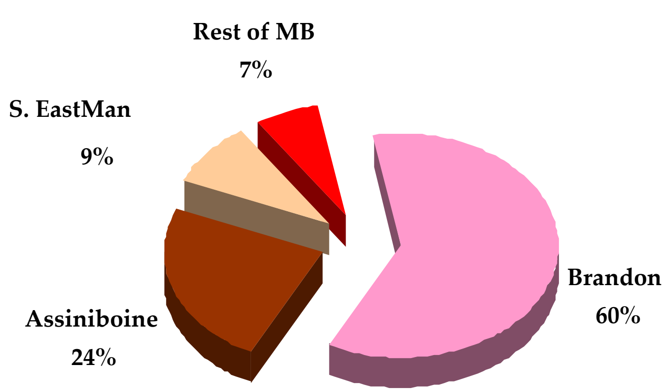


Figure 4.5: Share of Potato Production by RHA



The majority of food production in the Brandon RHA is in the Meat and Poultry industry (60%) and the Dairy sector, which constitutes 19% of Manitoba production. Figure 4.6 shows the share of meat and poultry production in the province.

Figure 4.6: Share of Meat and Poultry Production by RHA



Besides these four RHAs, little food production occurs in the other parts of the province. With the exception of Parkland which produces 25% of the Sweets and Sugars (all honey) and South Eastman which produces 30% of the eggs in Manitoba, none of the other regions produces more than 10% in any food category.

4.5 Total Manitoba Nutrition Available from Manitoba Based Food Production

The preceding sections presented the production of food in terms of the prevalent food types produced in Manitoba. The remainder of Section 4 presents this food production on a nutrition basis consistent with the categories used in Section 3. The 16 different categories of nutrients and vitamins are shown in Table 4.20.

Table 4.20: Nutrient/Vitamin Considered

Protein	Potassium
Carbohydrates	Vitamin A
Fibre	Vitamin C
Fat	Vitamin B6
Calcium	Folate
Iron	Thiamin
Zinc	Riboflavin
Sodium	Niacin

Based on this split Table 4.21 shows the total nutrition produced per day (assuming total production is averaged over 365 days).

Table 4.21: Total Daily Nutrition by Nutrient Available from Manitoba Food Production

Nutrient/Vitamin	Daily Produced	Measurement	Nutrient/Vitamin	Daily Produced	Measurement
Protein	654,323	kg	**Potassium**	24,846,765	g
Carbohydrates	1,465,124	kg	**Vitamin A**	6,150,640,002	IU[61]
Fibre	195,129	kg	**Vitamin C**	396,060	g
Fat	1,018,687	kg	**Vitamin B6**	18,266	g
Calcium	3,105,315	g	**Folate**	2,169	g
Iron	136,253	g	**Thiamin**	14,851	g
Zinc	84,999	g	**Riboflavin**	10,114	g
Sodium	3,953,945	g	**Niacin**	271,056,742	NE[62]

In order to determine the surplus or deficiency of each nutrient in the province, these figures will be compared to the daily requirements of Manitobans which were presented in Section 3 of the report. The results of the comparison are provided in Sections 6 and 11[63].

[61] IU = International Units
[62] NE = Niacin Equivalents
[63] For a complete breakdown of the food nutritional vectors (the nutrition components of each food product) see Appendix G.

4.6 Nutrition Available from Manitoba Based Food Production by RHA

Depending on the type of products produced in each region, high output levels may not always ensure that the region is producing all of the daily required nutritional components. Table 4.22 presents the distribution of nutrition available from Manitoba based food production in the individual RHAs. Table 4.23 summarizes the results on a pandemic planning area basis.

The Central RHA is the highest nutrition producing region in Manitoba. Thirteen out of the sixteen measured vitamins and nutrients in Table 4.23 are generated at the highest level in this region. Only sodium (Winnipeg), vitamin A (Winnipeg), and vitamin C (Assiniboine) are generated at greater quantities in other RHAs in the province.

Table 4.22: Total Daily Nutrition Available from Food Production by RHA

	Protein (kg)	Carbohydrates (kg)	Fibre (kg)	Fat (kg)	Calcium (g)	Iron (g)	Zinc (g)	Sodium (g)
Winnipeg	82,186	215,235	10,591	47,308	664,552	12,896	6,308	1,523,251
Brandon	168,891	9,018	163	92,895	290,610	7,606	19,031	496,114
Assiniboine	120,270	407,428	51,718	287,727	503,899	34,683	20,352	360,074
Central	237,000	809,608	129,693	561,246	1,384,267	76,395	33,991	1,168,080
Parkland	2,017	6,369	84	1,212	4,049	220	324	20,219
Interlake	7,290	6,248	1,848	5,904	35,229	1,528	1,406	37,806
N. Eastman	156	345	39	84	803	31	30	4,122
S. Eastman	36,340	10,748	990	22,220	219,450	2,883	3,526	342,655
Norman	174	126	2	90	2,456	11	31	1,624
Province	**654,323**	**1,465,124**	**195,129**	**1,018,687**	**3,105,315**	**136,253**	**84,999**	**3,953,945**
	Potassium (g)	**Vitamin A (IU)**	**Vitamin C (g)**	**Vitamin B6 (g)**	**Folate (g)**	**Thiamin (g)**	**Riboflavin (g)**	**Niacin (NE)**
Winnipeg	1,683,291	3,853,013,235	23,659	1,127	241	1,861	2,420	37,594,527
Brandon	2,298,848	360,117,799	3,066	2,133	43	4,057	2,103	60,594,884
Assiniboine	8,241,414	153,064,309	186,558	6,596	510	3,327	1,423	60,599,927
Central	11,972,855	981,990,927	179,054	7,484	1,293	5,304	3,496	95,331,006
Parkland	32,368	37,254,703	564	29	1	41	30	772,660
Interlake	206,496	84,121,516	1,280	196	34	64	69	2,717,214
N. Eastman	4,761	36,423,683	548	3	1	4	3	70,258
S. Eastman	402,418	640,706,658	1,315	696	47	191	565	13,321,228
Norman	4,314	3,947,171	15	2	0	2	4	55,037
Province	**24,846,765**	**6,150,640,002**	**396,060**	**18,266**	**2,169**	**14,851**	**10,114**	**271,056,742**

Table 4.23: Total Daily Nutrition Available from Food Production by Pandemic Planning Area

	Protein (kg)	Carbohydrates (kg)	Fibre (kg)	Fat (kg)	Calcium (g)	Iron (g)	Zinc (g)	Sodium (g)
Northern	*174*	*126*	*-*	*90*	*2,456*	*11*	*31*	*1,624*
Western	*291,178*	*422,814*	*51,965*	*381,834*	*798,558*	*42,509*	*39,707*	*876,407*
Capital	*362,971*	*1,042,184*	*143,164*	*636,763*	*2,304,301*	*93,733*	*45,261*	*3,075,914*
	Potassium (g)	**Vitamin A (IU)**	**Vitamin C (g)**	**Vitamin B6 (g)**	**Folate (g)**	**Thiamin (g)**	**Riboflavin (g)**	**Niacin (NE)**
Northern	*4,314*	*3,947,171*	*15*	*2*	*0*	*2*	*4*	55,037
Western	*10,572,630*	*550,436,811*	*190,188*	*8,758*	*554*	*7,425*	*3,556*	*121,967,471*
Capital	*14,269,821*	*5,559,256,020*	*205,857*	*9,506*	*1,615*	*7,424*	*6,554*	*149,034,234*

Some important observations can be drawn from Table 4.22 and Table 4.23. It has already been mentioned that the top four food-producing RHAs are in the southern part of the province. Because these regions are in generally close proximity transporting food amongst these areas, as well as parts of nearby RHAs, is fairly simple. Adjacent RHAs such as Parkland, Interlake, South and North Eastman are relatively minor food-producing regions, but are geographically close to those areas which are more productive, food-wise. That said, regions like Churchill, Norman, and Burntwood, which are negligible nutrition producing regions, will need many of their nutritional needs shipped to them. For this reason, transportation to the northern RHAs will be an important consideration when developing the food supply plan for the province should it ever be hit with a pandemic situation.

4.7 Nutrition Production by Firm Size

The estimate of available nutrition in the province is based on the production information of 283 firms. The majority of these firms (224) are considered small producers based on their employee numbers. Even though these firms constitute nearly 80% of the processing firms, nutrition-wise they do not provide nearly the same output as the larger companies. Table 4.24 presents the estimated breakdown of nutrition production by firm size.

Table 4.24: Total Daily Nutrition Available from Food Production by Firm Size

Firm Size	#	Protein (kg)	Carbohydrates (kg)	Fibre (kg)	Fat (kg)	Calcium (g)	Iron (g)	Zinc (g)	Sodium (g)
Small	224	18,133 (3%)[64]	62,161 (4%)	7,440 (4%)	16,088 (2%)	141,927 (5%)	5,871 (4%)	3,621 (4%)	226,412 (6%)
Medium	34	186,924 (29%)	341,204 (23%)	65,694 (34%)	116,977 (11%)	1,528,251 (49%)	55,051 (40%)	23,725 (28%)	951,050 (24%)
Large	20	169,954 (26%)	854,161 58%)	103,278 (53%)	751,464 (74%)	1,127,684 (36%)	52,977 (39%)	27,430 (32%)	2,045,483 (52%)
Unique	5	279,313 (43%)	207,598 (14%)	18,717 (10%)	134,158 (13%)	307,453 (10%)	22,354 (16%)	30,224 (36%)	730,999 (18%)
Province	**283**	**654,323**	**1,465,124**	**195,129**	**1,018,687**	**3,105,315**	**136,253**	**84,999**	**3,953,945**

Firm Size	#	Potassium (g)	Vitamin A (IU)	Vitamin C (g)	Vitamin B6 (g)	Folate (g)	Thiamin (g)	Riboflavin (g)	Niacin (NE)
Small	224	782,035 (3%)	935,058,523 (15%)	16,930 (4%)	543 (3%)	130 (6%)	370 (2%)	445 (4%)	7,058,572 (3%)
Medium	34	6,028,806 (24%)	3,734,928,358 (61%)	28,325 (7%)	3,013 (16%)	1,079 (50%)	3,375 (23%)	3,977 (39%)	60,488,565 (22%)
Large	20	11,269,191 (45%)	1,309,740,274 (21%)	241,904 (61%)	8,288 (45%)	818 (38%)	4,557 (31%)	2,660 (26%)	90,057,744 (33%)
Unique	5	6,766,733 (27%)	170,912,847 (3%)	108,900 (27%)	6,423 (35%)	143 (7%)	6,549 (44%)	3,032 (30%)	113,451,861 (42%)
Province	**283**	**24,846,765**	**6,150,640,002**	**396,060**	**18,266**	**2,169**	**14,851**	**10,114**	**271,056,742**

As shown in the table, the 224 smaller firms despite representing the vast majority of firms, contribute a relatively small proportion of available provincial nutrition. Conversely the five "unique" firms collectively contributed more than the 224 small firms (except for vitamin A). This group of 5 companies has the highest contribution to several nutritional categories including protein (43%), zinc (36%), thiamin (44%), and niacin (42%). These are significant numbers given there are only a handful of such firms in the province. Similarly, the 20 "large" firms generate the highest outputs in 7 of the 16 nutritional categories including nearly three quarters of the daily fat production. The "medium" firms are also noteworthy with significance in the several areas including approximately half the provincial calcium output, and 61% of the vitamin A produced.

[64]Percentage in brackets represents portion of total daily production for nutritional item.

SECTION 5 : TRADE IN NUTRITION IN MANITOBA

5.1 International Trade

To determine the total amount of nutrition available in Manitoba, one must consider both imports and exports in addition to production figures. As a whole, Manitoba is a net exporter of food. Food categories such as pork, legumes, milk, and potatoes are categories with the largest export levels. Beef, fruits, vegetables, and sweets and sugars have high imports levels. This section presents international imports and exports, domestic trade balances, and overall net trade balances. Data is analyzed first in terms of food categories and secondly in terms of the 16 nutrition elements.

International import and export data is based on Statistics Canada Import and Export Databases for 2006. That data was matched to the food product categories shown in Table 5.1 based on the largest imports and exports.

Table 5.1: Import and Export Food Product Types

Food Products	
Cereal Products	Milk
Fat and Oil	Cheese
Sweets and Sugars	Other Dairy
Fruit	Eggs
Pulses and Nuts	Potatoes
Beef	Vegetables
Pork	Mushrooms
Lamb	Soups
Poultry	Condiments
Fish	

The category of Cereal products includes all food grade grain products such as bread and baked goods, flour, flax, rolled oats, etc. This category does not include items such as wheat, raw oats, barley, etc. that is not yet processed for human consumption.

The category of "Other Dairy" includes all dairy products that are not classified as milk or cheese. This includes such products as yogurt, ice cream, powdered dairy, etc.

Table 5.2 shows the weight of imports of foods from international locations[65].

Table 5.2: Average Daily Quantity of International Imports of Food Products by Type

Food Category	International Imports (kg)
Cereal Products	101,096
Fat and Oil	76,712
Sweets and Sugars	11,507
Fruit	135,616
Pulses and Nuts	184,932
Beef	4,110
Pork	29,589
Lamb	2,192
Poultry	11,233
Fish	1,370
Milk	110
Cheese	301
Other Dairy	52
Eggs	7,945
Potatoes	11,233
Vegetables	86,301
Mushrooms	822
Soups	1,644
Condiments	11,781
Province	**678,545**

Average daily imports from international locations were 678,545 kilograms in 2006. The top five food imports to Manitoba from other countries were pulses and nuts, fruit, cereal products, vegetables, and fat and oil. As Canada's primary trading partner, it is no surprise that the majority of these food imports came from the United States. To a lesser degree, Mexico and other countries in Central America contributed to food imports, notably fruits and vegetables.

[65] The Statistics Canada provides imports "cleared" in Manitoba. In some cases these may have be transshipped to other provinces.

Table 5.3 shows these food products converted to nutritional equivalents.

Table 5.3: Average Daily Quantity of International Imports of Nutrition

Nutrient	International Imports
Protein (kg)	60,000
Carbs (kg)	138,000
Fibre (kg)	14,000
Fat (kg)	110,000
Calcium (g)	270,000
Iron (g)	14,000
Zinc (g)	6,700
Sodium (g)	1,250,000
Potassium (g)	2,865,000
Vitamin A (IU)	3,516,750,000
Vitamin C (g)	51,000
Vitamin B6 (g)	1,500
Folate (g)	400
Thiamin (g)	1,500
Riboflavin (g)	1,000
Niacin (NE)	24,500,000

Table 5.4 shows international exports of food products from Manitoba.

Table 5.4: Average Daily Quantity International Exports of Food Products by Type

Food Category	International Exports (kg)
Cereal Products	569,863
Fat and Oil	465,753
Sweets and Sugars	21,918
Fruit	-
Pulses and Nuts	1,205,479
Beef	466
Pork	438,356
Lamb	-
Poultry	9,315
Fish	23,014
Milk	603
Cheese	-
Other Dairy	1,096
Eggs	13,151
Potatoes	873,973
Vegetables	15,616
Mushrooms	36
Soups	959
Condiments	-
Province	**3,639,597**

Exports in 2006 were about 5 times the level of imports. The top five food exports from Manitoba to international markets were pulses and nuts, potatoes, cereal products, fat and oil, and pork. As was the case with imports the main destination for Manitoba exports was the United States. However with respect to pulses and nuts there is a broad range of countries receiving Manitoba exports, from Europe to Asia. Pork is another commodity in which the export base is quite diverse. Japan in particular is an important destination for Manitoba pork.

On a nutrition basis exports in 2006 were as shown in Table 5.5

Table 5.5: Average Daily Quantity of International Exports of Nutrition

Nutrient	International Exports
Protein (kg)	356,000
Carbs (kg)	765,000
Fibre (kg)	135,000
Fat (kg)	728,000
Calcium (g)	1,415,000
Iron (g)	78,000
Zinc (g)	62,000
Sodium (g)	1,999,000
Potassium (g)	14,633,000
Vitamin A (IU)	1,980,389,000
Vitamin C (g)	124,000
Vitamin B6 (g)	9,000
Folate (g)	2,000
Thiamin (g)	7,000
Riboflavin (g)	4,000
Niacin (NE)	131,300,000

5.2 Net International Trade Balance

The net of exports minus imports provides a measure of the net trade balance for food products and nutrition in Manitoba. These are shown in Tables 5.6 and 5.7. A negative value indicates a net export, while a positive value indicates a net import.

Table 5.6: Average Daily Net Quantity of the International Trade Balance Food Products by Type

Food Category	International Exports (kg)
Cereal Products	-468,767
Fat and Oil	-389,041
Sweets and Sugars	-10,411
Fruit	135,616
Pulses and Nuts	-1,020,548
Beef	3,644
Pork	-408,767
Lamb	2,192
Poultry	1,918
Fish	-21,644
Milk	-493
Cheese	301
Other Dairy	-1,044
Eggs	-5,205
Potatoes	-862,740
Vegetables	70,685
Mushrooms	786
Soups	685
Condiments	11,781
Province	**-2,961,052**

In 2006 Manitoba was a net international exporter of almost 3 million kilograms of food daily. On a net basis Manitoba's largest exports are pulses and nuts, potatoes, cereal products and fat and oil. The largest net imports are fruits and vegetables.

Table 5.7: Average Daily Net Quantity of the International Trade Balance of Nutrition

Nutrient	International Exports
Protein (kg)	-296,000
Carbs (kg)	-627,000
Fibre (kg)	-121,000
Fat (kg)	-618,000
Calcium (g)	-11,450,000
Iron (g)	-64,000
Zinc (g)	-55,300
Sodium (g)	-749,000
Potassium (g)	-11,768,000
Vitamin A (IU)	1,536,361,000
Vitamin C (g)	-73,000
Vitamin B6 (g)	-7,500
Folate (g)	-1,600
Thiamin (g)	-5,500
Riboflavin (g)	-3,000
Niacin (NE)	-106,800,000

Except for vitamin A, Manitoba is a net exporter of every nutrition category. For vitamin A, the province is a net importer due to the fact that Manitoba is a net importer of fruits and vegetables which contain large amounts of vitamin A[66].

5.3 Inter-provincial Trade

Inter-provincial trade also affects the supply of nutrition in Manitoba. The net inter-provincial trade balance for each food category was determined by subtracting production and net international trade from the food available for consumption to Canadians as outlined in the Statistics Canada database 'Food Statistics 2006'[67] multiplied by the population of Manitoba[68].

Table 5.8: Average Daily Net Quantity of the Inter-provincial Trade of Food Products by Type

Food Category	Net Inter-provincial Trade (kg)
Cereal Products	-145,205
Fat and Oil	-161,644
Sweets and Sugars	93,151
Fruit	153,425
Pulses and Nuts	131,507
Beef	84,932
Pork	-342,466
Lamb	1,644
Poultry	-10,959
Fish	1,918
Milk	-268,493
Cheese	-7,123
Other Dairy	87,671
Eggs	-120,548
Potatoes	-1,624,658
Vegetables	208,219
Mushrooms	3,288
Soups	0
Condiments	0
Province	**-1,915,342**

In terms of trade with other Canadian provinces, Manitoba is also a net exporter. The majority of Manitoba net exports to other provinces are potatoes, pork, milk, fat and oil, and cereal products. The majority of net imports to Manitoba from other provinces are vegetables, fruit, pulses and nuts, sweets and sugars, and other dairy products. It is

[66] Source: Statistics Canada International Trade Database
[67] Source: Statistics Canada: Agriculture Division, "Food Statistics 2006"
[68] Net inter-provincial trade Food = (Food Available for Consumption per person x Population) – (Production + International Imports – International Exports)

important to note that while this table approximates Manitoba's net inter-provincial trade, exports that Manitoba sends to other provinces may still be further shipped to foreign markets from other Canadian ports, and conversely imports arriving in Manitoba from other provinces may have come from foreign markets crossing through other province's ports. In the event of international borders being closed Manitoba could experience a decline in inter-provincial trade. As a net exporting province, this would result in more food remaining in the province.

Table 5.9 shows net inter-provincial trade on a nutrition basis. Since Manitoba exports more food products inter-provincially than it imports, it is a net exporter for all nutrition categories.

Table 5.9: Average Daily Net Quantity of the Inter-provincial Trade of Nutrition

Nutrient	Net Inter-provincial Trade
Protein (kg)	-232,000
Carbs (kg)	-339,000
Fibre (kg)	-53,000
Fat (kg)	-236,000
Calcium (g)	-863,000
Iron (g)	-48,000
Zinc (g)	-14,000
Sodium (g)	-1,800,000
Potassium (g)	-8,300,000
Vitamin A (IU)	-5,984,100,000
Vitamin C (g)	-170,000
Vitamin B6 (g)	-8,000
Folate (g)	0
Thiamin (g)	-5,000
Riboflavin (g)	-4,000
Niacin (NE)	-100,800,000

5.4 Total Trade Balances

Table 5.10 shows the combination of international and inter-provincial trade in Manitoba processed food.

Table 5.10: Average Daily Net Quantity of the International and Inter-provincial Trade Balance of Food Products by Type

Food Category	Net Trade Balance (kg)
Cereal Products	-613,973
Fat and Oil	-550,685
Sweets and Sugars	82,740
Fruit	289,041
Pulses and Nuts	-889,041
Beef	88,575
Pork	-751,233
Lamb	3,836
Poultry	-9,041
Fish	-19,726
Milk	-268,767
Cheese	-6,822
Other Dairy	86,627
Eggs	-125,753
Potatoes	-2,487,397
Vegetables	278,904
Mushrooms	4,074
Soups	685
Condiments	11,781
Province	**-4,876,175**

The net trade balance for each food category is obtained by combining net international trade with net inter-provincial trade. As in the previous table, a negative value indicates a net export, while a positive value indicates a net import. Overall, Manitoba's net trade balance is -4,876,175 kilograms daily. The food categories contributing most to the net export balance potatoes, pulses and nuts, pork, cereal products, and fat an oil. The largest contributions to the net import balance are fruits and vegetables.

Table 5.11 provides the trade balance on a net nutrition basis.

Table 5.11: Average Daily Net Quantity of the International and Inter-provincial Trade Balance of Nutrition

Nutrient	Net Trade Balance
Protein (kg)	-528,000
Carbs (kg)	-966,000
Fibre (kg)	-174,000
Fat (kg)	-854,000
Calcium (g)	-2,008,000
Iron (g)	-112,000
Zinc (g)	-69,300
Sodium (g)	-2,549,000
Potassium (g)	-20,069,000
Vitamin A (IU)	-4,447,739,000
Vitamin C (g)	-243,000
Vitamin B6 (g)	-15,500
Folate (g)	-1,600
Thiamin (g)	-10,500
Riboflavin (g)	-7,000
Niacin (NE)	-207,600,000

In the event of a pandemic event these net food balances are an important planning consideration. If the inter-provincial and international border were to close, these net balances would be available to feed Manitobans. However, there remains the challenges of assuring food supplies is processed and stored properly, distribution from processing plant to consumer functions to meet Manitoban's needs, and businesses within the chain remain viable during after the event.

SECTION 6 : REGIONAL NUTRITIONAL SURPLUSES AND DEFICITS

6.1 Background

The following section utilizes the information developed in Sections 3, 4 and 5 to develop a profile of regional nutrition surpluses and deficits in Manitoba. It takes into account nutritional requirements, nutrition available and net trade. It represents the status quo situation or "benchmark" against which pandemic planning scenarios can be compared.

The net trade data is only available at the produced at a province wide level, therefore a methodology was needed to convert it to an RHA level. Imports were allocated to the 11 Manitoba RHA's based on the population of each region using the following formulation:

International Imports RHA level = International Imports to MB x RHA's % of MB population

Exports were allocated based on the production levels of the various food categories in each RHA as follows:

International Exports RHA level = International Exports from MB x RHA's % of MB production

Net inter-provincial trade for each food category is determined by subtracting production and net international trade from the food available for consumption to Canadians (as outlined in the Statistics Canada database 'Food Statistics 2006') multiplied by the population of the region.

Net inter-provincial trade at RHA level =((Food Available per person x Population) – (Production + International Imports – International Exports))x RHA's % of Manitoba population

The total available nutrition is as shown in Section 5 and the total nutrition required is from Section 3.

6.2 Manitoba Nutritional Balances

Table 6.1 shows the nutritional balance for Manitoba as a whole under a status quo scenario, based on the information provided by processors and Statistics Canada.

Table 6.1: Nutritional Balance for Manitoba

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/Deficit w/ Trade
Protein (kg)	654,323	-528,794	125,529	54,449	71,080
Carbs (kg)	1,465,124	-965,682	499,442	153,809	345,633
Fibre (kg)	195,129	-173,835	21,295	33,428	-12,133
Fat (kg)	1,018,687	-854,257	164,430	35,361	129,069
Calcium (g)	3,105,315	-2,007,135	1,098,181	1,252,516	-154,335
Iron (g)	136,253	-112,519	23,734	12,652	11,082
Zinc (g)	84,999	-68,961	16,039	10,451	5,588
Sodium (g)	3,953,945	-2,522,261	1,431,684	1,624,683	-192,999
Potassium (g)	24,846,765	-20,100,423	4,746,342	5,326,579	-580,237
Vitamin A (IU)	6,150,640,002	-4,447,722,499	1,702,917,503	2,907,270,841	-1,204,353,338
Vitamin C (g)	396,060	-240,810	155,250	85,989	69,261
Vitamin B6 (g)	18,266	-15,379	2,887	1,520	1,367
Folate (g)	2,169	-1,801	368	437	-69
Thiamin (g)	14,851	-10,726	4,125	1,255	2,870
Riboflavin (g)	10,114	-6,920	3,194	1,305	1,889
Niacin (NE)	271,056,742	-207,620,402	63,436,340	16,424,171	47,012,169

Based on this data in the status quo situation, Manitoba as a whole has some very small deficits in fibre, calcium, sodium, potassium, vitamin A and folate.[69] This pattern of imbalances in the status quo situation is relatively consistent across RHAs.

In the event of a pandemic, these deficits can be met by reducing trade for the following:

[69] Theses are estimated values.

6.3 Regional Nutritional Balances

Tables 6.2 through 6.13 present the balances for each RHA and pandemic planning areas.

Table 6.2: Nutritional Balance for Winnipeg RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/Deficit w/ Trade
Protein (kg)	82,186	-11,133	71,053	31,108	39,945
Carbs (kg)	215,235	67,462	282,697	87,035	195,662
Fibre (kg)	10,591	1,462	12,053	18,947	-6,894
Fat (kg)	47,308	45,763	93,072	20,015	73,057
Calcium (g)	664,552	-42,953	621,599	710,065	-88,466
Iron (g)	12,896	538	13,434	7,205	6,229
Zinc (g)	6,308	2,770	9,078	5,947	3,131
Sodium (g)	1,523,251	-712,880	810,371	922,298	-111,927
Potassium (g)	1,683,291	1,003,265	2,686,556	3,027,657	-341,101
Vitamin A (IU)	3,853,013,235	-2,889,116,644	963,896,592	1,656,274,736	-692,378,144
Vitamin C (g)	23,659	64,217	87,876	49,244	38,632
Vitamin B6 (g)	1,127	507	1,634	868	766
Folate (g)	241	-32	209	249	-40
Thiamin (g)	1,861	474	2,335	716	1,619
Riboflavin (g)	2,420	-612	1,808	744	1,064
Niacin (NE)	37,594,527	-1,687,871	35,906,656	9,362,080	26,544,576

Table 6.3: Nutritional Balance for Brandon RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/Deficit w/ Trade
Protein (kg)	168,891	-163,592	5,299	2,305	2,994
Carbs (kg)	9,018	12,067	21,085	6,504	14,581
Fibre (kg)	163	736	899	1,406	-507
Fat (kg)	92,895	-85,954	6,942	1,493	5,449
Calcium (g)	290,610	-244,249	46,361	52,581	-6,220
Iron (g)	7,606	-6,604	1,002	542	460
Zinc (g)	19,031	-18,354	677	441	236
Sodium (g)	496,114	-435,673	60,440	68,572	-8,132
Potassium (g)	2,298,848	-2,098,476	200,373	224,712	-24,339
Vitamin A (IU)	360,117,799	-288,227,059	71,890,740	122,802,191	-50,911,451
Vitamin C (g)	3,066	3,488	6,554	3,647	2,907
Vitamin B6 (g)	2,133	-2,011	122	64	58
Folate (g)	43	-28	16	19	-3
Thiamin (g)	4,057	-3,883	174	53	121
Riboflavin (g)	2,103	-1,968	135	55	80
Niacin (NE)	60,594,884	-57,916,842	2,678,043	693,819	1,984,224

Table 6.4: Nutritional Balance for Assiniboine RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/Deficit w/ Trade
Protein (kg)	120,270	-112,986	7,283	3,186	4,097
Carbs (kg)	407,428	-378,450	28,978	8,917	20,061
Fibre (kg)	51,718	-50,483	1,236	1,922	-686
Fat (kg)	287,727	-278,187	9,540	2,052	7,488
Calcium (g)	503,899	-440,181	63,717	73,969	-10,252
Iron (g)	34,683	-33,306	1,377	709	668
Zinc (g)	20,352	-19,421	931	611	320
Sodium (g)	360,074	-277,007	83,067	93,349	-10,282
Potassium (g)	8,241,414	-7,966,028	275,386	310,318	-34,932
Vitamin A (IU)	153,064,309	-54,259,699	98,804,610	170,068,421	-71,263,811
Vitamin C (g)	186,558	-177,551	9,008	5,038	3,970
Vitamin B6 (g)	6,596	-6,429	168	90	78
Folate (g)	510	-489	21	26	-5
Thiamin (g)	3,327	-3,087	239	73	166
Riboflavin (g)	1,423	-1,238	185	76	109
Niacin (NE)	60,599,927	-56,919,300	3,680,626	959,549	2,721,077

Table 6.5: Nutritional Balance for Central RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/Deficit w/ Trade
Protein (kg)	237,000	-226,168	10,832	4,612	6,220
Carbs (kg)	809,608	-766,510	43,097	13,297	29,800
Fibre (kg)	129,693	-127,856	1,838	2,879	-1,041
Fat (kg)	561,246	-547,057	14,189	3,051	11,138
Calcium (g)	1,384,267	-1,289,504	94,763	107,416	-12,653
Iron (g)	76,395	-74,346	2,048	1,081	967
Zinc (g)	33,991	-32,607	1,384	891	493
Sodium (g)	1,168,080	-1,044,539	123,541	139,573	-16,032
Potassium (g)	11,972,855	-11,563,290	409,566	456,054	-46,488
Vitamin A (IU)	981,990,927	-835,044,809	146,946,118	247,905,934	-100,959,816
Vitamin C (g)	179,054	-165,658	13,397	7,258	6,139
Vitamin B6 (g)	7,484	-7,235	249	129	120
Folate (g)	1,293	-1,261	32	37	-5
Thiamin (g)	5,304	-4,948	356	107	249
Riboflavin (g)	3,496	-3,221	276	111	165
Niacin (NE)	95,331,006	-89,857,033	5,473,973	1,397,145	4,076,828

Table 6.6: Nutritional Balance for Parkland RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/Deficit w/ Trade
Protein (kg)	2,017	2,428	4,445	1,928	2,517
Carbs (kg)	6,369	11,315	17,683	5,440	12,243
Fibre (kg)	84	670	754	1,170	-416
Fat (kg)	1,212	4,610	5,822	1,252	4,570
Calcium (g)	4,049	34,833	38,883	44,884	-6,001
Iron (g)	220	620	840	435	405
Zinc (g)	324	244	568	370	198
Sodium (g)	20,219	30,472	50,691	56,818	-6,127
Potassium (g)	32,368	135,683	168,051	188,571	-20,520
Vitamin A (IU)	37,254,709	23,039,585	60,294,294	102,975,652	-42,681,358
Vitamin C (g)	564	4,933	5,497	3,045	2,452
Vitamin B6 (g)	29	73	102	55	47
Folate (g)	1	12	13	15	-2
Thiamin (g)	41	105	146	44	102
Riboflavin (g)	30	83	113	46	67
Niacin (NE)	772,660	1,473,397	2,246,057	581,790	1,664,267

Table 6.7: Nutritional Balance for Interlake RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/Deficit w/ Trade
Protein (kg)	7,290	900	8,190	3,574	4,616
Carbs (kg)	6,248	26,338	32,586	10,027	22,559
Fibre (kg)	1,848	-458	1,389	2,181	-792
Fat (kg)	5,904	4,824	10,728	2,307	8,421
Calcium (g)	35,229	36,422	71,651	82,673	-11,022
Iron (g)	1,528	20	1,549	810	739
Zinc (g)	1,406	-360	1,046	687	359
Sodium (g)	37,806	55,605	93,411	105,836	-12,425
Potassium (g)	206,496	103,181	309,677	348,603	-38,926
Vitamin A (IU)	84,121,516	26,986,164	111,107,681	190,910,524	-79,802,843
Vitamin C (g)	1,280	8,849	10,129	5,641	4,488
Vitamin B6 (g)	196	-7	188	100	88
Folate (g)	34	-10	24	29	-5
Thiamin (g)	64	205	269	82	187
Riboflavin (g)	69	139	208	86	122
Niacin (NE)	2,717,214	1,421,720	4,138,935	1,077,282	3,061,653

Table 6.8: Nutritional Balance for North Eastman RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/Deficit w/ Trade
Protein (kg)	156	4,122	4,278	1,853	2,425
Carbs (kg)	345	16,674	17,019	5,238	11,781
Fibre (kg)	39	687	726	1,140	-414
Fat (kg)	84	5,519	5,603	1,205	4,398
Calcium (g)	803	36,619	37,422	43,035	-5,613
Iron (g)	31	778	809	423	386
Zinc (g)	30	516	547	357	190
Sodium (g)	4,122	44,664	48,786	55,268	-6,482
Potassium (g)	4,761	156,975	161,736	181,550	-19,814
Vitamin A (IU)	36,423,683	21,604,788	58,028,471	99,127,153	-41,098,682
Vitamin C (g)	548	4,742	5,290	2,920	2,370
Vitamin B6 (g)	3	95	98	52	46
Folate (g)	1	12	13	15	-2
Thiamin (g)	4	137	141	43	98
Riboflavin (g)	3	106	109	44	65
Niacin (NE)	70,258	2,091,393	2,161,651	559,651	1,602,000

Table 6.9: Nutritional South Eastman RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/Deficit w/ Trade
Protein (kg)	36,340	-29,800	6,540	2,777	3,763
Carbs (kg)	10,748	15,274	26,022	8,022	18,000
Fibre (kg)	990	119	1,109	1,753	-644
Fat (kg)	22,220	-13,653	8,567	1,842	6,725
Calcium (g)	219,450	-162,233	57,217	64,569	-7,352
Iron (g)	2,883	-1,646	1,237	660	577
Zinc (g)	3,526	-2,691	836	538	298
Sodium (g)	342,655	-268,063	74,592	84,774	-10,182
Potassium (g)	402,418	-155,128	247,290	275,193	-27,903
Vitamin A (IU)	640,706,658	-551,982,647	88,724,011	149,475,168	-60,751,157
Vitamin C (g)	1,315	6,773	8,089	4,363	3,726
Vitamin B6 (g)	696	-545	150	77	73
Folate (g)	47	-28	19	22	-3
Thiamin (g)	191	24	215	64	151
Riboflavin (g)	565	-399	166	67	99
Niacin (NE)	13,321,228	-10,016,120	3,305,108	842,334	2,462,774

Table 6.10: Nutritional Balance for Norman RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/Deficit w/ Trade
Protein (kg)	174	2,419	2,593	1,088	1,505
Carbs (kg)	126	10,189	10,316	3,181	7,135
Fibre (kg)	2	438	440	691	-251
Fat (kg)	90	3,306	3,396	730	2,666
Calcium (g)	2,456	20,226	22,682	25,413	-2,731
Iron (g)	11	479	490	265	225
Zinc (g)	31	301	331	211	120
Sodium (g)	1,624	27,946	29,570	33,514	-3,944
Potassium (g)	4,314	93,717	98,032	108,404	-10,372
Vitamin A (IU)	3,947,171	31,225,102	35,172,274	58,493,362	-23,321,088
Vitamin C (g)	15	3,191	3,207	1,702	1,505
Vitamin B6 (g)	2	58	60	30	30
Folate (g)	0	7	8	9	-1
Thiamin (g)	2	83	85	25	60
Riboflavin (g)	4	62	66	26	40
Niacin (NE)	55,037	1,255,185	1,310,222	330,799	979,423

Table 6.11: Nutritional Balance for Burntwood RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Required	Net Surplus/ Deficit w/ Trade
Protein (kg)	0	4,917	4,917	1,976	2,941
Carbs (kg)	0	19,564	19,564	6,027	13,537
Fibre (kg)	0	834	834	1,312	-478
Fat (kg)	0	6,441	6,441	1,385	5,056
Calcium (g)	0	43,018	43,018	46,951	-3,933
Iron (g)	0	930	930	512	418
Zinc (g)	0	628	628	388	240
Sodium (g)	0	56,083	56,083	63,395	-7,312
Potassium (g)	0	185,926	185,926	201,374	-15,448
Vitamin A (IU)	0	66,707,382	66,707,382	106,972,320	-40,264,938
Vitamin C (g)	0	6,082	6,082	3,063	3,019
Vitamin B6 (g)	0	113	113	54	59
Folate (g)	0	14	14	16	-2
Thiamin (g)	0	162	162	46	116
Riboflavin (g)	0	125	125	48	77
Niacin (NE)	0	2,484,954	2,484,954	606,982	1,877,972

Table 6.12: Nutritional Balance for Churchill RHA

	Nutrition Available from MB Production	Net Trade Balance	Total Available	Nutrition Requirement	Net Surplus/Deficit w/ Trade
Protein (kg)	0	99	99	42	57
Carbs (kg)	0	395	395	121	274
Fibre (kg)	0	17	17	27	-10
Fat (kg)	0	130	130	28	102
Calcium (g)	0	868	868	960	-92
Iron (g)	0	19	19	10	9
Zinc (g)	0	13	13	8	5
Sodium (g)	0	1,131	1,131	1,287	-156
Potassium (g)	0	3,750	3,750	4,143	-393
Vitamin A (IU)	0	1,345,332	1,345,332	2,265,381	-920,049
Vitamin C (g)	0	123	123	67	56
Vitamin B6 (g)	0	2	2	1	1
Folate (g)	0	0	0	0	0
Thiamin (g)	0	3	3	1	2
Riboflavin (g)	0	3	3	1	2
Niacin (NE)	0	50,116	50,116	12,740	37,376

Table 6.13: Nutritional Balance by Pandemic Planning Area

	North	*Western*	*Capital*
Protein (kg)	*6,928*	*9,608*	*57,321*
Carbs (kg)	*32,727*	*46,885*	*274,043*
Fibre (kg)	*-1,153*	*-1,609*	*-7,618*
Fat (kg)	*12,222*	*17,507*	*101,183*
Calcium (g)	*-12,369*	*-22,473*	*-54,924*
Iron (g)	*1,038*	*1,533*	*9,172*
Zinc (g)	*555*	*754*	*4,819*
Sodium (g)	*-17,894*	*-24,541*	*-65,792*
Potassium (g)	*-46,027*	*-79,791*	*-179,225*
Vitamin A (IU)	*-105,604,757*	*-164,856,620*	*-784,416,792*
Vitamin C (g)	*6,950*	*9,329*	*57,348*
Vitamin B6 (g)	*136*	*183*	*1,124*
Folate (g)	*-5*	*-10*	*-31*
Thiamin (g)	*276*	*389*	*2,270*
Riboflavin (g)	*184*	*256*	*1,517*
Niacin (NE)	*4,496,771*	*6,369,568*	*36,988,165*

SECTION 7 : THE MANITOBA NUTRITION SUPPLY CHAIN POST PROCESSING

7.1 Population and Sample Data

To further understand the Manitoba nutrition supply chain, data was obtained from wholesalers, retailers, and logistics companies. Based on data obtained from several different sources, a total of 798 firms were identified. Tables 7.1 and 7.2 show the population split by type of firm and firm size and by RHA.

Table 7.1: Population of Firms in the Manitoba Supply Chain Post Processing by Type and Size

	Firm Type:		
Firm Size:	**Wholesaler**	**Retailer**	**Logistics**
Small	14	335	157
Medium	4	120	61
Large	12	64	31
Province	**30**	**519**	**249**

Table 7.2: Population of Firms in the Manitoba Supply Chain Post Processing by Type and RHA

	Firm Type		
RHA:	**Wholesaler**	**Retailer**	**Logistics**
Assiniboine	-	58	32
Brandon	-	10	7
Burntwood	1	30	4
Central	-	63	49
Churchill	-	1	-
Interlake	-	43	26
Norman	-	14	3
N. Eastman	-	34	11
Parkland	-	24	8
S. Eastman	-	28	25
Winnipeg	29	214	84
Province	**30**	**519**	**249**
Northern	*1*	*45*	*7*
Western	*0*	*92*	*47*
Capital	*29*	*382*	*195*

From this population 35 firms were selected and interviewed in person between July 01, 2007 and November 30, 2007. Examples of the surveys used are provided in Appendix D. An additional 670 firms were pre contacted by telephone. Of these, 231 agreed to complete a survey related to their operations and subsequently received a survey package in the mail. The mail out surveys were sent out in early November, 2007 with returns received up to December 31, 2007. A copy of the mail-out survey is provided in

Appendix E. In total, an additional 88 mail out surveys from potential respondents in the wholesaler, retailer, and logistics categories were received. The number of respondents to each of the surveys by firm size is shown in Tables 7.3 and 7.4.

Table 7.3: Number of Firms in the Manitoba Supply Chain Post Processing Interviewed in Person by Type and Size

	Firm type		
Firm size:	**Wholesaler**	**Retailer**	**Logistics**
Small	4	1	-
Medium	2	1	2
Large	10	5	10
Province	**16**	**7**	**12**

Table 7.4: Number of Firms in the Manitoba Supply Chain Post Processing Responding to the Mail Out Survey by Type and Size

	Firm Type		
Firm size:	**Wholesaler**	**Retailer**	**Logistics**
Small	2	31	24
Medium	-	12	14
Large	-	-	5
Province	**2**	**43**	**43**

Table 7.5 shows the number of firms that responded, in total, by RHA.

Table 7.5: Total Firms in the Manitoba Supply Chain Post Processing in the Sample by Type and RHA

	Firm type		
RHA:	**Wholesaler**	**Retailer**	**Logistics**
Assiniboine	-	12	5
Brandon	-	1	3
Burntwood	1	1	-
Central	-	10	10
Churchill	-	-	-
Interlake	-	3	3
Norman	-	-	-
North Eastman	-	5	1
Parkland	-	2	-
South Eastman	-	5	5
Winnipeg	17	11	28
Province	**18**	**50**	**55**
Northern	*1*	*1*	-
Western	*0*	*15*	*8*
Capital	*18*	*34*	*47*

The following statistics for wholesalers, retailers, and logistics companies were compiled from the information of the companies who completed the respective surveys.

7.2 Wholesalers/Distributors

The wholesaler/distributor survey posed various questions regarding distribution as well as sourcing. Figure 7.1 displays the principal sources from which wholesalers received their food supplies. On average, 66% of products were sourced from processors. Sourcing from other wholesalers was 14% of the total. A relatively small amount (6%) was sourced directly from farms, while 12% was sourced from other sources. The remaining 3% was sourced from the retail level.

Figure 7.1: Wholesaler Sourcing by Industry

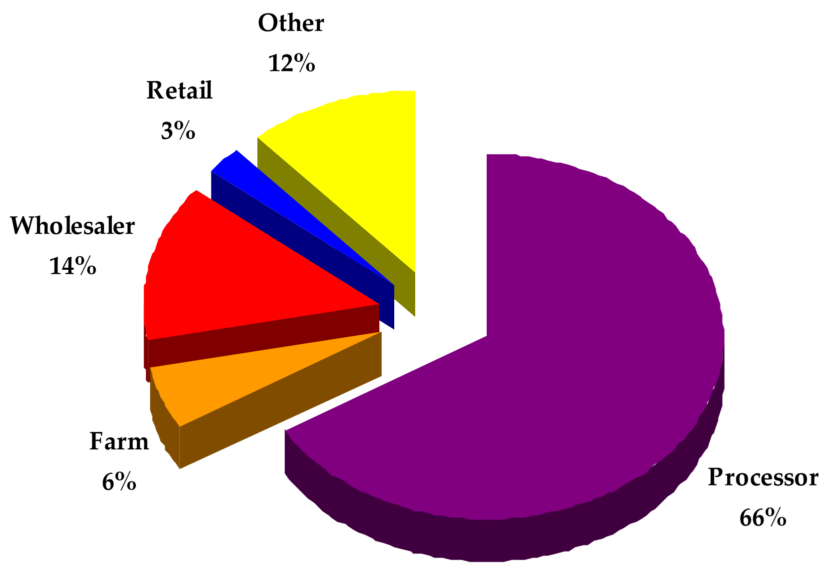
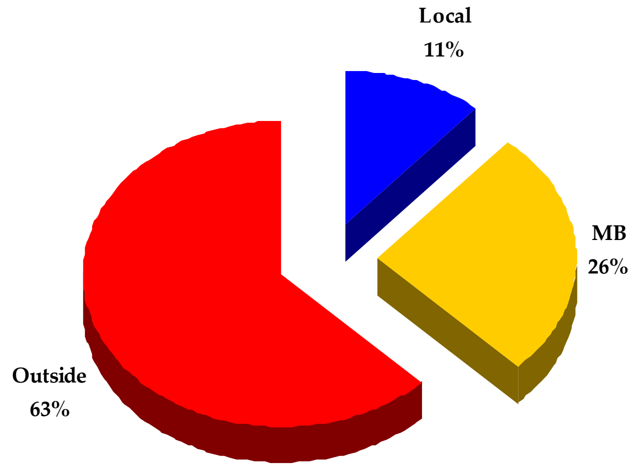


Figure 7.2 shows, on average the locations where wholesalers sourced their products. “Local” indicates any area within 50 kilometres of the wholesalers site, “within Manitoba (MB)” accounts for anything within the province, and “outside MB” refers to any locations outside Manitoba borders, either domestic or international.

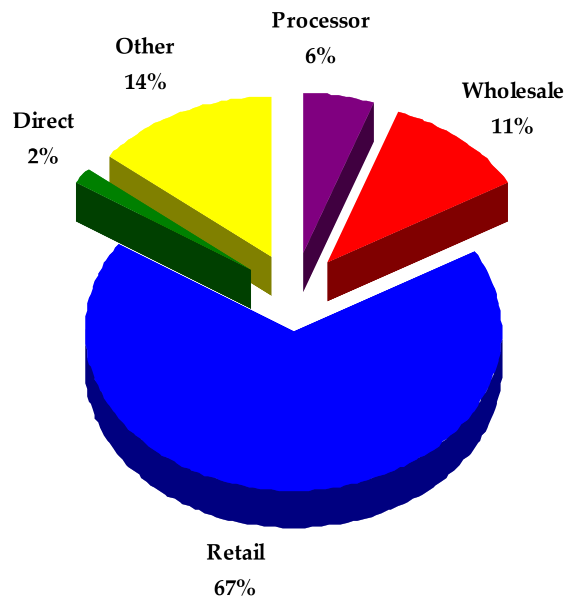
Figure 7.2: Wholesaler Sourcing by Location



The majority of wholesalers surveyed sourced most of their products from outside of Manitoba, while 37% of products were sourced from inside the province with 11% of being local.

Figure 7.3 shows the distribution of products from wholesalers to various industries. Most of the distribution is headed for retailers. The other category makes up the next largest section at 14%. It is comprised of restaurants, food service providers, schools, and healthcare[70].

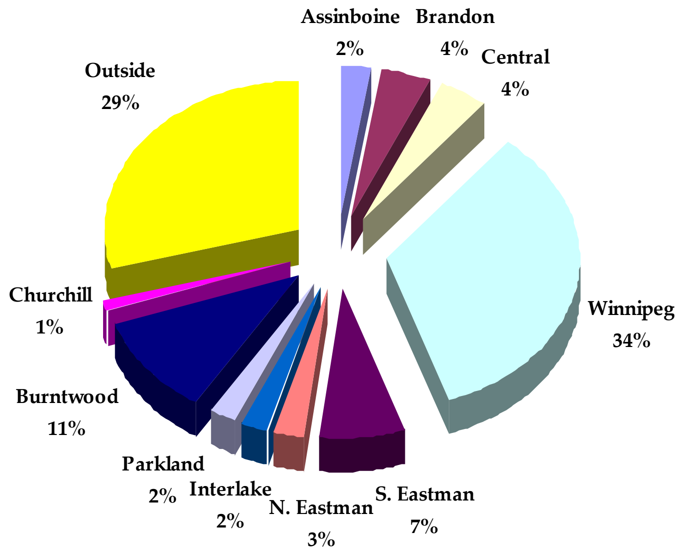
Figure 7.3: Wholesaler Distribution by Industry



[70] A further breakdown of this data is not available.

Figure 7.4 displays the locations in Manitoba where wholesalers distribute their products. On average, Winnipeg is the most important destination at 34%, with outside Manitoba following at 29%. The Norman RHA had no shipments however some of the 11% accounted by Burntwood can most likely be attributed to the Norman region through Thompson.

Figure 7.4: Wholesaler Distribution by RHA



7.3 Retailers

Figure 7.5 displays the industries that retailers source their products from. Among the retailers surveyed, on average, 63% of products were sourced from wholesalers, while 22% were sourced from regional distribution centres (essentially warehouses dedicated to the chain).

Figure 7.5: Retailer Sourcing by Industry

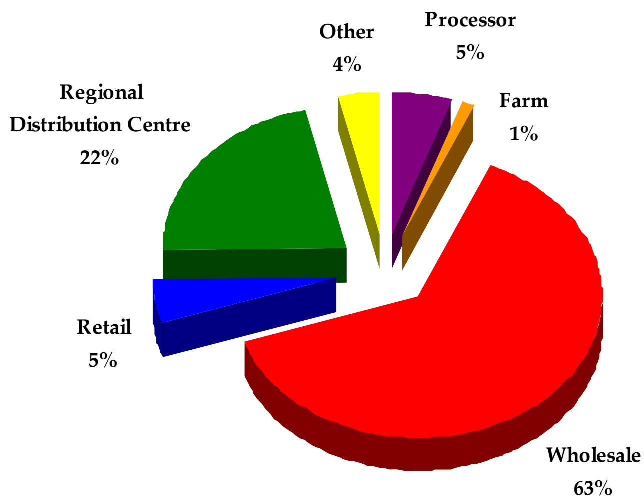
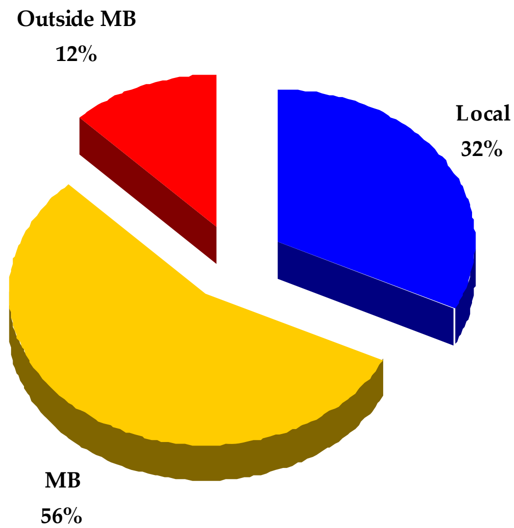


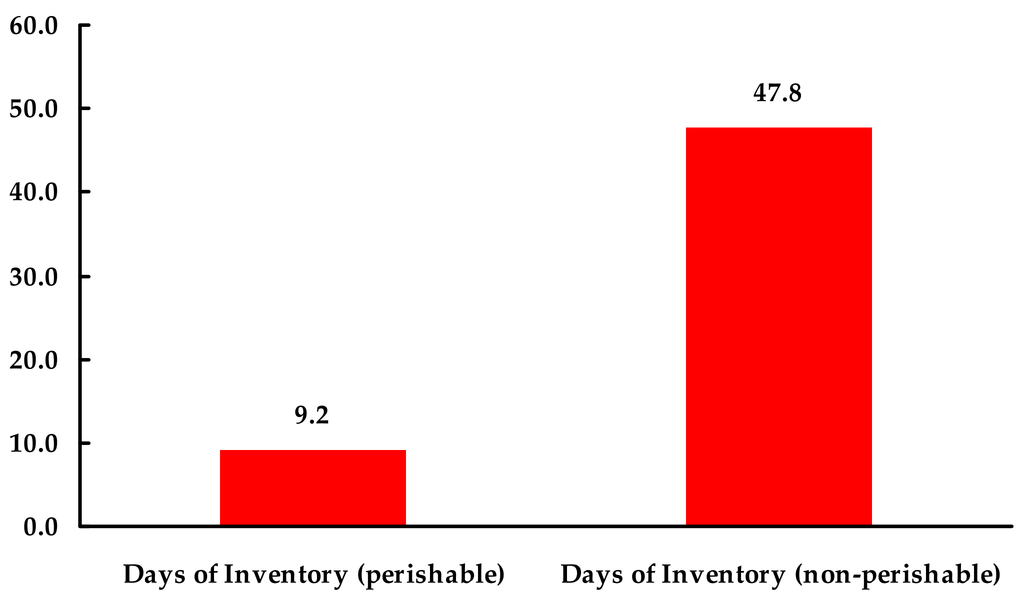
Figure 7.6 shows on average where the retailers surveyed sourced their products. Approximately 88% of products were sourced from inside the province, with 32% being sourced within 50 kilometres of retail stores. The remaining 12% of products were sourced from outside of Manitoba.

Figure 7.6: Retailer Sourcing by Location



Retailers were asked how many days of perishable and non-perishable inventory their stores contained. Based on the respondents, on average, retail stores contained 9 days of perishable inventory and 48 days of non-perishable inventory.

Figure 7.7: Retailer Inventory



7.4 Transportation Availability

Transportation firms, specifically common carrier truckers, were surveyed for the purpose of determining the availability of equipment to move food products within in Manitoba. Processor and wholesaler firms were also queried as to the availability of fleets they privately operate.

7.4.1 Equipment Available

Supplying nutrition to Manitobans is dependent on the availability of equipment to move food within the province. The bulk of food supplies flow through Winnipeg and then are redistributed to their ultimate destinations. A variety of transportation equipment is available throughout the province. For the transportation and distribution of food, several common equipment types will be used. These would be Cube Vans (both refrigerated - "Reefer" and non-refrigerated) and Tractors (Semi) pulling both Dry Van and Refrigerated (Reefer) trailers (typically 53 feet).

Transportation firms were asked the number of each equipment type they operated. As well, other members of the food supply chain were queried as to the types of transportation equipment they directly owned.

As some of these firms are national carriers, their responses included fleets that operate across Canada and in the United States. As a follow up question, firms were asked what percentage on average of each equipment type is typically located in Manitoba. This number would include equipment that was either based in Manitoba (permanently), passing through Manitoba, or "resting" in Manitoba. The data shown is based on the responses of participating medium and large transportation firms[71].

Tables 7.6 through 7.9 provide information about the transportation equipment used by survey respondents.

Table 7.6 displays the number of units operated and the average number of equipment types located in Manitoba on any given day.

Table 7.6: Transportation Equipment Operated - Survey Results

Equipment Type	# Operated	Average # Located in MB
Cube Van (Non-Refrigerated)	775	97
Cube Van (Refrigerated)	48	17
Tractor	4,674	1,394
Dry Van 53' (Trailer)	5,270	1,302
53' Refrigerated Trailer	1,177	440

[71] Medium firms had 50 to 100 drivers, and large firms had more than 100 or more drivers.

The availability of refrigerated equipment (cube vans and 53' trailers) is about one third that of dry vans. On average there are 440 refrigerated 53' foot refrigerated trailers available in Manitoba, compared to over 1,300 53' foot dry vans. There is a much smaller supply of cube vans. The demand for refrigerated equipment will likely be high, not only for food transportation but for other distribution and storage as well (e.g. health and medical).

In addition to transportation firms, many other types of firms (processors, abattoirs, and wholesalers) operate transport equipment. Overall, approximately 50% of these firms own and operate some type of transportation equipment. Table 7.7 shows the level of ownership by type of firm.

Table 7.7: Percent of Non Transportation Firms with Transportation Equipment - Survey Results

Industry	**# of Companies Surveyed**	**% Owning Transport Equipment**
Processor	47	44.7%
Abattoir	8	25.0%
Wholesale (Processing)	4	50.0%
Wholesale (Non-Processing)	21	71.4%

The summary of the equipment owned by surveyed non-logistics firms that were surveyed is presented in Table 7.8

Table 7.8: Types of Equipment Owned by Non Transportation Firms - Survey Results

Industry	Cube Van (Non-Refrigerated)	Cube Van (Refrigerated)	Tractor	Dry Van 53' (Trailer)	Refrigerated 53' Trailer
Processor	15	5	32	12	20
Abattoir	0	6	14	0	2
Wholesale (Processing)	1	2	0	0	3
Wholesale (Non-Processing)	10	21	38	7	111
Province	**26**	**34**	**84**	**19**	**136**

As shown in Table 7.8, unlike transportation firms, the majority of transportation equipment operated by companies in the food industry is refrigerated.

Overall, this adds greatly to the total capacity of transportation equipment operated in Manitoba. The summary of the total number of units is presented in Table 7.9.

Table 7.9: Total Equipment by Type - Survey Results

Industry	Cube Van (Non-Refrigerated)	Cube Van (Refrigerated)	Tractor	Dry Van 53' (Trailer)	Refrigerated 53' Trailer
Transportation Firms	97	17	1,394	1,302	440
Processors etc.	26	34	84	19	136
Province	**123**	**51**	**1,478**	**1,321**	**576**

Overall, approximately 30% of Manitoba's transportation equipment (Cube Vans and 53' Trailers) is refrigerated. This is based strictly on the data provided by medium and large firms that participated in the study. In addition to the equipment listed, there are numerous transportation and logistics firms operating throughout Manitoba that were not included. These firms range in size from national carriers to owner-operators running a single tractor. Similarly, there are additional trailer types that were not included in our summary that could be readily used (e.g. alternate sized Dry Vans and Refrigerated Trailers) or adapted in the event of an emergency (e.g. flat decks, step decks, and tankers)

To better account for the total population of trucks in Manitoba, Manitoba Public Insurance (the Registrar of vehicles) provided data for 2006. According to MPI there were approximately 2,112 cube-vans, 33,381 transport trailers, and 8,888 tractor units registered in Manitoba. Based on the survey results of Manitoba logistics and processing firms these were split into refrigerated and non-refrigerated categories. The estimated amount of equipment is shown in Table 7.10.

Table 7.10: Available Transportation Equipment – Estimate of Total Population

	Cube Van (Non-Refrigerated)	Cube Van (Refrigerated)	Tractor	Dry Van 53' (Trailer)	Refrigerated 53' Trailer
Registered (MPI)	2,112		8,888	33,381	
Total Manitoba	1,916[72]	196	8,888	26,742	6,639
Available Manitoba	1,916	196	2,761	6,679	2,912

From a planning perspective this is likely the maximum amount of transportation equipment capacity.

[72] Most cube vans registered in Manitoba would operate exclusively in Manitoba.

7.4.2 Drivers Available

Without licensed and skilled personnel, the available supply of transportation equipment is almost useless. Transportation firms that were surveyed were also asked about the number of drivers they employed, the number of these drivers that were residents of Manitoba, and the average number of company drivers that could be found in Manitoba on a given day (either working or resting). Table 7.11 displays the number of drivers who are residents of Manitoba and the average number of drivers who are located in Manitoba on any given day, as reported on the surveys.

Table 7.11: Drivers Employed by Transportation Firms - Survey Results

Total # of Drivers	MB Residents	Average # of Drivers Located in MB
6,513	3,197	1,316

Manitoba Public Insurance also provided information related to the number of drivers with class 1 licenses, who are thereby eligible to operate heavy trucks. According to MPI in 2006 there were 33,977 Class 1 license holders in the province. Allocating these based on the average number located in Manitoba from the survey data suggests that there potentially 15,000 eligible drivers in the province as shown in Table 7.12.

Table 7.12: Potential Number of Class 1 Drivers – Estimate of Total Population

Based on 2006 MPI Data	**# of Drivers**
Total # of Drivers	33,977
Average # of Available Drivers	14,498

This is likely to be a high estimate since many of these Class 1 licensed drivers may have previously worked in the industry and have maintained their Class 1 status but will not be available if called upon.

If drivers are recalled or return home as a pandemic develops, the number of drivers who are Manitoban residents can provide a rough estimate of the number of drivers available in the province. Based on Table 7.11, the minimum would be nearly 3,200 drivers that are residents of Manitoba. Based on Table 7.12 the maximum would be nearly 34,000 drivers.

In the event that the provincial borders were closed with limited warning, the average number of drivers in Manitoba can be used to provide an estimate of the number of drivers that would remain in the province. As illustrated in Table 7.11, on average there are over 1,300 drivers in Manitoba at any given time. Based on the information in Table 7.12, the maximum would be nearly 15,000 drivers.

7.4.3 Fuel Supplies

While strictly outside the scope of this research, logistics survey participants were asked if they operated any fuel depots. Among the 55 respondents, 11 operated independent fuel supplies. The summary of the locations (RHA) of these facilities is found in Table 7.13.

Table 7.13: Number of Fuel Depots Operated by Logistics Companies

RHA	# Fuel Depots
Winnipeg	5
Assiniboine	1
Central	2
South Eastman	2
Burntwood	1
Province	**11**

SECTION 8 : HOUSEHOLD RESPONSE TO PANDEMIC CONDITIONS

8.1 Introduction

An important consideration in nutrition planning in the event of a pandemic is the expected response of households to pandemic conditions. In addition to the health planning assumption that 35% of the workforce will be either absent due to the influenza or caregiving for household members who have the influenza, two other factors enter into the planning.

The first is the amount of food stocks held by households prior to a pandemic and the likely change in stock holding of nutrition as a pandemic advances. Will households stock up on food in the event of a pandemic? If so, the amount of nutrition required and water safety stocks needed in any particular region can be decreased. The second is migration behavior in the event of a pandemic emerging. Will households move to what are viewed as more secure locations? If so, then the plan must provide for nutrition being increased in regions where in migration is likely to occur, and reduced in regions where out migration is likely to occur.

To gain a better understanding of these factors, a survey was developed (Appendix H) and fielded starting the week of November 19, 2007. A telephone approach was used with the study divided into three groups – Winnipeg, rural not North, and northern Manitoba[73]. A quota approach was used, with the telephone survey organization randomly calling households in each region until the desired count was reached. The count and statistical accuracy by region is shown in the following table.

Table 8.1: Consumer Safety Stock Survey Quotas and Accuracy

Region	Estimated Households	Count	Weighted Count	Accuracy
Winnipeg	250,000	171	268	+ or – 7.5% @ 95% Confidence
Rural	132,000	209	142	+ or – 7.5% @ 95% Confidence
North	37,000	99	40	+ or – 10.5% @ 95% Confidence
All of Manitoba	419,000	476	450	+ or – 5% @ 95% Confidence

[73] The definition was based on postal codes forward sortation areas, and does not match directly to the pandemic planning areas.

8.2 Likely Consumer Response to a Pandemic

Four questions in the survey provide specific information that are needed for development of the nutrition plan. These are as follows:

Thinking about the chance of a flu pandemic occurring in Manitoba, do you believe that **(READ LIST)**:

A pandemic will definitely occur within in the next 5 years	◎
There is a good chance of a pandemic occurring within the next 5 years	◎
There is only a slight chance of a pandemic occurring within the next 5 years, or	◎
There is no chance of a pandemic occurring within the next 5 years	◎
DO NOT READ Don't Know/ Not Stated	◎

If a flu pandemic were announced as being about to start, how likely are you to stock up on food? Would you be…….. **(READ LIST)**?

Very likely to stock up	◎
Somewhat likely to stock up	◎
Somewhat unlikely to stock up or	◎
Not at all likely to stock up	◎
DO NOT READ Don't Know/ Not Stated	◎

Some researchers suggest that some households will temporarily move to other communities in the province to limit their exposure in the event of a pandemic. If a pandemic were to occur in Manitoba, how likely are you and your household to move? Would you be…….. **(READ LIST)**?

Very likely to move	◎
Somewhat likely to move	◎
Somewhat unlikely to move, or	◎
Not at all likely to move	◎
DO NOT READ Don't Know/ Not Stated	◎

Thinking about the types of plans or preparations you may have made, how well prepared do you believe your household is for a flu pandemic, should one occur in Manitoba? Would you say you ……… **(READ LIST)**:

Have plans in place and are completely prepared for such an event,	◎
Have started to make plans but are only partially prepared,	◎
Have thought about it, but have not made any preparations, or	◎
Have not thought about planning, and are completely unprepared for a pandemic	◎
DO NOT READ Don't Know/ Not Stated	◎

Table 8.2 shows the response to the question related to the likelihood of a pandemic occurring by region.

Table 8.2: Likelihood of a Pandemic Occurring

	Percent of Respondents				
Region:	Definitely Occur	Good Chance	Slight Chance	No Chance	Don't know Not stated
Winnipeg	3.5	23.4	59.1	6.4	7.6
Rural	1.0	23.0	60.3	9.1	6.7
North	3.1	29.2	52.1	10.4	5.2
Province	2.7	23.8	58.8	7.6	7.1

Only 26.5% of Manitobans believe that there is a good chance that a pandemic will occur or that a pandemic will definitely occur. Views in this regard were higher in the north and lower in rural Manitoba.

Table 8.3 shows safety stock building actions by Manitobans if a pandemic were to occur.

Table 8.3: Likelihood of Stocking Up on Food Percentage of Respondents

	Percentage of Respondents				
Region:	Very Likely	Somewhat Likely	Unlikely	Not at all Likely	Don't know/ Not stated
Winnipeg	38.8	40.3	8.2	9.7	3
Rural	28.2	48.3	11.0	9.6	2.9
North	41.5	34.0	7.4	17.0	0
Province	34.3	42.8	9.4	11.2	2.3

If pandemic were to occur Manitobans will stock up on food supplies. Overall 34.3% of Manitobans are very likely to stock up and 42.8% are somewhat likely to stock up.

With respect to migration Table 8.4 shows the views of Manitobans

Table 8.4: Likelihood of Moving, Percentage of Respondents

	Percentage of Respondents				
Region:	Very Likely	Somewhat Likely	Unlikely	Not at all Likely	Don't know/ Not stated
Winnipeg	6	11.9	14.9	65.7	1.5
Rural	0.5	5.3	11.5	81.3	1.4
North	1.1	1.1	9.6	88.3	0
Province	2.3	6.4	12.1	78.0	1.1

Manitobans are not likely to move in event of a pandemic. Overall 78% of Manitobans stated they were "not likely at all" to move, and a further 12.1% stated it was "unlikely".

In rural and northern Manitoba resistance to moving was stronger, while in Winnipeg it was lower.

With respect to preparation for a pandemic, the overall level of preparation is low, as shown in Table 8.5

Table 8.5: State of Preparedness for a Pandemic

	Percentage of Respondents				
Region:	Have plans	Have started to make plans	Have thought about it	Have Not thought about it	Don't know/ Not stated
Winnipeg	6.0	11.9	28.4	53.0	0.7
South	9.1	15.3	27.3	46.4	1.9
North	8.5	10.6	27.7	52.1	1.1
Province	8.0	13.3	27.7	49.7	1.4

Generally, Manitobans are not prepared for a pandemic. Only 8% of Manitobans have plans, while 13.3% have started to make plans. Almost 50% of Manitobans have not thought about it.

SECTION 9 : MODELLING THE MANITOBA NUTRITION SUPPLY CHAIN

9.1 Background

Nutrition systems worldwide have changed essentially from a supply driven approach to one where farmers make investments for future production where the prime consideration is whether there is a market that will offer sufficient return to justify the risks to be undertaken[74]. Nutrition supply chains are usually modeled on the basis of advantages of cooperation in supply chains and establishing consumer value by adding tangible and intangible assets to products.

Practices such as just-in-time have reduced inventories and the number of suppliers. In addition, there is evidence to suggest that firms have also reduced the number of locations in which they store their ingredients and products[75].

Tracking and managing supply chains, including food supply chains, are becoming more complicated due to these circumstances particularly with the growth of the globalization of the food supply. Modeling nutrition supply chains and assessing risks provides information for decision making on the resilience of the assorted chains.

Generally, a pandemic will make the food supply chain more vulnerable. Food and other essential goods (i.e. medication) may be only available in limited supply. The processing and distribution of food supplies could be dramatically disrupted, emptying grocery store shelves and creating crippling shortages for several months. As soon as global travel and trade is shut down, there will be very few areas that will be hit as quickly as will be food, given its perishable nature[76].

In a large scale emergency, governments, on their own, may not be able to provide safety and security to citizens alone and so there is a need of public-private sector collaboration[77]. Governments may be able to use different pieces of legislation to redirect food supplies, set food prices, storage and distribution of food during a Level 6 influenza pandemic[78]. This analysis focuses on strengthening public and private sector resilience to a pandemic, using market signals to direct resources where feasible.

One of the first steps in any emergency is to secure the nutrition supply chain. This requires insight into the chain and the players involved. Modeling the supply chain is

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[74] Smith, et al., Foodmiles final report, DEFRA, Government of UK, 2005
[75] Ibid, page 7, Annex 2
[76] Branswell, Flu Pandemic would disrupt food supplies, The Vancouver Sun, Jun 17, 2005, page 3
[77] Cohen, Public-private collaboration, Government can't do it alone, Frontline Security, 2006, page 1
[78] Galloway, Government, industry plan for food shortage during flu pandemic, The Globe and Mail, Mar. 26, page 1

the first step in this direction. Knowing the capacities, nutritional requirements spatially is the next.

9.2 Modeling Supply Chains

Logistic systems are usually complex and include many cause-effect relationships. This tasks gets further complicated and the model becomes more dynamic in the case of an emergency which induces many uncertainties in the model and many changes throughout the supply chain. Understanding the overall supply chain process, characteristics, and system dynamics[79] enables a better response.

The impact of a poor plan can cause unbalanced capacities, uncertain production plans, overly large shortages and excesses and high backlog. A model developed on a spatial platform is capable of handling and optimizing the flows as demand, supply and capacities change with the onset of a pandemic, and through its various stages. Simulation tools aid the human planner to visualize the whole chain, and the affects of changing parameters. It also enables better decision making and provides better information. This creates better insight of the overall supply chain, and can dramatically increase the resilience needed for emergency planning. Various alternatives could be tested before changing the plans, and this is especially critical when the dynamics on the ground are changing[80,81].

A Geographic Information System (GIS) is an automated information system that is able to compile, store, retrieve, analyze, and display mapped data[82]. Today, it is used by government officials, natural resource and social analysts, and many others. Its applications include environmental research and model building, urban demographic studies, and transportation analysis to mention only a few. GISs allow the storage, retrieval, and analysis of the mapped data to be performed by the computers. Its power to analyze data and to present the results of that analysis as useful information to assist decisions makers distinguishes it from a simple mapping system. The use of GIS is driven by the need to answer geographical or spatial questions.

The conventional modeling approach in a non-GIS environment employs digitization of the paper-based engineering drawings. This process is very tedious, costly, and time consuming. Thus, non-GIS models typically employ skeletal data as an approximation of the true data. For example, the effort in coding an entire street network for large metropolitan areas has proven prohibitive even for large government organizations.

[79] Laurikkala et al., Modeling and control of supply chain with systems theory, ELO Logistics Tech, 2006, page 7
[80] Chang et al., Supply chain modeling using simulation, I.J. of Simulation, Vol. 2, No.1, 2001, page 1
[81] This was the reason for selecting a GIS based system that specializes in the analysis of transportation problems (TransCAD) and which can handle data where inputs are changing.
[82] Falbo, Daniel et al., Introduction to data analysis using GIS, University of Minnesota, 2002, page 1

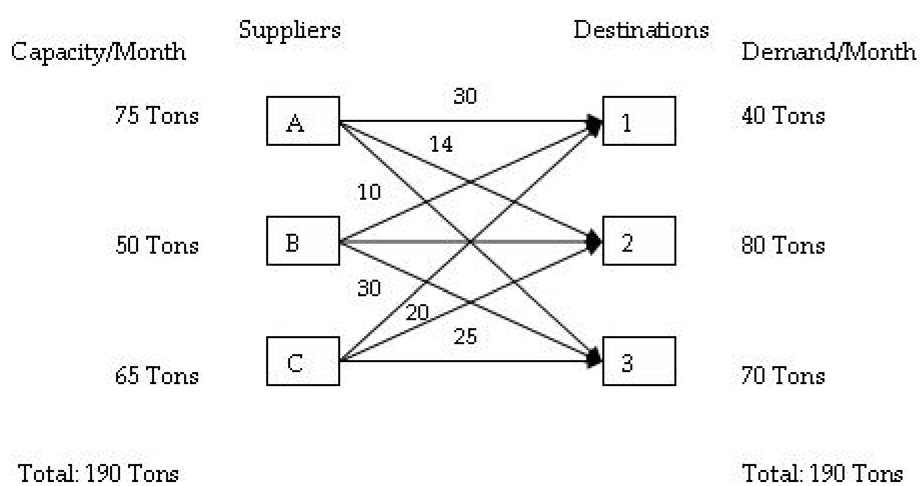
Updating networks in a non-GIS environment is equally cumbersome. The consequence being that more often than not, such updates are not performed regularly.

GIS data sets are capable of addressing the above-mentioned shortcomings. For almost all jurisdictions in North America and Western Europe, digital road network files are readily available from the government agencies or the private sector. Even in developing countries, such as Pakistan and India, digitized road networks are now available for major metropolitan areas. These networks become a ready input into the transportation problem or other similar analysis problems, which eliminates the need to digitize paper-based street maps[83].

9.3 Conceptual Overview of the Nutrition Supply Chain Model for Manitoba

The 'Transportation model' described below was selected as the underlying model for modeling the nutrition supply chain. The model considers various suppliers, final destinations and alternate routes. The model is very useful in the allocation of supplies. It does this by considering "a single criteria" which can be either a "maximizing" or a "minimizing" problem. For example, it can be an allocation of supply based on minimum costs or maximizing flows of nutritional value or profits.

Figure 9.1: Balanced Supply and Demand

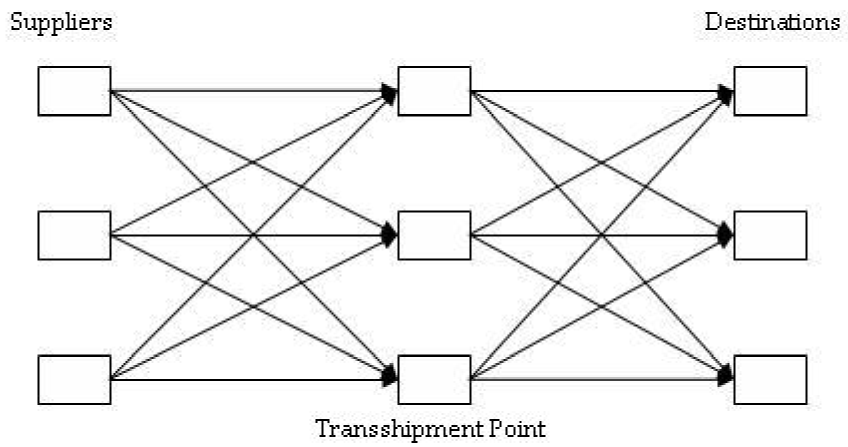


The model shown in Figure 9.1 is that of a balanced supply and demand, where demand equals supply. The model can be extended by considering one or more transshipment points in between supply and demand as shown in Figure 9.2. Supply and demand can also be in an unbalanced form, for example, the supply can be more than the demand, or

[83] Haidar, The design and development of large-scale traffic assignment models, TRB Annual meeting, 2006, page 3

the demand can outpace the supply. The unbalanced problem is a more likely occurrence[84] and is what is expected in Manitoba with respect to nutrition.

Figure 9.2: Transshipment Model



The example shown in Figure 9.2 is very simple consisting of 3 suppliers and 3 destinations. The model can grow dramatically in complexity once the number of suppliers and destinations increase. For example in a situation of 20 suppliers and 50 destinations there are about 1000 alternate route possibilities.

Sensitivity analysis can be performed on the model by testing it under various scenarios and conditions such as altering routes, adding new routes, prohibiting some routes or changing the demand values or the capacity (supply side) values. All these scenarios can be "real" under a Level 6 pandemic, where supplies can suddenly disappear or be reduced. Some routes may not be feasible. Demand may dramatically rise in a few destinations due to panic buying, or later on subside or change due to demographic movements.

The nutrition supply chain in the province can also be viewed in terms of a Location-Allocation problem. This involves multiple market areas, multiple facility locations, known demand at the various areas, and known transportation costs from potential facilities to destinations.

[84] Bernard Taylor, Introduction to Management Science 9th Ed., Pearson Prentice Hall, 2007, page 225

For the sake of simplicity, it can be assumed that each potential facility location is suitable to produce one product. The variables for the problem are defined as follows:

xij = quantity of the product transported from facility i to area j
cij = transportation cost per unit of product from facility i to area j
Ki = production capacity at facility i
Fi = total fixed cost at facility i
Di = demand for the product in market area j
yi = 1 if facility location i is selected, 0 otherwise

The model can be developed as follows:

$$\text{Minimize } Z = \sum_{i=1}^{n} \sum_{j=1}^{n} cij\ xj + \sum_{i=1}^{m} Fiyi$$

Subject to

$$xij < Kiyi \quad (i=1,2,3,\ldots,m)$$
$$xij > Dj \quad (j=1,2,3,\ldots,n)$$
$$yj = 0 \text{ or } 1$$

In the case of the present study the approach used will be to minimize the total cost of delivery, or Z, by considering the travel time between each origin and destination, and minimizing it[85].

The procedure for solving this problem uses an adaptation of the simplex method for linear programming. The algorithm is based on an important characteristic of the Hitchcock[86] problem: when the optimal solution is reached, the number of links carrying flows equals the minimum number of links that can connect supply nodes to demand nodes and all other links are empty. The algorithm starts with an initial feasible solution with this minimum number of flow carrying nodes, then checks whether the solution can be improved by using a currently empty link. If such a link is found, the algorithm determines the amount of flow that can be assigned to the new link without violating any constraint, adjusts the flow on all other flow carrying links, and updates the network. The process repeats until no further improvement can be found by switching links[87].

The process to solve the problem involves identifying the most efficient way to service a set of destinations from a set of origins. This type of problem is solved by finding the least cost solution for shipping a commodity from multiple origins to multiple destinations. The cost can be expressed in terms of distance, travel time, dollar shipping

[85] Lee, Sang et al., Management Science, 3rd Ed., Wm. C. Brown Publishers, 1990, page 746
[86] Bernard Taylor. Introduction to Management Science, 9th Ed. Prentice Hall, 2007, page 225.
[87] TransCAD Transportation GIS Software users guide, Caliper Corporation, 2006

cost, or any user-defined variable. In the case of Manitoba nutrition supply planning travel time was used as the criteria. Any number of destinations can be serviced from a single origin, and multiple origins may service a single destination. TransCAD solves the Transportation problem for cases where supply and demand are equal, supply exceeds demand, or demand exceeds supply.

9.4 Data Used in the Analysis

The model used four data sets. These were:

- Digitized Street Network CanMap Route Logistics (Roads MBrte) Version 2005.3, developed by DMTI Spatial Inc[88].

- Multiple Enhanced Postal Codes v7.2, developed by DMTI Spatial Inc.

  A postal code, or "FSA LDU" is defined and maintained by the Canada Post Corporation for the sorting and delivery of mail. The first three characters of a postal code represent the Forward Sortation Area (FSA), which indicates a geographic area. The last three characters represent the Local Delivery Unit (LDU), and indicates a specific business or residential point of delivery within a FSA.

  The data set includes information such as Postal Code, census division, unique identifiers, type of census division, community name, delivery mode, census population, positional details[89].

  There were cases of duplicative postal codes in the DMTI data set. Many postal codes have been retired and many locations had multiple postal codes. The retired postal codes were removed by creating a selection set, and the data was connected to the postal code layer file, using one-to-one connection, thus eliminating duplicate postal codes. Each postal code in this data set was tagged to a unique node from the street layer, which is a requirement for analysis.

- Manitoba Regional Health Authority (RHA) Data (MB-PCCF June 2007)

  The MB-PCCF originated as a collaborative effort involving Manitoba Health, the Manitoba Centre for Health Policy, Cancer Care Manitoba, First Nation and Inuit Health Branch of Health Canada and the Winnipeg RHA (WRHA). This data set is updated annually by Manitoba Health.

[88] DMTI Spatial Inc. publishes street map and routing data. Additionally it publishes a full range of positionally accurate geospatial data products, census data and boundaries, postal geography etc.
[89] Multiple Enhanced Postal Codes v7.2 user manual, DMTI Spatial Inc., August 2003, page 6

- MB-PCCF includes:
  - A postal code conversion file (PCCF). It is a tool that can be used to geo-code event records which contain a 6 digit postal code to the administrative geographies used for the planning and delivery of health services in the province. It covers the RHAs (RHAs), the Community Areas (CA), and the Neighbourhood Clusters (NC) for the Winnipeg.
  - Population Denominator Files. Population data is included for the years 1984-2006.
  - Base Map Files: Three base map files are included for each of the administrative health geographies. Only the RHA boundary set was used in the model. It was received as ESRI shape file format which was then converted into the Standard format that TransCAD requires for analysis[90].

- Survey data collected by UMTI related to Food processing and the Manitoba Food Supply Chain

9.5 Model Preparation

To solve the transportation problem through the TransCAD software, the following data was prepared:

- A "point layer" containing the origins and destinations, or one layer for the origins and another for destinations.
- If the origin and destinations are in the same layer, a selection set of origins and a selection set of destinations.
- A cost matrix indicating the cost of shipping (travel time) a unit of product from each origin to each destination.

The output of the transportation problem procedure is a matrix of flows that indicate the quantity of product to be shipped from each origin to each destination.

In order to simplify the process, one postal code was chosen in each RHA as a supply point and another as a demand point. The production capacity of each type of nutrient vector in that region was aggregated to this chosen supply point, and the nutrient requirements of the population of the region were aggregated at the chosen demand

[90] MB – PCCF files user manual, Manitoba Health, June 2007, page 4

point. These postal codes were situated in a major city of each region. Since there are 11 RHAs in Manitoba, the data consisted of 11 supply and 11 demand points in the province. Approximately 10 of these supply/demand points are connected to each other through the road network, whereas the 11th set of points, representing the region of Churchill, was isolated as it is not connected via any road network, but through the railway line and airport.

SECTION 10 : MANITOBA NUTRITION SUPPLY CHAIN VULNERABITIY SCENARIO ANALYSIS

10.1 Introduction

In order to better understand the risks to the Manitoba nutrition supply chain, and sensitivity to vulnerabilities described in Section 11, the techniques of Section 9, and the information in Sections 3 through 8 were used for a scenario analysis of the Manitoba nutrition supply chain. The objective of the models were to test (stress test) the risk to nutrition flows in the Manitoba food supply chain[91], given that overall supplies are likely to be adequate in the event of a pandemic and the borders closing. In doing the analysis, the status quo scenario, which was an optimized supply chain for each nutrient, was compared to the optimized supply chain under the adverse scenario[92]. Models were constructed for each type of nutritional item.

For each type of nutritional items three key stresses were tested. These were:

- The total supply of the nutrients decreases by 35%.
- Production ceases in Winnipeg.
- Migration occurs with 2.5% of Winnipeg's population moving to the South Eastman RHA and 2.5% to the Central RHA.

This section provides the results for the major nutrient categories; proteins, carbohydrates, fibre, fat, calcium and iron. Appendix I provides scenarios for other nutrients, (sodium, potassium, vitamin A, vitamin C, vitamin B6, folate, thiamin, riboflavin, and niacin) as well as the combined effect of a supply decrease of 35% for nutrients coupled with migration from Winnipeg for proteins, carbohydrates and fat.

10.2 Proteins

The major sources of proteins in the province are the Central, Assiniboine, and Brandon RHAs. The Winnipeg and South Eastman RHAs are also important suppliers. The major demand centres are the Winnipeg, Central, Interlake and Assiniboine RHAs.

In the status quo scenario the most cost effective distribution is shown in Table 10.1. In this optimized framework, Winnipeg meets all of its demand and also supplies proteins to the Interlake and North Eastman RHAs. The Parkland RHA meets all of its requirements and the little surplus that it has (89 kilograms) is used to meet the demand of the Norman RHA. The Interlake, Central, Brandon, Assiniboine and South Eastman

[91] The ability to review possible alternate nutrient flows, will be critical if a pandemic occurs.
[92] These are the optimized flows, and may differ from actual flows.

are self sufficient RHAs and also have substantial surpluses. Brandon also provides nutrition to the Norman RHA.

The North Eastman and Norman RHAs are the most vulnerable areas and depend on other RHAs for most of their requirements. The daily requirements for the Churchill RHA are small. In these RHAs stocks will need to be held.

Table 10.1: Optimized Flows of Protein: Status Quo[93]
(kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	3,186										**3,186**
	Brandon		2,305				825					**3,130**
	Central				4,612							**4,612**
	Interlake			1,976								**1,976**
	Norman						174					**174**
	N. Eastman							156				**156**
	Parkland						89		1,928			**2,017**
	S. Eastman									2,777		**2,777**
	Winnipeg					3,574		1,697			31,108	**36,379**
	Province	**3,186**	**2,305**	**1,976**	**4,612**	**3,574**	**1,088**	**1,853**	**1,928**	**2,777**	**31,108**	**54,407**

10.2.1 The Total Supply of Protein Decreases by 35%.

In this scenario the total supply of protein in the province of Manitoba was reduced by 35%. This change alters the status quo flows as follows:

- The RHAs that have surpluses are the same but the amount of surplus is somewhat reduced.
- The vulnerable areas are the same.
- The Parkland RHA becomes more vulnerable with part of its needs are being met by Brandon.

[93] The status quo represents the most cost effective method of moving food. Actual patterns may vary form the status quo. The objective of the analysis is to show how patterns might change.

Table 10.2 shows the flows in this scenario.

Table 10.2: Optimized Flows of Protein: 35% Production Reduction (kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	3,186										**3,186**
	Brandon		2,305				975		617			**3,897**
	Central				4,612							**4,612**
	Interlake			1,976								**1,976**
	Norman						113					**113**
	N. Eastman							101				**101**
	Parkland								1,311			**1,311**
	S. Eastman									2,777		**2,777**
	Winnipeg					3,574		1,752			31,108	**36,434**
	Province	**3,186**	**2,305**	**1,976**	**4,612**	**3,574**	**1,088**	**1,853**	**1,928**	**2,777**	**31,108**	**54,407**

10.2.2 Protein Production Ceases in Winnipeg

Table 10.3 shows the change in flows where production ceases in the Winnipeg RHA. The effect of this change is as follows:

- Winnipeg's needs are met by the Central RHA and partly by the Interlake RHA. Winnipeg would need to create stocks of proteins.
- The needs of the Interlake RHA are filled from within the Interlake.
- The South Eastman RHA becomes the main supplier to North Eastman RHA

Table 10.3: Optimized Flows of Protein: Production Ceases in Winnipeg (kg)

		Destination:										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin:	Assiniboine	3,186										**3,186**
	Brandon		2,305				825					**3,130**
	Central				4,612						29,368	**33,980**
	Interlake			1,976		3,574					1,740	**7,290**
	Norman						174					**174**
	N. Eastman							156				**156**
	Parkland						89		1,928			**2,017**
	S. Eastman							1,697		2,777		**4,474**
	Winnipeg											**0**
	Province	**3,186**	**2,305**	**1,976**	**4,612**	**3,574**	**1,088**	**1,853**	**1,928**	**2,777**	**31,108**	**54,407**

10.2.3 Migration from Winnipeg

The effect of the total 5% migration from Winnipeg would be an increase in demand in the Central and South Eastman RHAs. It does not have a significant impact as there is are surpluses in the Central and South Eastman RHAs.

Table 10.4 shows the optimized flows in this scenario. There is little change from the status quo scenario other than that the protein requirements in the Central and South Eastman RHAs increase while those in the Winnipeg RHA decrease.

Table 10.4: Optimized Flows of Protein: 5% Migration from Winnipeg (kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	3,186										**3,186**
	Brandon		2,305				825					**3,130**
	Central				5,390							**5,390**
	Interlake			1,976								**1,976**
	Norman						174					**174**
	N. Eastman							156				**156**
	Parkland						89		1,928			**2,017**
	S. Eastman									3,560		**3,560**
	Winnipeg					3,574		1,697			29,547	**34,817**
	Province	**3,186**	**2,305**	**1,976**	**5,390**	**3,574**	**1,088**	**1,853**	**1,928**	**3,560**	**29,547**	**54,407**

10.3 Carbohydrates

In the status quo scenario the most cost effective distribution of carbohydrates is shown in Table 10.5.

Winnipeg meets all of its demand and also supplies carbohydrates to the Interlake and North Eastman RHAs. After supplying these RHAs, Winnipeg still has a carbohydrate surplus. The Parkland RHA meets all of its internal requirements with a that meets approximately one third of the demand of Norman RHA. The Parkland RHA has no surplus at this point and in the event of a pandemic may have difficulty supporting the Norman RHA. In the optimized scenario the Norman RHA is also supported by the Brandon RHA. The North Eastman RHA receives carbohydrates from the Winnipeg RHA.

Similar to the situation with proteins the North Eastman and Norman RHAs are the most vulnerable areas and depend on other RHAs for most of their requirements. The requirements of the Churchill RHA are small and also dependent on the south.

Table 10.5: Optimized Flows of Carbohydrates: Status Quo
(kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	8,917										**8,917**
	Brandon		6,504				2,126					**8,630**
	Central											**13,297**
	Interlake			6,027								**6,027**
	Norman						126					**126**
	N. Eastman							345				**345**
	Parkland						929		5,440			**6,369**
	S. Eastman									8,022		**8,022**
	Winnipeg					10,027		4,893			87,035	**101,955**
	Province	**8,917**	**6,504**	**6,027**		**10,027**	**3,181**	**5,238**	**5,440**	**8,022**	**87,035**	**153,688**

10.3.1. The Total Supply of Carbohydrates Decreases by 35%.

Table 10.6 shows the optimized carbohydrate flows in this scenario. Relative to the status quo the changes in flows are:

- There are more vulnerable RHAs. The Brandon, Interlake, and Parkland RHAs become more vulnerable.
- The Brandon and Parkland RHAs become partially dependent on the Assiniboine RHA.
- The Interlake is less able to provide carbohydrate to Burntwood, with flows to that RHA also occurring from the Central RHA.

Table 10.6: Optimized Flows of Carbohydrates: 35% Production Reduction (kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	8,917	642				3,099		1,300			**13,958**
	Brandon		5,862									**5,862**
	Central			1,966	13,297							**15,263**
	Interlake			4,061								**4,061**
	Norman						82					**82**
	N. Eastman							224				**224**
	Parkland								4,140			**4,140**
	S. Eastman									6,986		**6,986**
	Winnipeg					10,027		5,014		1,036	87,035	**103,112**
	Province	**8,917**	**6,504**	**6,027**	**13,297**	**10,027**	**3,181**	**5,238**	**5,440**	**8,022**	**87,035**	**153,688**

10.3.2 Carbohydrate Production Ceases in Winnipeg

In this scenario as shown in Table 10.7, Winnipeg becomes dependent on the Central RHA. The Central RHA also becomes the source for the Interlake RHA, which was previously supplied by Winnipeg. The Central RHA also ships carbohydrates to the Burntwood RHA. The North Eastman RHA is supplied from South Eastman and Central RHAs.

Generally, all the RHAs of Manitoba become vulnerable to shortages of carbohydrates except the Central and Assiniboine RHAs. The Central RHA plays a very crucial role in meeting the needs of the province in this scenario.

Table 10.7: Optimized Flows of Carbohydrates: Production Ceases in Winnipeg (kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	8,917										**8,917**
	Brandon		6,504				2,126					**8,630**
	Central			6,027	13,297	3,779		2,167			87,035	**112,305**
	Interlake					6,248						**6,248**
	Norman						126					**126**
	N. Eastman							345				**345**
	Parkland						929		5,440			**6,369**
	S. Eastman							2,726		8,022		**10,748**
	Winnipeg											**0**
	Province	**8,917**	**6,504**	**6,027**	**13,297**	**10,027**	**3,181**	**5,238**	**5,440**	**8,022**	**87,035**	**153,688**

10.3.3 Migration from Winnipeg

In this scenario the only significant effect is that the South Eastman RHA becomes more vulnerable. It will be able to meet all of its demand, but will be left with a very low surplus. This scenario does not alter the situation in a substantive manner in other RHAs, as there is significant surplus of carbohydrates in the Central RHA. Table 10.8 presents the flows of carbohydrates in this scenario.

Table 10.8: Optimized Flows of Carbohydrates: 5% Migration from Winnipeg (kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	8,917										**8,917**
	Brandon		6,504				2,126					**8,630**
	Central				15,480							**15,480**
	Interlake			6,027								**6,027**
	Norman						126					**126**
	N. Eastman							345				**345**
	Parkland						929		5,440			**6,369**
	S. Eastman									10,194		**10,194**
	Winnipeg					10,027		4,893			82,680	**97,600**
	Province	**8,917**	**6,504**	**6,027**	**15,480**	**10,027**	**3,181**	**5,238**	**5,440**	**10,194**	**82,680**	**153,688**

10.4 Fibre

Based on the model, the most cost effective distribution of fibre in the status quo situation is shown in Table 10.9. Key outcomes of his scenario are:

- Other than the Assiniboine and Central RHAs most regions are fibre deficient.
- The Assiniboine RHA becomes an important supplier to the Brandon, Parkland and Norman RHAs.
- The Central RHA provides fibre to the Burntwood, Interlake, South Eastman, North Eastman and Winnipeg RHAs.

Table 10.9: Optimized Flows of Fibre: Status Quo
(kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	1,922	1,243				689		1,086			**4,940**
	Brandon		163									**163**
	Central			1,312	2,879	333		1,101		763	8,356	**14,744**
	Interlake					1,848						**1,848**
	Norman						2					**2**
	N. Eastman							39				**39**
	Parkland								84			**84**
	S. Eastman									990		**990**
	Winnipeg										10,591	**10,591**
	Province	**1,922**	**1,406**	**1,312**	**2,879**	**2,181**	**691**	**1,140**	**1,170**	**1,753**	**18,947**	**33,401**

10.4.1 The Total Supply of Fibre Decreases by 35%.

Table 10.10 shows the optimized flows of fibre when production in Manitoba decreases by 35%. This scenario suggests that even though fibre is still sufficient overall in the province, dependence on the Assiniboine and Central RHAs increases.

Table 10.10: Optimized Flows of Fibre: 35% Production Reduction
(kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	1,922	1,300				690		1,115			**5,027**
	Brandon		106									**106**
	Central			1,312	2,879	981		1,115		1,109	12,063	**19,459**
	Interlake					1,200						**1,200**
	Norman						1					**1**
	N. Eastman							25				**25**
	Parkland								55			**55**
	S. Eastman									644		**644**
	Winnipeg										6,884	**6,884**
	Province	**1,922**	**1,406**	**1,312**	**2,879**	**2,181**	**691**	**1,140**	**1,170**	**1,753**	**18,947**	**33,401**

10.4.2 Fibre Production Ceases in Winnipeg

Table 10.11 shows the flow of fibre in the event that all production in Winnipeg is lost. Similar to the preceding scenario, the main effect is to increase the dependence on the Assiniboine and Central RHAs.

Table 10.11: Optimized Flows of Fibre: Production Ceases in Winnipeg
(kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	1,922	1,243				689		1,086			**4,940**
	Brandon		163									**163**
	Central			1,312	2,879	333		1,101		763	18,947	**25,335**
	Interlake					1,848						**1,848**
	Norman						2					**2**
	N. Eastman							39				**39**
	Parkland								84			**84**
	S. Eastman									990		**990**
	Winnipeg											**0**
	Province	**1,922**	**1,406**	**1,312**	**2,879**	**2,181**	**691**	**1,140**	**1,170**	**1,753**	**18,947**	**33,401**

10.4.3. Migration from Winnipeg

Table 10.12 shows the optimum flow of fibre in a scenario where 5% of the population of Winnipeg relocates. The primary effect is to increase the requirement of fibre from the Central RHA to the South Eastman RHA, with the requirement to the Winnipeg RHA decreasing.

Table 10.12: Optimized Flows of Fibre: 5% Migration from Winnipeg (kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	1,922	1,243				689		1,086			**4,940**
	Brandon		163									**163**
	Central			1,312	3,354	333		1,101		1,235	7,409	**14,744**
	Interlake					1,848						**1,848**
	Norman						2					**2**
	N. Eastman							39				**39**
	Parkland								84			**84**
	S. Eastman									990		**990**
	Winnipeg										10,591	**10,591**
	Province	**1,922**	**1,406**	**1,312**	**3,354**	**2,181**	**691**	**1,140**	**1,170**	**2,228**	**18,000**	**33,401**

10.5 Fat

The most cost effective distribution of fat flows is shown in Table 10.13. The vulnerable RHAs are Burntwood, North Eastman, Norman and Parkland. The Parkland RHA meets much of its own demand but is somewhat dependent on the Brandon RHA. The North Eastman RHA depends on the Winnipeg RHA, while the Norman RHA has its demand met by Brandon. The Burntwood RHA is supplied by the Interlake RHA, which in turn is supplied by the Winnipeg RHA. Churchill is dependent on southern supplies.

Table 10.13: Optimized Flows of Fat: Status Quo
(kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	2,052										**2,052**
	Brandon		1,493				640		40			**2,173**
	Central				3,051							**3,051**
	Interlake			1,385								**1,385**
	Norman						90					**90**
	N. Eastman							84				**84**
	Parkland								1,212			**1,212**
	S. Eastman									1,842		**1,842**
	Winnipeg					2,307		1,121			20,015	**23,443**
	Province	**2,052**	**1,493**	**1,385**	**3,051**	**2,307**	**730**	**1,205**	**1,252**	**1,842**	**20,015**	**35,332**

10.5.1 The Total Supply of Fat Decreases by 35%.

Table 10.14 shows the optimal flow of fat when the total supply in Manitoba decreases by 35%. The main effect is that the Parkland RHA becomes increasingly vulnerable, with more of its requirements met by the Brandon RHA.

Table 10.14: Optimized Flows of Fat: 35% Production Reduction
(kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	2,052										**2,052**
	Brandon		1,493				670		462			**2,625**
	Central				3,051							**3,051**
	Interlake			1,385								**1,385**
	Norman						60					**60**
	N. Eastman							55				**55**
	Parkland								790			**790**
	S. Eastman									1,842		**1,842**
	Winnipeg					2,307		1,150			20,015	**23,472**
	Province	**2,052**	**1,493**	**1,385**	**3,051**	**2,307**	**730**	**1,842**	**1,252**	**1,205**	**20,015**	**35,332**

10.5.2 Fat Production Ceases in Winnipeg

If fat production ceased in Winnipeg the pattern of flows would be as shown in Table 10.15. The impacts are as follow:

- Winnipeg becomes dependant on the Central RHA and somewhat on the Interlake RHA.
- The Interlake RHA fills its own requirements, instead of having them filled by Winnipeg.
- Most of the North Eastman requirements are met by the South Eastman RHA.

Table 10.15: Optimized Flows of Fat: Production Ceases in Winnipeg (kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	2,052										**2,052**
	Brandon		1,493				640		40			**2,173**
	Central				3,051						17,803	**20,854**
	Interlake			1,385		2,307					2,212	**5,904**
	Norman						90					**90**
	N. Eastman							84				**84**
	Parkland								1,212			**1,212**
	S. Eastman							1,121		1,842		**2,963**
	Winnipeg											**0**
	Province	**2,052**	**1,493**	**1,385**	**3,051**	**2,307**	**730**	**1,205**	**1,252**	**1,842**	**20,015**	**35,332**

10.5.3 Migration from Winnipeg

A 5% migration of the population from Winnipeg results in the optimal flow pattern as shown in Table 10.16. The effect is an increase in the self fulfilled requirements in the Central and South Eastern RHAs, with the requirements within the Winnipeg RHA decreasing.

Table 10.16: Optimized Flows of Fibre: 5% Migration from Winnipeg (kg)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	2,052										**2,052**
	Brandon		1,493				640		40			**2,173**
	Central				3,550							**3,550**
	Interlake			1,385								**1,385**
	Norman						90					**90**
	N. Eastman							84				**84**
	Parkland								1,212			**1,212**
	S. Eastman									2,358		**2,358**
	Winnipeg					2,307		1,121			19,000	**22,428**
	Province	**2,052**	**1,493**	**1,385**	**3,550**	**2,307**	**730**	**1,205**	**1,252**	**2,358**	**19,000**	**35,332**

10.6 Calcium

The major sources of calcium rich products in the province are the Central, Winnipeg, Assiniboine, Brandon and South Eastman RHAs. The major demand centres are Winnipeg, Central RHA, Interlake and Assiniboine. The most cost effective distribution of calcium is shown Table 10.17.

Most of the demand of the Winnipeg RHA is met by its own sources, but about 46,000 grams of calcium are required to be shipped from the Central RHA daily (or about 7% of Winnipeg RHA's total needs). There is no excess capacity available in the Winnipeg RHA.

In the optimized scenario, the North Eastman RHA is almost totally dependent on the South Eastman RHA which fulfills nearly 94% of its calcium needs. Only a very little amount is available locally (6%). Similarly, the Norman RHA is totally dependent on the Brandon RHA for its needs. The local capacity in the Norman RHA is very low and meets only 10% of the total requirement. In addition to supplying the Winnipeg RHA, the Central RHA takes care of all the needs of the Burntwood RHA. The Interlake RHA is heavily dependent on South Eastman RHA, which can supply 57% of its needs cost effectively.

The most vulnerable RHAs are Norman, Interlake, Winnipeg, North Eastman and Parkland. These are the places where there is a need to stockpile calcium.

Table 10.17: Optimized Flows of Calcium: Status Quo
(g)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	73,969										**73,969**
	Brandon		52,581				22,957		40,835			**116,373**
	Central			46,951	107,416						45,513	**199,880**
	Interlake					35,229						**35,229**
	Norman						2,456					**2,456**
	N. Eastman							803				**803**
	Parkland								4,049			**4,049**
	S. Eastman					47,444		42,232		64,569		**154,245**
	Winnipeg										664,552	**664,552**
	Province	**73,969**	**52,581**	**46,951**	**107,416**	**82,673**	**25,413**	**43,035**	**44,884**	**64,569**	**710,065**	**1,251,556**

10.6.1 The Total Supply of Calcium Decreases by 35%.

Table 10.18 shows the optimized flow where calcium production decreases by 35%. Relative to the status quo, flows change in the following manner:

- The dependence of the Winnipeg RHA on the Central RHA increases to about 40% of its requirements.
- The Norman RHA would need calcium from the Assiniboine RHA in addition to Brandon RHA to meet its needs of calcium.
- The Interlake RHA is supplied by the South Eastman RHA, in addition to the Central RHA.

The remaining vulnerabilities and surplus RHAs remain the same.

Table 10.18: Optimized Flows of Calcium: 35% Production Reduction (g)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine						3,723					**3,723**
	Brandon	52,581	73,969				20,094		42,252			**188,896**
	Central			46,951	107,416	24,214					278,106	**456,687**
	Interlake					22,899						**22,899**
	Norman						1,596					**1,596**
	N. Eastman							522				**522**
	Parkland								2,632			**2,632**
	S. Eastman					35,560		42,513		64,569		**142,642**
	Winnipeg										431,959	**431,959**
	Province	**52,581**	**73,969**	**46,951**	**107,416**	**82,673**	**25,413**	**43,035**	**44,884**	**64,569**	**710,065**	**1,251,556**

10.6.2 Production Ceases in Winnipeg

In this scenario (refer to Table 10.19) the Central RHA takes care of all the needs of Winnipeg. The flow between the other RHAs does not change.

Table 10.19: Optimized Flows of Calcium: Production Ceases in Winnipeg (g)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	73,969										**73,969**
	Brandon		52,581				22,957		40,835			**116,373**
	Central			46,951	107,416						710,065	**864,432**
	Interlake					35,229						**35,229**
	Norman						2,456					**2,456**
	N. Eastman							803				**803**
	Parkland								4,049			**4,049**
	S. Eastman					47,444		42,232		64,569		**154,245**
	Winnipeg											**0**
	Province	**73,969**	**52,581**	**46,951**	**107,416**	**82,673**	**25,413**	**43,035**	**44,884**	**64,569**	**710,065**	**1,251,556**

10.6.3 Migration from Winnipeg

In this scenario 2.5% of the population of Winnipeg migrates to the South Eastman RHA and 2.5% moves to the Central RHA. As shown in Table 10.20, there is little effect as a result of this change. The Winnipeg RHA would still be partially supplied by the Central RHA. The South Eastman and Central RHAs have substantial surpluses and there is little change.

Table 10.20: Optimized Flows of Calcium: 5% Migration from Winnipeg (g)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	73,969										**73,969**
	Brandon		52,581				22,957					**116,373**
	Central			46,951	116,248						27,748	**190,947**
	Interlake					35,229						**35,229**
	Norman						2,456					**2,456**
	N. Eastman							803				**803**
	Parkland											**4,049**
	S. Eastman					47,444		42,232		73,502		**163,178**
	Winnipeg										664,552	**664,552**
	Province	**73,969**	**52,581**	**46,951**	**116,248**	**82,673**	**25,413**	**43,035**		**73,502**	**692,300**	**1,251,556**

10.7 Iron

The most cost effective distribution of iron in the status quo scenario is shown in Table 10.21. The Winnipeg, South Eastman, Central, Brandon and Assiniboine RHAs fulfill their requirements from within the RHA. Winnipeg also supplies iron to the Interlake and North Eastman RHAs. The Brandon RHA covers 50% of the needs of the Parkland RHA and nearly all of the needs of Norman RHA. North Eastman, Norman, Interlake and Burntwood are totally dependent on other RHAs for their iron needs. The Winnipeg RHA ships iron to the North Eastman and Interlake RHA. The Brandon RHA ships iron to Norman RHA. The Burntwood RHA is supplied by the Interlake RHA.

Table 10.21: Optimized Flows of Iron: Status Quo
(g)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	709										**709**
	Brandon		542				254		215			**1,011**
	Central				1,081							**1,081**
	Interlake			512								**512**
	Norman						11					**11**
	N. Eastman							31				**31**
	Parkland								220			**220**
	S. Eastman									660		**660**
	Winnipeg					810		392			7,205	**8,407**
	Province	**709**	**542**	**512**	**1,081**	**810**	**265**	**423**	**435**	**660**	**7,205**	**12,642**

10.7.1 The Total Supply of Iron Decreases by 35%

Table 10.22 shows the flow pattern if the production of iron declined by 35%. There is little change in the pattern of flows.

Table 10.22: Optimized Flows of Iron: 35% Production Reduction
(g)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	709										**709**
	Brandon		542				258		295			**1,095**
	Central				1,081							**1,081**
	Interlake			512		18						**530**
	Norman						7					**7**
	N. Eastman							20				**20**
	Parkland								140			**140**
	S. Eastman									660		**660**
	Winnipeg					792		403			7,205	**8,400**
	Province	**709**	**542**	**512**	**1,081**	**810**	**265**	**423**	**435**	**660**	**7,205**	**12,642**

10.7.2 Production Ceases in Winnipeg

If the production of iron ceased in Winnipeg the optimal flows would be as shown in Table 10.23. In this scenario the South Eastman RHA replaces the Winnipeg RHA as the main supplier to the North Eastman RHA. The requirements in the Winnipeg RHA are mainly supplied by the Central RHA. The Interlake RHA also provides supplies to the Winnipeg RHA.

Table 10.23: Optimized Flows of Iron: Production Ceases in Winnipeg (g)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	N. Eastman							31				**31**
	S. Eastman							392		660		**1,052**
	Assiniboine	709										**709**
	Brandon		542				254		215			**1,011**
	Central				1,081						6,999	**8,080**
	Interlake			512		810					206	**1,528**
	Parkland								220			**220**
	Norman						11					**11**
	Winnipeg											**0**
	Province	**709**	**542**	**512**	**1,081**	**810**	**265**	**423**	**435**	**660**	**7,205**	**12,642**

10.7.3 Migration from Winnipeg

If there was migration from Winnipeg during a pandemic the optimal flows would be as presented in Table 10.24. The main impact is greater supplies needed in the South Eastman and Central RHAs. These would be internally supplied.

Table 10.24: Optimized Flows of Iron: 5% Migration from Winnipeg (g)

		Destination										
		Assiniboine	Brandon	Burntwood	Central	Interlake	Norman	N. Eastman	Parkland	S. Eastman	Winnipeg	**Province**
Origin	Assiniboine	709										**709**
	Brandon		542				254		215			**1,011**
	Central				1,261							**1,261**
	Interlake			512								**512**
	Norman						11					**11**
	N. Eastman							31				**31**
	Parkland								220			**220**
	S. Eastman									840		**840**
	Winnipeg					810		392			6,845	**8,047**
	Province	**709**	**542**	**512**	**1,261**	**810**	**265**	**423**	**435**	**840**	**6,845**	**12,642**

SECTION 11 : MANITOBA NUTRITION SUPPLY CHAIN VULNERABILITIES

11.1 Introduction

Vulnerabilities and subsequent planning strategies in the event of a pandemic affecting the Manitoba nutrition supply chain were analyzed in terms of the M3[94] model for risk assessment and risk management. The M3 model contains the following components:

- M_1: Measuring and monitoring the risk.
- M_2: Mitigating the risk.
- M_3: Managing the risk.

Monitoring and measuring is the stage of identifying vulnerabilities. Vulnerabilities are the result of either natural or human created events. A natural event would be typified by a volcano or a comet hitting the earth. In the former case the likelihood and consequence of the event may be calculable. In this case in the classic Knight tradition[95] the vulnerability would be described as a "risk". Conversely, the latter is not determinable. In the classical Knight framework this would be considered an "uncertain" vulnerability. An example of a human created event is a radiation leak from a nuclear reactor. Typically human created events are more measurable than natural events. Some vulnerabilities reflect a combination of the two. In this situation the underlying cause may be natural, but interaction with humans causes the vulnerability to increase. An example would be a highly pathogenic H5N1 flu pandemic. The underlying cause is natural, though it could mutate and spread human to human as the result of human actions.

Mitigating the risk involves steps put in place to limit the impact of the vulnerability if the event should take place. Broadly speaking, it involves the development of the risk management plan in order to preempt the most undesirable effects of the vulnerability.

Managing the risk involves implementing the plan.

In terms of the Manitoba Nutrition Supply Chain plan during a pandemic, these steps relate to triggers based on the pandemic threat level described in Section 1. This current project relates to M_1 with the existing threat at pandemic level 3. As the threat increases to pandemic level 6.2 the full plan would be invoked corresponding to M_3.

In assessing the vulnerabilities to the Manitoba nutrition supply chain (M1), the vulnerabilities have been classified into 3 groupings. The first deals with system failures,

[94] Copyright of this particular model is held by A. Hickson, Ph.D.
[95] Knight, Frank. H. Risk Uncertainty and Profit. Houghton Mifflin Co. Boston , 1921.

for example the inability to acquire critical inputs, lack of transportation equipment, etc. The second deals more directly human caused or human related vulnerabilities. The third relates to unique situations.

11.2 System Vulnerabilities to the Manitoba Nutrition Supply Chain

During the course of research the study team identified a variety of system related vulnerabilities to the Manitoba nutrition supply chain. Each is itemized in the following discussion.

11.2.1 International Trade Flow Disruption

If international borders were closed, the estimated effect on nutrition surplus or deficit is as shown in Table 11.1 and 11.2.

Table 11.1: International Trade Flow Disruption Daily Nutrient Surplus/Deficit - Protein through Sodium

	Nutrients							
RHA	**Protein (kg)**	**Carbs (kg)**	**Fibre (kg)**	**Fat (kg)**	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**
Assiniboine	86,100	264,500	43,400	239,900	546,900	27,100	20,300	160,200
Brandon	87,000	9,000	-1,100	48,300	61,000	3,700	9,700	145,100
Burntwood	600	8,100	-1,000	800	-14,500	-100	-20	-56,200
Central	166,200	483,800	82,800	427,200	627,200	42,900	28,500	1,330,000
Churchill	10	160	-20	10	-310	-2	-1	-1,150
Interlake	5,600	29,900	1,800	7,800	19,100	1,900	1,400	-79,200
Norman	960	12,660	-1,520	1,210	-20,910	-166	-28	-86,050
N. Eastman	400	7,100	-900	700	-14,700	-100	-30	-48,900
Parkland	1,000	11,900	-900	1,100	-14,700	-35	40	-48,200
S. Eastman	4,900	16,000	-200	5,000	700	800	700	-59,700
Winnipeg	15,400	137,800	-14,100	16,500	-212,400	-800	100	-752,700
Province	**368,170**	**980,920**	**108,260**	**748,520**	**977,380**	**75,197**	**60,661**	**503,200**
Province Status Quo Trade	**71,080**	**345,633**	**-12,133**	**129,069**	**-154,355**	**11,082**	**5,588**	**-192,999**
Northern	*1,570*	*20,920*	*-2,540*	*2,020*	*-35,720*	*-268*	*-49*	*-143,400*
Western	*174,100*	*285,400*	*41,400*	*289,300*	*593,200*	*30,765*	*30,040*	*257,100*
Capital	*192,500*	*674,600*	*69,400*	*457,200*	*419,900*	*44,700*	*30,670*	*389,500*

Table 11.2: International Trade Flow Disruption Daily Nutrient Surplus/Deficit - Potassium through Niacin

RHA	Nutrients							
	Potassium (g)	Vit A (IU)	Vit C (g)	Vit B6 (g)	Folate (g)	Thiamin (g)	Riboflavin (g)	Niacin (NE)
Assiniboine	4,586,500	256,688,700	59,200	3,500	600	1,800	900	33,514,700
Brandon	971,800	-144,457,700	2,000	1,100	-5	2,200	1,000	32,229,800
Burntwood	-127,700	-178,121,400	1,000	1	-20	60	40	917,500
Central	7,815,500	-19,176,100	63,300	4,000	1,400	3,200	1,700	63,390,600
Churchill	-2,700	-3,733,450	15	0	0	1	1	17,800
Interlake	28,500	-251,918,200	1,500	200	20	150	100	2,885,300
Norman	-66,400	-91,764,700	500	0	-10	30	20	494,300
N. Eastman	-116,600	-155,035,100	700	-3	-18	50	30	766,500
Parkland	-110,100	-160,987,900	700	6	-18	66	42	1,035,700
S. Eastman	-65,700	-147,223,500	1,200	100	-2	100	100	2,584,800
Winnipeg	-1,721,900	-1,840,863,400	12,900	100	-300	900	600	15,988,300
Province	**11,191,200**	**-2,736,592,750**	**143,015**	**9,004**	**1,647**	**8,557**	**4,533**	**153,825,300**
Province Status Quo Trade	**-580,237**	**-1,204,353,338**	**69,261**	**1,367**	**-69**	**2,870**	**1,889**	**47,012,169**
Northern	*-196,800*	*-273,619,550*	*1,515*	*1*	*-30*	*91*	*61*	*1,429,600*
Western	*5,448,200*	*-48,756,900*	*61,900*	*4,606*	*577*	*4,066*	*1,942*	*66,780,200*
Capital	*5,939,800*	*-2,414,216,300*	*79,600*	*4,397*	*1,100*	*4,400*	*2,530*	*85,615,500*

Depending on the timing of the event the effect would vary. During the summer season generally the effect is less significant than during the winter season.

11.2.2 Domestic Trade Flow Disruption

If domestic trade in food ceased the effect on the nutrition surplus or deficit is as shown in Table 11.3. Similar to the international trade flow disruption case, a decrease in inter-provincial trade results in greater nutrition available to Manitobans. Unlike the case of the international trade flow disruption, the available vitamin A would increase due to international imports of fruits and vegetables entering Manitoba and domestic exports of vitamin A, in the form of starchy vegetables remaining in the province.

Table 11.3: Domestic Trade Flow Disruption, Daily Nutrient Surplus/Deficit - Protein through Sodium

RHA	Nutrients							
	Protein (kg)	**Carbs (kg)**	**Fibre (kg)**	**Fat (kg)**	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**
Assiniboine	35,000	154,100	5,700	53,200	-127,200	7,500	-200	96,300
Brandon	82,600	8,100	-700	48,600	170,800	3,800	9,100	274,300
Burntwood	400	-600	-800	2,900	-36,400	0	-100	-14,500
Central	72,400	342,300	43,000	142,200	637,000	33,400	5,100	-317,600
Churchill	6	-11	-16	60	-700	1	-3	-300
Interlake	2,800	-11,100	-2,900	4,300	-77,500	-400	-300	-1,300
Norman	200	-300	-400	1,600	-19,600	0	-100	-7,200
N. Eastman	300	-200	-600	2,600	-33,100	100	-100	-8,700
Parkland	1,500	1,300	-600	3,500	-32,200	200	100	5,500
S. Eastman	32,500	4,700	-1,200	22,100	146,800	2,000	2,600	307,400
Winnipeg	75,600	186,100	-1,100	83,900	78,400	12,800	3,400	1,241,700
Province	**303,306**	**684,389**	**40,384**	**364,960**	**706,300**	**59,401**	**19,497**	**1,575,600**
Province Status Quo Trade	**71,080**	**345,633**	**-12,133**	**129,069**	**-154,355**	**11,082**	**5,588**	**-192,999**
Northern	*606*	*-911*	*-1,216*	*4,560*	*-56,700*	*1*	*-203*	*-22,000*
Western	*119,100*	*163,500*	*4,400*	*105,300*	*11,400*	*11,500*	*9,000*	*376,100*
Capital	183,600	521,800	37,200	255,100	751,600	47,900	10,700	1,221,500

Table 11.4: Domestic Trade Flow Disruption, Daily Nutrient Surplus/Deficit - Potassium through Niacin

RHA	Nutrients							
	Potassium (g)	**Vit A (IU)**	**Vit C (g)**	**Vit B6 (g)**	**Folate (g)**	**Thiamin (g)**	**Riboflavin (g)**	**Niacin (NE)**
Assiniboine	3,309,700	-344,956,600	126,200	3,100	-200	1,600	600	28,846,700
Brandon	1,078,000	330,861,900	400	1,000	0	2,000	1,100	29,655,500
Burntwood	-89,100	30,884,100	-1,100	0	0	0	0	353,500
Central	3,654,800	652,301,300	114,600	3,500	-200	2,200	1,900	34,620,100
Churchill	-1,900	548,000	-26	0	0	0	0	6,900
Interlake	-209,500	65,326,300	-1,400	0	0	0	0	1,816,300
Norman	-48,100	13,897,400	-600	0	0	0	0	209,400
N. Eastman	-80,000	51,232,900	-700	0	0	0	0	346,100
Parkland	-66,600	52,585,600	-700	0	0	0	0	819,400
S. Eastman	165,000	577,703,800	-600	600	0	200	500	12,356,900
Winnipeg	36,400	3,345,223,800	200	900	200	1,900	2,100	38,788,800
Province	**7,748,700**	**4,775,608,500**	**236,274**	**9,100**	**-200**	**7,900**	**6,200**	**147,819,600**
Province Status Quo Trade	**-580,237**	**-1,204,353,338**	**69,261**	**1,367**	**-69**	**2,870**	**1,889**	**47,012,169**
Northern	-139,100	45,329,500	-1,726	0	0	0	0	569,800
Western	*4,321,100*	*38,490,900*	*125,900*	*4,100*	*-200*	*3,600*	*1,700*	*59,321,600*
Capital	*3,566,700*	*4,691,788,100*	*112,100*	*5,000*	*0*	*4,300*	*4,500*	*87,928,200*

11.2.3 All Trade Ceases

If both international and domestic trade in food ceases the surplus/deficit is shown in Tables 11.5 and 11.6. Overall, the province has a surplus of nutrition. Generally speaking the north remains nutritionally deficient.

Table 11.5: All Trade Ceases Daily Nutrient Surplus/Deficit - Protein through Sodium

	Nutrients							
RHA	**Protein (kg)**	**Carbs (kg)**	**Fibre (kg)**	**Fat (kg)**	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**
Assiniboine	117,100	398,500	49,800	285,700	429,900	34,000	19,700	266,700
Brandon	166,600	2,500	-1,200	91,400	238,000	7,100	18,600	427,500
Burntwood	-2,000	-6,000	-1,300	-1,400	-47,000	-500	-400	-63,400
Central	232,400	796,300	126,800	558,200	1,276,900	75,300	33,100	1,028,500
Churchill	-42	-100	-27	-28	-1000	-10	-8	-1,300
Interlake	3,700	-3,800	-300	3,600	-47,400	700	700	-68,000
Norman	-900	-3,100	-700	-600	-23,000	-300	-200	-31,900
N. Eastman	-1,700	-4,900	-1,100	-1,100	-42,200	-400	-300	-51,100
Parkland	100	900	-1,100	0	-40,800	-200	0	-36,600
S. Eastman	33,600	2,700	-800	20,400	154,900	2,200	3,000	257,900
Winnipeg	51,100	128,200	-8,400	27,300	-45,500	5,700	400	601,000
Province	**599,958**	**1,311,200**	**161,673**	**983,472**	**1,852,800**	**123,590**	**74,592**	**2,329,300**
Province Status Quo Trade	**71,080**	**345,633**	**-12,133**	**129,069**	**-154,355**	**11,082**	**5,588**	**-192,999**
Northern	-2,942	-9,200	-2,027	-2,028	-71,000	-810	-608	-96,600
Western	*283,800*	*401,900*	*47,500*	*377,100*	*627,100*	*40,900*	*38,300*	*657,600*
Capital	*319,100*	*918,500*	*116,200*	*608,400*	*1,296,700*	*83,500*	*36,900*	*1,768,300*

Table 11.6: All Trade Ceases Daily Nutrient Surplus/Deficit - Potassium through Niacin

RHA	Nutrients							
	Potassium (g)	**Vit A (IU)**	**Vit C (g)**	**Vit B6 (g)**	**Folate (g)**	**Thiamin (g)**	**Riboflavin (g)**	**Niacin (NE)**
Assiniboine	7,931,100	-17,004,100	181,500	6,500	500	3,300	1,300	59,640,400
Brandon	2,074,100	237,315,600	-600	2,100	0	4,000	2,000	59,901,100
Burntwood	-201,400	-106,972,300	-3,100	-100	0	0	0	-607,000
Central	11,516,800	734,085,000	171,800	7,400	1,300	5,200	3,400	93,933,900
Churchill	-4,100	-2,265,400	-67	0	0	0	0	-12,700
Interlake	-142,100	-106,789,000	-4,400	100	0	0	0	1,639,900
Norman	-104,100	-54,546,200	-1,700	0	0	0	0	-275,800
N. Eastman	-176,800	-62,703,500	-2,400	0	0	0	0	-489,400
Parkland	-156,200	-65,720,900	-2,500	0	0	0	0	190,900
S. Eastman	127,200	491,231,500	-3,000	600	0	100	500	12,478,900
Winnipeg	-1,344,400	2,196,738,500	-25,600	300	0	1,100	1,700	28,232,400
Province	**19,520,100**	**3,243,369,200**	**309,933**	**16,900**	**1,800**	**13,700**	**8,900**	**254,632,600**
Province Status Quo Trade	**-580,237**	**-1,204,353,338**	**69,261**	**1,367**	**-69**	**2,870**	**1,889**	**47,012,169**
Northern	-309,600	-163,783,900	-4,867	-100	0	0	0	-895,500
Western	*9,849,000*	*154,590,600*	*178,400*	*8,600*	*500*	*7,300*	*3,300*	*119,732,400*
Capital	9,980,700	3,252,562,500	136,400	8,400	1,300	6,400	5,600	135,795,700

As part of the planning exercise complete cessation of trade was a required assumption.

11.2.4 Critical Ingredients are not Available

Based on the survey of members of the Manitoba food supply chain, there were few ingredients that respondents suggested were critical in nature and not available within Manitoba. Many processors suggested their raw feedstock (example chickens) along with water and labour were critical ingredients. It is given that their plants would not operate without these raw inputs. More specifically the research focused on ingredients that were supplemental to the raw feed stocks but necessary for production. The list was relatively small as shown in Table 11.7.

Table 11.7: Critical Ingredients

Ingredient	Use	Source	Average Inventory Held (Days)
Sugar	Bread	Alberta	25
Yeast	Bread	Saskatchewan/Alberta	30
Salt	Bread	Saskatchewan/Alberta	25
Bacteria Culture	Cheese	Ontario	150
Enzymes	Cheese	Ontario	80
Coagulant	Cheese	Ontario	30
Vitamin A	Milk	Ontario	n.a.
Vitamin D	Milk	Ontario/U.S.	40

Packaging for products and sanitation supplies used to sterilize production equipment are also critical ingredients. While there was generally little reported by surveyed firms on these ingredients, they are considered in the plan in the next section of this report.

Water is also a critical ingredient. Other than a plan for supplemental emergency water supplies for human consumption mitigating the risks to water supplies is outside the scope of this study and plan.

11.2.5 Shortage of Drinking Water for Human Consumption

While planning for disruptions in city, rural, and municipal water supplies is beyond the scope of this study, a critical planning element is to provide emergency supplies in the event that a supply become inoperable.

Table 11.8 shows the required daily needs of potable water for human consumption by RHA.

Table 11.8: Drinking Water for Human Consumption

RHA	Required Water (000 litres)
Assiniboine	200
Brandon	144
Burntwood	125
Central	290
Churchill	3
Interlake	225
Norman	68
North Eastman	117
Parkland	121
South Eastman	175
Winnipeg	1,950
Province	**3,418**
Northern	*196*
Western	*465*
Capital	*2,757*

Average consumption is 3 litres per person per day.

11.2.6 Shortage of Transportation Equipment

As shown in Section 7.4.1, on average there is a substantial amount of trucking equipment available in Manitoba, particularly for larger sizes trailers. There are vulnerabilities to this supply, namely:

- Competition for large refrigerated trailers with medical authorities.

- Equipment being unavailable in Manitoba as it is stationed outside Manitoba when borders close.
- Lack of fuel (fuel supplies are outside the scope of this project).

The plan outlined in Section 12 provides methods to reduce this vulnerability

11.2.7 Agricultural Production Reduction

Farm level production is needed to support upstream elements of the nutrition supply chain. During each wave of a pandemic, expectations are that about 35% of workers will be unable to work at their jobs. In the most extreme case up to 35% of production could be lost, however the drop in available nutrition would be negligible since Manitoba is a net exporter of most agricultural commodities (for example grains, beef, pork). The worst case would be a wave hitting during the seasonal harvest for vegetables. Tables 11.9 to 11.12 show the effect of a complete stop of fruit and vegetable production under both the status quo trade and a ceasing of all trade. The key vegetables that contribute to nutrition availability are potatoes, carrots and rutabagas. Fruits are about .001% of provincial food production.

Table 11.9: Agricultural Production Reduction Daily Nutrient Surplus/Deficit: Status Quo Trade - Protein through Sodium

	Nutrients							
RHA	**Protein (kg)**	**Carbs (kg)**	**Fibre (kg)**	**Fat (kg)**	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**
Assiniboine	4,038	19,736	-763	7,486	-11,069	639	308	-14,968
Brandon	2,994	14,581	-507	5,449	-6,220	460	236	-8,132
Burntwood	2,941	13,537	-478	5,056	-3,933	418	240	-7,312
Central	6,102	29,151	-1,195	11,132	-14,287	908	472	-25,404
Churchill	57	274	-10	102	-92	9	5	-156
Interlake	4,583	22,374	-835	8,419	-11,488	722	353	-15,103
Norman	1,505	7,135	-251	2,666	-2,731	225	120	-3,944
N. Eastman	2,407	11,688	-436	4,396	-5,847	378	186	-7,821
Parkland	2,500	12,150	-438	4,569	-6,235	397	195	-7,466
S. Eastman	3,729	17,814	-688	6,723	-7,819	560	292	-12,860
Winnipeg	39,317	191,850	-7,683	72,964	-97,617	5,927	3,006	-165,096
Province	**70,173**	**340,290**	**-13,284**	**128,962**	**-167,338**	**10,643**	**5,413**	**-268,262**
Northern	*4,503*	*20,946*	*-739*	*7,824*	*-6,756*	*652*	*365*	*-11,412*
Western	*9,532*	*46,467*	*-1,708*	*17,504*	*-23,524*	*1,496*	*739*	*-30,566*
Capital	*56,138*	*272,877*	*-10,837*	*103,634*	*-137,058*	*8,495*	*4,309*	*-226,284*

Table 11.10: Agricultural Production Reduction Daily Nutrient Surplus/Deficit: Status Quo Trade - Potassium through Niacin

RHA	Nutrients							
	Potassium (g)	**Vit A (IU)**	**Vit C (g)**	**Vit B6 (g)**	**Folate (g)**	**Thiamin (g)**	**Riboflavin (g)**	**Niacin (NE)**
Assiniboine	-42,857	-177,737,452	2,162	74	-6	164	107	2,685,917
Brandon	-24,339	-50,911,451	2,907	58	-3	121	80	1,984,224
Burntwood	-15,448	-40,264,938	3,019	59	-2	116	77	1,877,972
Central	-62,336	-313,905,980	2,525	111	-8	243	160	4,006,515
Churchill	-393	-920,049	56	1	0	2	2	37,376
Interlake	-43,453	-140,654,688	3,456	86	-6	185	121	3,041,564
Norman	-10,372	-23,321,088	1,505	30	-1	60	40	979,423
N. Eastman	-22,078	-71,489,313	1,854	46	-3	97	64	1,591,955
Parkland	-22,784	-73,071,995	1,936	45	-2	101	66	1,654,221
S. Eastman	-32,431	-121,603,001	2,693	70	-3	150	99	2,442,686
Winnipeg	-438,888	-2,209,285,453	27,709	725	-52	1,593	1,039	26,175,910
Province	**-715,379**	**-3,223,165,408**	**49,822**	**1,305**	**-86**	**2,832**	**1,855**	**46,477,763**
Northern	*-26,213*	*-64,506,075*	*4,580*	*90*	*-3*	*178*	*119*	*2,894,771*
Western	*-89,980*	*-301,720,898*	*7,005*	*177*	*-11*	*386*	*253*	*6,324,362*
Capital	*-599,186*	*-2,856,938,435*	*38,237*	*1,038*	*-72*	*2,268*	*1,483*	*37,258,630*

Table 11.11: Agricultural Production Reduction Daily Nutrient Surplus/Deficit All Trade Ceases - Protein through Sodium

RHA	Nutrients							
	Protein (kg)	**Carbs (kg)**	**Fibre (kg)**	**Fat (kg)**	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**
Assiniboine	117,008	398,080	49,698	285,672	428,838	33,941	19,727	261,912
Brandon	166,586	2,514	-1,243	91,402	238,029	7,064	18,590	427,542
Burntwood	-1,976	-6,027	-1,312	-1,385	-46,951	-512	-388	-63,395
Central	232,236	795,449	126,617	558,189	1,274,668	75,247	33,072	1,018,880
Churchill	-42	-121	-27	-28	-960	-10	-8	-1,287
Interlake	3,673	-4,025	-389	3,595	-48,067	700	711	-70,781
Norman	-914	-3,055	-689	-640	-22,957	-254	-180	-31,890
N. Eastman	-1,719	-5,017	-1,129	-1,122	-42,544	-401	-331	-52,521
Parkland	67	805	-1,114	-41	-41,146	-224	-50	-37,974
S. Eastman	33,520	2,479	-819	20,376	154,257	2,204	2,980	255,131
Winnipeg	50,336	123,616	-9,310	27,198	-56,671	5,358	214	546,444
Province	**598,775**	**1,304,698**	**160,283**	**983,216**	**1,836,496**	**123,113**	**74,337**	**2,252,061**
Northern	*-2,932*	*-9,203*	*-2,028*	*-2,053*	*-70,868*	*-776*	*-576*	*-96,572*
Western	*283,661*	*401,399*	*47,341*	*377,033*	*625,721*	*40,781*	*38,267*	*651,480*
Capital	*318,046*	*912,502*	*114,970*	*608,236*	*1,281,643*	*83,108*	*36,646*	*1,697,153*

Table 11.12: Agricultural Production Reduction Daily Nutrient Surplus/Deficit: All Trade Ceases - Potassium through Niacin

RHA	Nutrients							
	Potassium (g)	Vit A (IU)	Vit C (g)	Vit B6 (g)	Folate (g)	Thiamin (g)	Riboflavin (g)	Niacin (NE)
Assiniboine	7,920,833	-144,293,420	179,603	6,501	483	3,250	1,344	59,598,042
Brandon	2,074,136	237,315,608	-581	2,069	24	4,004	2,048	59,901,065
Burntwood	-201,374	-106,972,320	-3,063	-54	-16	-46	-48	-606,982
Central	11,496,275	479,506,377	167,962	7,343	1,253	5,190	3,380	93,849,190
Churchill	-4,143	-2,265,381	-67	-1	0	-1	-1	-12,740
Interlake	-147,972	-179,525,755	-5,457	93	4	-20	-18	1,615,741
Norman	-104,090	-54,546,191	-1,687	-28	-9	-23	-22	-275,762
N. Eastman	-179,721	-99,071,844	-2,920	-50	-15	-40	-42	-501,489
Parkland	-159,135	-102,089,323	-3,029	-28	-14	-4	-17	178,774
S. Eastman	121,360	418,494,743	-4,143	615	24	125	497	12,454,703
Winnipeg	-1,460,975	-1,654,568,650	-37,271	207	-22	1,114	1,648	-9,324,915
Province	**19,355,194**	**-1,208,016,156**	**289,347**	**16,667**	**1,712**	**13,549**	**8,769**	**216,875,627**
Northern	*-309,607*	*-163,783,892*	*-4,817*	*-83*	*-25*	*-70*	*-71*	*-895,484*
Western	*9,835,834*	*-9,067,135*	*175,993*	*8,542*	*493*	*7,250*	*3,375*	*119,677,881*
Capital	*9,828,967*	*-1,035,165,129*	*118,171*	*8,208*	*1,244*	*6,369*	*5,465*	*98,093,230*

11.2.8 Processor Production Reduction

In the event of a pandemic and a trade flow disruption, large processors will inevitably cut back production. Based on the survey interviews, most large processors in Manitoba have some level of contingency plan in place in the event of a pandemic or are in the process of developing a plan. Of the large processors and abattoirs surveyed, 8 out of 13 had at least some strategy developed in the event of a pandemic. As well, 8 out of 13 companies had either trained employees for business continuation in event of a disaster or had related planning sessions. The remaining 5 companies did not have a strategy in place and had not considered training employees in regards to emergency preparations. 9 of the 13 companies indicated they were comfortable with their preparations in terms of pandemic preparedness.

Smaller processors such as regional abattoirs are less likely to have a plan in place. Based on 45 surveys of small to medium sized processors and abattoirs, only 10 had some level of strategy developed in terms of a business continuity plan. Only 7 out of the 45 surveyed had trained their employees for disruptions. This makes dependency on these smaller processors a risky proposition in the event of a pandemic.

Assuming 35% of workers will be unable to work at their jobs and there is a consequent 35% drop in processing capacity in Manitoba, the effect on available nutrition by RHA is shown in Tables 11.13 to 11.16. *With respect to nutrition availability the worst case scenario tested was an event where processors decrease production by 35% and trade continues.* This provides a backdrop to the type of foods the decision maker may wish to protect in the event of a looming pandemic.

Table 11.13: Processor Production Reduction Daily Nutrient Surplus/Deficit: Status Quo Trade - Protein Through Sodium

RHA	Nutrients							
	Protein (kg)	**Carbs (kg)**	**Fibre (kg)**	**Fat (kg)**	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**
Assiniboine	2,755	12,716	-836	6,373	13,876	471	322	-14,059
Brandon	2,018	11,491	-564	4,637	-18,455	317	97	-10,881
Burntwood	2,941	13,537	-478	5,056	-3,933	418	240	-7,312
Central	4,225	18,878	-1,264	9,480	-37,659	675	209	83,907
Churchill	57	274	-10	102	-92	9	5	-156
Interlake	3,756	26,088	-223	8,620	-6,654	932	388	-16,683
Norman	1,471	7,123	-252	2,639	-2,810	222	113	-4,137
N. Eastman	2,377	11,673	-426	4,372	-5,862	376	180	-7,892
Parkland	2,038	11,602	-443	4,274	-7,098	348	111	-8,430
S. Eastman	2,558	16,042	-581	5,724	-22,451	400	126	-13,566
Winnipeg	26,856	127,376	-8,354	62,178	-252,498	4,310	1,270	-148,703
Province	**51,052**	**256,800**	**-13,431**	**113,455**	**-343,636**	**8,478**	**3,061**	**-147,912**
Northern	*4,469*	*20,934*	*-740*	*7,797*	*-6,835*	*649*	*358*	*-11,605*
Western	*6,811*	*35,809*	*-1,843*	*15,284*	*-11,677*	*1,136*	*530*	*-33,370*
Capital	*39,772*	*200,057*	*-10,848*	*90,374*	*-325,124*	*6,693*	*2,173*	*-102,937*

Table 11.14: Processor Production Reduction Daily Nutrient Surplus/Deficit: Status Quo Trade - Potassium through Niacin

RHA	Nutrients							
	Potassium (g)	**Vit A (IU)**	**Vit C (g)**	**Vit B6 (g)**	**Folate (g)**	**Thiamin (g)**	**Riboflavin (g)**	**Niacin (NE)**
Assiniboine	-73,167	61,336,994	1,846	49	49	112	64	1,930,231
Brandon	-52,161	-24,130,870	2,247	37	-2	82	47	1,408,790
Burntwood	-15,448	-15,362,766	3,019	59	0	116	77	1,877,972
Central	-103,314	-46,167,642	2,980	78	54	168	98	2,900,994
Churchill	-393	-406,226	56	1	0	2	2	37,376
Interlake	-22,246	-38,438,386	4,148	81	3	185	114	2,608,031
Norman	-10,740	-10,152,559	1,503	29	-1	60	40	967,873
N. Eastman	-21,177	-19,436,282	2,190	45	-1	96	64	1,580,123
Parkland	-27,727	-20,211,877	2,269	41	-1	93	60	1,477,418
S. Eastman	-62,220	-27,676,696	3,319	48	-1	102	59	1,752,764
Winnipeg	-713,939	-333,074,553	31,370	487	-25	1,089	624	18,830,921
Province	**-1,102,532**	**-473,720,863**	**54,947**	**955**	**75**	**2,105**	**1,249**	**35,372,493**
Northern	*-26,581*	*-25,921,551*	*4,578*	*89*	*-1*	*178*	*119*	*2,883,221*
Western	*-153,055*	*16,994,247*	*6,362*	*127*	*46*	*287*	*171*	*4,816,439*
Capital	*-922,896*	*-464,793,559*	*44,007*	*739*	*30*	*1,640*	*959*	*27,672,833*

In this scenario the province has a deficit in fibre, calcium, sodium, potassium and vitamin A. Foods that are relatively rich in these nutrients include bread, milk, and eggs.

Table 11.15: Processor Production Reduction Daily Nutrient Surplus/Deficit: All Trade Ceases - Protein Through Sodium

RHA	Nutrients							
	Protein (kg)	Carbs (kg)	Fibre (kg)	Fat (kg)	Calcium (g)	Iron (g)	Zinc (g)	Sodium (g)
Assiniboine	74,989	255,911	31,695	184,971	253,565	21,835	12,618	140,699
Brandon	107,474	-643	-1,300	58,889	136,316	4,402	11,929	253,902
Burntwood	-1,976	-6,027	-1,312	-1,385	-46,951	-512	-388	-63,395
Central	149,438	512,948	81,422	361,759	792,357	48,575	21,203	619,679
Churchill	-42	-121	-27	-28	-960	-10	-8	-1,287
Interlake	1,164	-5,966	-980	1,531	-59,774	183	227	-81,262
Norman	-975	-3,099	-690	-671	-23,817	-258	-191	-32,458
N. Eastman	-1,752	-5,014	-1,115	-1,150	-42,513	-403	-337	-52,589
Parkland	-617	-1,300	-1,115	-464	-42,252	-292	-159	-43,675
S. Eastman	20,844	-1,036	-1,109	12,601	78,073	1,214	1,754	137,952
Winnipeg	22,313	52,868	-12,063	10,735	-278,106	1,177	-1,847	67,815
Province	**370,860**	**798,521**	**93,406**	**626,788**	**765,938**	**75,911**	**44,801**	**945,381**
Northern	*-2,993*	*-9,247*	*-2,029*	*-2,084*	*-71,728*	*-780*	*-587*	*-97,140*
Western	*181,846*	*253,968*	*29,280*	*243,396*	*347,629*	*25,945*	*24,388*	*350,926*
Capital	*192,007*	*553,800*	*66,155*	*385,476*	*490,037*	*50,746*	*21,000*	*691,595*

Table 11.16: Processor Production Reduction Daily Nutrient Surplus/Deficit: All Trade Ceases - Potassium through Niacin

RHA	Nutrients							
	Potassium (g)	Vit A (IU)	Vit C (g)	Vit B6 (g)	Folate (g)	Thiamin (g)	Riboflavin (g)	Niacin (NE)
Assiniboine	5,046,601	-70,576,620	116,225	4,198	306	2,089	849	38,430,403
Brandon	1,269,539	111,274,379	-1,654	1,322	9	2,584	1,312	38,692,856
Burntwood	-201,374	-106,972,320	-3,063	-54	-16	-46	-48	-606,982
Central	7,326,302	390,388,168	109,127	4,736	803	3,340	2,162	60,568,009
Churchill	-4,143	-2,265,381	-67	-1	0	-1	-1	-12,740
Interlake	-214,381	-136,231,539	-4,809	27	-7	-40	-41	688,907
Norman	-105,600	-55,927,701	-1,692	-29	-9	-24	-23	-295,025
N. Eastman	-178,455	-75,451,759	-2,564	-50	-15	-41	-42	-513,983
Parkland	-167,532	-78,760,091	-2,679	-36	-14	-17	-26	-79,561
S. Eastman	-13,622	266,984,160	-3,508	375	8	60	300	7,816,464
Winnipeg	-1,933,518	848,183,867	-33,866	-135	-92	494	829	15,074,363
Province	**10,823,817**	**1,090,645,163**	**171,450**	**10,353**	**973**	**8,398**	**5,271**	**159,762,711**
Northern	*-311,117*	*-165,165,402*	*-4,822*	*-84*	*-25*	*-71*	*-72*	*-914,747*
Western	*6,148,608*	*-38,062,332*	*111,892*	*5,484*	*301*	*4,656*	*2,135*	*77,043,698*
Capital	*4,986,326*	*1,293,872,897*	*64,380*	*4,953*	*697*	*3,813*	*3,208*	*83,633,760*

Even if production in the processing sector drops by 35%, Manitobans will not have an imminent shortage of food. Shortages may, however, exist in terms of calcium, sodium and vitamin A, mainly due to the decreased availability of milk, bread, pork and poultry.

If trade ceases at the same time as a reduction in production the situation improves as shown in Tables 11.15 and 11.16. Within Manitoba, shortages are most likely to occur in the north.

11.2.9 Wholesaler/Distributor Failure

Food wholesalers and distributors are the link between processors and the retail food chain. As shown in Section 7 the study team visited 16 wholesaler/distributors in person. As well mail-out surveys were returned from 2 firms. Based on this survey data and trade data the following profile emerges of the sector:

- Most of their products come from processors outside Manitoba
- They mainly distribute their products to the retail sector.

The wholesale/distributor sector is the main source of food supplies to the major supermarket chains. They are also suppliers to the smaller chains and independent grocers. The main risk to this sector is failure due to staff shortages which would have downstream effect on retailers.

11.2.10 Retail Network Failure

There were approximately 519 retail food outlets identified throughout all of Manitoba (excluding restaurants and convenience stores). Of these, about 64 are large supermarkets, while the remainders are smaller local or regional stores. As part of the study the major chains were contacted in person with respect to their pandemic plans.

Based on the survey results the smaller chains have very little preparation and training in terms of pandemic preparedness. Only 7 of the 45 small to medium sized retailer respondents indicated they had some level of strategy in place. Only 9 of the retailers said they had trained employees for disruptions.

As shown in the supply chain maps in Section 2, the retail sector is the main interface between final consumers and the food processing sector in Manitoba.

11.2.11 Energy Supplies are Disrupted

Even if transportation equipment and operators are available, movement of food will be dependent on fuel, mainly diesel being available. For processors, energy, mainly electricity and natural gas, will also be needed to operate their plants.

Planning for energy supply disruptions is outside the scope of this study and plan.

11.3 Human Related Vulnerabilities to the Manitoba Nutrition Supply Chain

11.3.1 Feeding Requirements for Infants

As shown in Section 3 Table 3.8 as of June 2007 there were 7,113 infants in the 0-6 month age category and an additional 7,217 from 6-12 months age. Based on this information the nutritional requirements for infants in these groups are as shown in Table 11.17.

Table 11.17: Total Infant Nutrition Requirements Daily by Age Cohort

Nutrition Required	0-6 months	7-12 months
Protein (kg)	15	60
Carbs (kg)	85	480
Fibre (kg)	10	150
Fat (kg)	50	150
Calcium (g)	300	1400
Iron (g)	1	60
Zinc (g)	3	15
Sodium (g)	170	1,900
Potassium (g)	600	3,550
Vitamin A (IU)	1,900,000	8,400,000
Vitamin C (g)	60	250
Vitamin B6 (g)	.1	1
Folate (g)	.1	.4
Thiamin (g)	1	1
Riboflavin (g)	1	1
Niacin (NE)	2,850	20,500
Population	**7,113**	**7,217**
Not breast fed population	**1,400**[96]	**5,000**[97]

In order to estimate the required amount of commercial food needed to support this population, the required protein and carbohydrate levels in commercial foods was considered. For the 0-6 month cohort based on protein the estimated number of cans of a typical water soluble formula required is 170 (680 gram)[98] cans per day. Based on carbohydrates the requirement is 235 (680 gram cans) per day. For a typical beginner cereal product to provide 15 kilograms of protein would require 460 (227 gram)[99] boxes per day. Based on carbohydrate needs the requirement is also 520 (227 gram) boxes per

[96] Based on early post partum rate of 80% breast fed for 2004. Source: http://www.cdc.gov/breastfeeding/data/NIS_data/data_2004.htm
[97] Based on the average of the at 6 month and at 12 month breast feeding rates for 2004 Source: http://www.cdc.gov/breastfeeding/data/NIS_data/data_2004.htm
[98] Based on each can having 13 grams of protein per 100 grams and 53 grams of carbohydrates per 100 grams.
[99] Based on each box of beginner cereal having 32 grams of protein and 162 grams of carbohydrates.

day. For strained infant products the requirement based on protein is 3,750 (128 millilitre)[100] jars per day. On a carbohydrate basis the requirement is 7,700 (128 millilitre) jars per day.

For the 6-12 month grouping, based on a typical water soluble product the requirement a on protein basis is 680 (680 gram) cans per day and 1,350 cans per day on carbohydrate basis. For cereals the estimated requirement based on protein is 3,700 boxes (227 gram)[101] per day while on a carbohydrate basis the estimate is 2,800 boxes per day. For strained foods the equivalent requirements are 15,000 (protein) and 43,000 (carbohydrate) 128 millilitre jars per day.

Infants may have intolerance for certain food types and products. Accordingly all types of foods are needed to meet requirements. Based on the foregoing analysis the recommended amount acquired for government stockpiling is 33% of each based on the carbohydrate needs. On a daily basis this is equivalent to 500 (680 gram) cans of water soluble food, 1,100 (227 gram) boxes of infant cereal and 17,000 jars of strained food. In an extreme scenario, where food is unavailable for 6 weeks; the requirement is more than 20,000 cans of water soluble food, 47,000 boxes of cereal and 700,000 jars of strained food. These are quite large amounts. The plan calls for somewhat smaller levels.

In order to provide infant formula the government should use its authorities (nationally and provincially) for emergency movement of infant foods. Consequently, the suggestion in this analysis is that the government hold inventories for a 3 week period, or 10,000 (680 gram) cans of water soluble food plus 23,500 boxes (227 gram) of cereal and about 350,000 (128 millilitre) jars of strained food. The inventory should consist of a variety of brands for the water soluble foods and a variety of flavours of strained foods.

11.3.2 Shortage of Transportation Equipment Operators and Maintenance Employees

In addition to having the necessary equipment available, staff to operate and maintain the equipment must be available. As shown in Section 7.4.2 in the case of transportation firms the number of drivers available (1,300 on average) is slightly less than the average number of tractor units available (1,400). While the full fleet of tractors and related equipment may not be needed on a particular day during the pandemic if there is a substantial absentee rate the number of drivers available could drop by up to 35%, leaving only about 845 drivers available. Similarly for equipment operated by non-transportation firms, assuming each unit has one operator both the available semi trailer and smaller vehicle fleet operable could drop by 35% due to lack of drivers.

[100] Based on each 128 ml jar having 4 grams of protein and 11 grams of carbohydrates.

[101] Based on each box of 8 month old cereal having 16 grams of protein and 170 grams of carbohydrates

Little information is available as to the number of qualified maintenance personnel available in Manitoba. According to Manitoba Job Futures[102] there are 2,150 heavy duty mechanics in Manitoba. Overall their average age is higher than most occupations, and demand for their services is high due to the many construction projects underway in Manitoba and western Canada.

11.3.3 Failure to Have Business Continuity Plans

As Table 11.18 shows there is a general dearth of planning for business continuation in event of a disaster in the Manitoba nutrition supply chain. Typically, large firms have more planning in place than smaller firms. Even so, for large processors and abattoirs, only 33% reported having plans in place. Large retailers had the highest level of business disruption planning with 60% of firms reporting plans in place. The lowest level of planning was for logistics firms.

Table 11.18: Percent of Firms with a Completed Business Continuity Plan

Firm Size:	Firm Type				
	Abattoir	**Processor**	**Retailer**	**Wholesaler**	**Logistics**
Small	0%	25%	15%	0%	8%
Medium	0%	18%	0%	25%	6%
Large	33%	33%	60%	30%	7%
Province	**10%**	**24%**	**15%**	**18%**	**5%**

11.3.4 Public Resistance to Consumption of a Major Food Source

A possibility in the event of a pandemic or similar emergency is that the public will reject consumption of a food group which they perceive as an antecedent to the outbreak. To test this effect, since H5N1 is associated with poultry production, the effect of eliminating the consumption of poultry was considered.

Annual Manitoba poultry production in 2006 was 84,420,000[103] kilograms. Tables 11.19 to 11.22 show the effect of removing poultry from the Manitoba nutrition supply chain.

[102] Refer to: http://mb.jobfutures.org/profiles/profile.cfm?noc=7312
[103] Source: Statistics Canada Catalogue # 23-015-XIE. Poultry and Egg Statistics April to June 2007, Table 1.

Table 11.19: Public Resistance to Consumption of a Major Food Source
Daily Nutrient Surplus/Deficit: Status Quo Trade - Protein Through Sodium

RHA	Nutrients							
	Protein (kg)	**Carbs (kg)**	**Fibre (kg)**	**Fat (kg)**	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**
Assiniboine	4,097	20,061	-686	7,488	-10,252	668	320	-10,282
Brandon	2,994	14,581	-507	5,449	-6,220	460	236	-8,132
Burntwood	2,941	13,537	-478	5,056	-3,933	418	240	-7,312
Central	6,220	29,800	-1,041	11,138	-12,653	967	493	-16,032
Churchill	57	274	-10	102	-92	9	5	-156
Interlake	1,448	22,547	-792	7,275	-12,799	557	112	-28,069
Norman	1,505	7,135	-251	2,666	-2,731	225	120	-3,944
N. Eastman	2,425	11,781	-414	4,398	-5,613	386	190	-6,482
Parkland	2,517	12,243	-416	4,570	-6,001	405	198	-6,127
S. Eastman	-16,035	17,922	-644	-439	-18,457	-559	-1,251	-107,955
Winnipeg	31,432	195,629	-6,894	69,976	-93,241	5,741	2,466	-153,970
Province	**39,601**	**345,510**	**-12,133**	**117,679**	**-171,992**	**9,277**	**3,129**	**-348,461**
Northern	*4,503*	*20,946*	*-739*	*7,824*	*-6,756*	*652*	*365*	*-11,412*
Western	*9,608*	*46,885*	*-1,609*	*17,507*	*-22,473*	*1,533*	*754*	*-24,541*
Capital	*25,490*	*277,679*	*-9,785*	*92,348*	*-142,763*	*7,092*	*2,010*	*-312,508*

Table 11.20: Public Resistance to Consumption of a Major Food Source
Daily Nutrient Surplus/Deficit: Status Quo Trade - Potassium Through Niacin

RHA	Nutrients							
	Potassium (g)	**Vit A (IU)**	**Vit C (g)**	**Vit B6 (g)**	**Folate (g)**	**Thiamin (g)**	**Riboflavin (g)**	**Niacin (NE)**
Assiniboine	-34,932	-71,263,811	3,970	78	-5	166	109	2,721,077
Brandon	-24,339	-50,911,451	2,907	58	-3	121	80	1,984,224
Burntwood	-15,448	-40,264,938	3,019	59	-2	116	77	1,877,972
Central	-46,488	-100,959,816	6,139	120	-5	249	165	4,076,828
Churchill	-393	-920,049	56	1	0	2	2	37,376
Interlake	-71,592	-86,365,977	4,483	7	-6	178	99	1,674,223
Norman	-10,372	-23,321,088	1,505	30	-1	60	40	979,423
N. Eastman	-19,814	-41,098,682	2,370	46	-2	98	65	1,602,000
Parkland	-20,520	-42,681,358	2,452	47	-2	102	67	1,664,267
S. Eastman	-232,063	-101,769,990	3,693	-434	-7	97	-46	-6,208,504
Winnipeg	-428,891	-710,016,378	38,617	548	-42	1,595	1,001	22,815,897
Province	**-904,852**	**-1,269,573,538**	**69,211**	**560**	**-75**	**2,784**	**1,659**	**33,224,783**
Northern	*-26,213*	*-64,506,075*	*4,580*	*90*	*-3*	*178*	*119*	*2,894,771*
Western	*-79,791*	*-164,856,620*	*9,329*	*183*	*-10*	*389*	*256*	*6,369,568*
Capital	*-798,848*	*-1,040,210,843*	*55,302*	*287*	*-62*	*2,217*	*1,284*	*23,960,444*

Table 11.21: Public Resistance to Consumption of a Major Food Source
Daily Nutrient Surplus/Deficit: All Trade Ceases - Protein Through Sodium

	Nutrients							
RHA	**Protein (kg)**	**Carbs (kg)**	**Fibre (kg)**	**Fat (kg)**	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**
Assiniboine	117,084	398,511	49,796	285,675	429,930	33,974	19,741	266,725
Brandon	166,586	2,514	-1,243	91,402	238,029	7,064	18,590	427,542
Burntwood	-1,976	-6,027	-1,312	-1,385	-46,951	-512	-388	-63,395
Central	232,388	796,311	126,814	558,195	1,276,851	75,314	33,100	1,028,507
Churchill	-42	-121	-27	-28	-960	-10	-8	-1,287
Interlake	304	-3,792	-333	2,362	-49,357	523	452	-84,880
Norman	-914	-3,055	-689	-640	-22,957	-254	-180	-31,890
N. Eastman	-1,697	-4,893	-1,101	-1,121	-42,232	-392	-327	-51,146
Parkland	89	929	-1,086	-40	-40,835	-215	-46	-36,599
S. Eastman	12,240	2,642	-763	12,662	142,920	999	1,321	152,573
Winnipeg	41,909	128,164	-8,356	23,976	-50,656	5,165	-356	555,670
Province	**565,971**	**1,311,183**	**161,700**	**971,058**	**1,833,782**	**121,656**	**71,899**	**2,161,820**
Northern	*-2,932*	*-9,203*	*-2,028*	*-2,053*	*-70,868*	*-776*	*-576*	*-96,572*
Western	*283,759*	*401,954*	*47,467*	*377,037*	*627,124*	*40,823*	*38,285*	*657,668*
Capital	*285,144*	*918,432*	*116,261*	*596,074*	*1,277,526*	*81,609*	*34,190*	*1,600,724*

Table 11.22: Public Resistance to Consumption of a Major Food Source
Daily Nutrient Surplus/Deficit: All Trade Ceases - Potassium through Niacin

	Nutrients							
RHA	**Potassium (g)**	**Vit A (IU)**	**Vit C (g)**	**Vit B6 (g)**	**Folate (g)**	**Thiamin (g)**	**Riboflavin (g)**	**Niacin (NE)**
Assiniboine	7,931,096	-17,004,112	181,520	6,506	484	3,254	1,347	59,640,378
Brandon	2,074,136	237,315,608	-581	2,069	24	4,004	2,048	59,901,065
Burntwood	-201,374	-106,972,320	-3,063	-54	-16	-46	-48	-606,982
Central	11,516,801	734,084,993	171,796	7,355	1,256	5,197	3,385	93,933,861
Churchill	-4,143	-2,265,381	-67	-1	0	-1	-1	-12,740
Interlake	-177,290	-113,857,804	-4,367	8	4	-27	-42	145,607
Norman	-104,090	-54,546,191	-1,687	-28	-9	-23	-22	-275,762
N. Eastman	-176,789	-62,703,470	-2,372	-49	-14	-39	-41	-489,393
Parkland	-156,203	-65,720,943	-2,481	-26	-14	-3	-16	190,870
S. Eastman	-92,669	447,051,518	-3,083	72	20	68	342	3,139,360
Winnipeg	-1,438,921	2,177,741,111	-25,600	24	-10	1,120	1,609	24,216,447
Province	**19,170,554**	**3,173,123,009**	**310,015**	**15,876**	**1,725**	**13,504**	**8,561**	**239,782,711**
Northern	*-309,607*	*-163,783,892*	*-4,817*	*-83*	*-25*	*-70*	*-71*	*-895,484*
Western	*9,849,029*	*154,590,553*	*178,458*	*8,549*	*494*	*7,255*	*3,379*	*119,732,313*
Capital	*9,631,132*	*3,182,316,348*	*136,374*	*7,410*	*1,256*	*6,319*	*5,253*	*120,945,882*

If poultry production ceased, similar to the case of a 35% reduction in processor production, Manitobans will still have a surplus of food, although regional shortages may occur. With a reduction in poultry production and trade ceasing the effect is mitigated.

11.3.5 Lower than Expected Home Food Safety Stocks

In Section 8 attitudes toward home food safety stocks were discussed. Home food security is to be encouraged ahead of a pandemic. If stocks are less than expected the risk of a nutrition downfall will increase.

11.3.6 Unexpected Migration

Section 8.2 provides an overview of the findings relative to migration. If the survey results indeed reflect of Manitobans attitudes then migration is a low risk.

11.4 Unique Circumstances

There are two unique circumstances related to the MB Pandemic Nutrition plan. These relate to food banks and hospitals/health centres.

11.4.1 Food Banks

A special consideration during a pandemic is the supply of food banks and emergency food programs. Many people depend on these charities to supplement their monthly food supply.

Figure 11.1 presents the typical for-profit and not-for-profit food supply chain in Manitoba. While stores such as Safeway Canada, Sobeys and SuperStore are examples of the for-profit food retailer serving Manitoba, Winnipeg Harvest[104] is mostly a not-for-profit food wholesaler. Through a network of food banks and soup kitchens, Winnipeg Harvest provides food for needy Manitobans. Thus, Winnipeg Harvest and other food banks will be a critical member of the food supply chain, if/when the pandemic comes.

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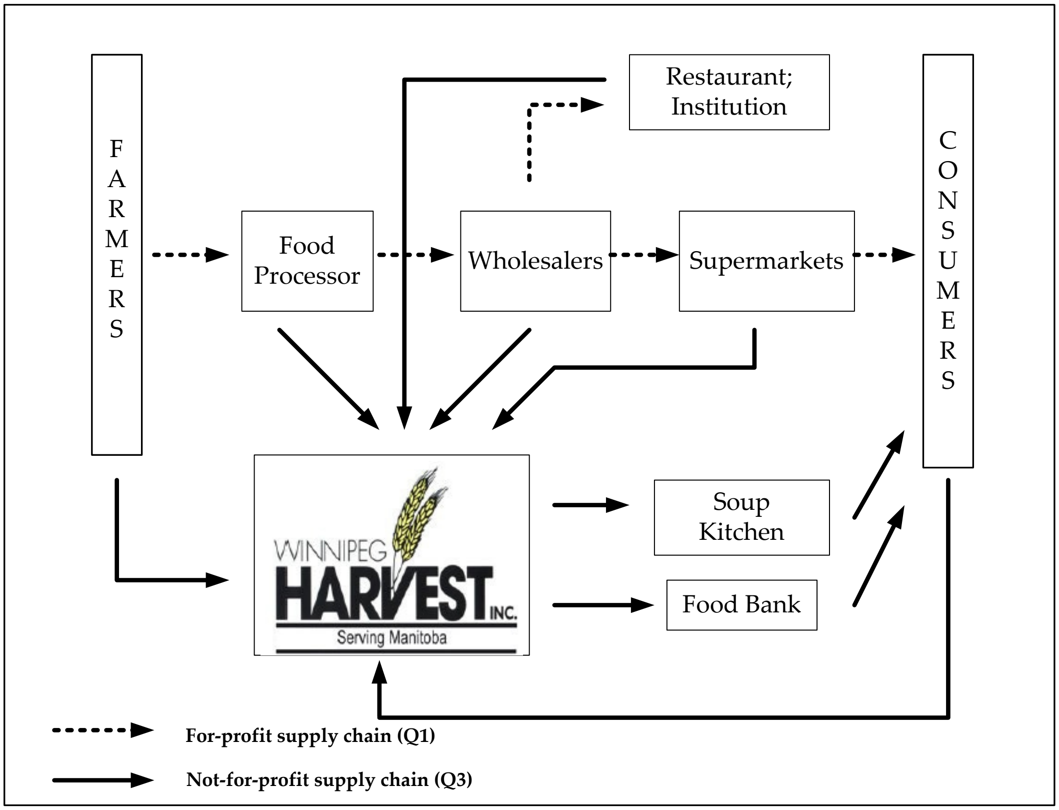
[104] Note that all members of the for-profit supply chain are potential sources of supply for Winnipeg Harvest.

Figure 11.1: For-Profit and Not-for-Profit Food Supply Chain



Currently, there are 48 food banks operating in Manitoba.[105] These include operations in centres such as Winnipeg, Brandon, Dauphin, Beausejour, Selkirk, Swan River, Gimli, and Teulon. Based on a study conducted by the Canadian Association of Food Banks, approximately 43,563 people were assisted by Manitoba food banks in March 2007.[106] For this study, the month of March was used as it is considered an "unexceptional" month with neither high (December, January, and October) nor low (June, July) demands.[107]

Food banks operate using donations and surpluses from processors, retailers, and charities/private citizens. Additionally, food banks support each other, contributing surplus supplies when available. The distribution of supplies is often in the form of grocery hampers with items that can be used to supplement meals over several days. The contents of a Winnipeg Harvest hamper, which is typical of food bank hampers is shown in Table 11.23.

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105 Winnipeg Harvest. "Manitoba's Response to Hunger." (February 2006) <http://www.winnipegharvest.org/hunger/mbresponse>
106 Hunger Count 2007. Canadian Association of Food Banks, 2007 (Page 25).
107 Hunger Count 2007. Canadian Association of Food Banks, 2007 (Page 10).

Table 11.23: Winnipeg Harvest "Food Bank Hamper"

<table>
<tr><td colspan="2">5 lbs. Potatoes</td></tr>
<tr><td colspan="2">2 lbs. Onions</td></tr>
<tr><td colspan="2">1 bag/head of Lettuce</td></tr>
<tr><td colspan="2">3 lbs. Fruit/Vegetables</td></tr>
<tr><td colspan="2">1 loaf Bread</td></tr>
<tr><td colspan="2">1 bag Buns</td></tr>
<tr><td colspan="2">1 package Pastry</td></tr>
<tr><td colspan="2">1 bag Frozen Potatoes/ French Fries</td></tr>
<tr><td rowspan="4">1 "Kit"</td><td>1 "Protein"
(Lentils, Beans, Canned Meat/Fish</td></tr>
<tr><td>1 "Mix"
(Dry Soup, Stew, Rice, Pizza)</td></tr>
<tr><td>1 can Fruit or Vegetables</td></tr>
<tr><td>1 Pasta</td></tr>
</table>

For families that have children under the age of 12 years or women who are pregnant or nursing, hampers include 1 litre of milk and 1 additional Kit. These hampers are meant to sustain a family of 2.75 people for 2-5 days. Based on demand from 43,563 customers, there were 15,841 (up to 5 day) hampers distributed in March, 2007. If 6 hampers are needed per month the total distributions would be slightly more than 95,000 hampers.

The nutritional profile of the typical hamper is presented in Table 11.24 and 11.25.

Table 11.24: Nutritional Profile of a Typical Hamper - Protein Through Sodium

	Nutrients	**Protein (g)**	**Carbs (g)**	**Fibre (g)**	**Fat (g)**	**Calcium (g)**	**Iron (g)**	**Zinc (g)**	**Sodium (g)**
Kit	Can Fruit/Veg	13.0	95.0	9.9	4.3	25.9	2.2	2.2	1304.6
	Protein	35.1	0.0	0.0	16.2	450.9	2.2	1.6	1001.7
	Pasta	23.7	142.0	8.1	3.4	33.8	7.1	2.7	5.1
	Soup	12.0	32.0	4.4	4.0	140.0	2.0	0.8	5428.0
Standard Hamper	Potatoes	56.2	573.1	51.7	0.0	224.8	30.3	6.7	179.8
	Onions	10.7	75.0	15.0	0.0	182.1	2.1	2.1	32.1
	Lettuce	5.7	5.7	5.7	0.0	119.7	4.0	0.6	28.5
	Fruit/Vegetables	15.4	150.7	33.8	0.0	254.5	8.1	3.4	684.7
	Bread	40.0	240.0	12.0	20.0	540.0	16.0	4.0	2680.0
	Buns	24.3	170.0	10.9	24.3	412.9	10.9	2.4	1797.1
	Pastry	25.5	293.6	10.2	140.4	268.1	11.5	3.8	3280.9
	French Fries	2.2	320.0	32.0	80.0	80.0	12.0	4.0	300.0
Extra	Milk	34.9	46.5	0.0	19.4	1217.1	0.4	3.9	500.0
Extra Kit	Can Fruit/Veg	13.0	95.0	9.9	4.3	25.9	2.2	2.2	1304.6
	Protein	35.1	0.0	0.0	16.2	450.9	2.2	1.6	1001.7
	Pasta	23.7	142.0	8.1	3.4	33.8	7.1	2.7	5.1
	Soup	12.0	32.0	4.4	4.0	140.0	2.0	0.8	5428.0

Table 11.25: Nutritional Profile of a Typical Hamper - Potassium Through Niacin

	Nutrients	Potassium (g)	Vitamin A (IU)	Vitamin C (g)	Vitamin B6 (g)	Folate (g)	Thiamin (g)	Riboflavin (g)	Niacin (g)
Kit	Can Fruit/Veg	889.9	1153.4	25.9	0.3	237.6	0.2	0.3	6.9
	Protein	712.8	137.7	0.0	0.5	29.7	0.0	0.3	20.5
	Pasta	155.5	0.0	0.0	0.2	33.8	1.0	0.5	13.5
	Soup	128.0	268.0	0.0	0.0	8.0	0.3	0.2	6.0
Standard Hamper	Potatoes	9484.6	0.0	292.2	7.9	247.2	2.5	0.8	50.6
	Onions	1424.4	0.0	53.6	1.1	171.4	0.4	0.2	4.3
	Lettuce	980.4	8766.6	79.8	0.2	456.0	0.3	0.3	2.3
	Fruit/Vegetables	2318.7	13459.2	521.7	1.2	309.4	0.7	0.7	9.4
	Bread	600.0	0.0	0.0	0.4	160.0	2.4	1.8	28.0
	Buns	461.4	0.0	0.0	0.2	109.3	1.7	1.1	19.4
	Pastry	766.0	344.7	0.0	0.4	51.1	1.3	1.4	17.9
	French Fries	4180.0	0.0	100.0	3.0	120.0	1.2	0.2	28.0
Extra	Milk	1542.6	2050.4	7.8	0.4	50.4	0.4	1.7	8.5
Extra Kit	Can Fruit/Veg	889.9	1153.4	25.9	0.3	237.6	0.2	0.3	6.9
	Protein	712.8	137.7	0.0	0.5	29.7	0.0	0.3	20.5
	Pasta	155.5	0.0	0.0	0.2	33.8	1.0	0.5	13.5
	Soup	128.0	268.0	0.0	0.0	8.0	0.3	0.2	6.0

When discussing the role of a food bank during a natural disaster, a consideration is the increased demand on food banks as people are unable to work.

11.4.2 Hospitals, Personal Care Homes, and Meals on Wheels

Additional populations and production facilities are found in the form of hospitals, personal care homes, and home delivery services. These concentrated populations require assistance preparing nutrition. In the event of a pandemic, the demand for these services will likely increase substantially.

Most hospitals and personal care facilities operate their own kitchens or are supplied by nearby production and distribution facilities. While many personal care facilities are individual facilities, some of the rural facilities are nearby or even connected with the local hospitals. In total, Manitoba has just over 13,000 hospital and personal care beds. The number of available beds in each RHA are listed below in Table 11.26.

Table 11.26: Available Hospital Beds by RHA[108]

RHA	Patient Beds	Personal Care	RHA Total Beds
Winnipeg	2,135	5,474	7,609
Brandon	336	597	933
Assiniboine	415	873	1,288
Central	187	505	692
Parkland	226	544	770
Interlake	136	420	556
North Eastman	53	216	269
South Eastman	125	334	459
Norman	96	130	226
Burntwood	101	85	186
Churchill	20	7	27
Total Patient Beds	**3,830**	**9,185**	**13,015**

The largest number of hospital and personal care beds (7,609) is found in the Winnipeg RHA and accounts for nearly 60% of the total beds in the province. Other large numbers of beds are found in the Assiniboine (1,288), Brandon (933), and Parkland (770) RHAs.

Processors that provide meals to hospitals are able to produce at least three meals daily for every bed available in the RHA. As well, many of these processors also produce additional meals for various community food services. These include “Congregate” programs where recipients meet at a location to dine with others and “Delivery” programs (such as Meals on Wheels) where meals are delivered directly to the recipient’s residence. Most often, the delivery of these meals is performed by volunteers.

A sample of the daily number of “community” meals prepared by several RHAs is available in Table 11.27.

Table 11.27: Number of Daily Community Meals Produced

RHA	#
Winnipeg	750
Central	523
South Eastman	400
Parkland	235
Churchill	10

While delivery programs are most often used by senior citizens, these programs are available to any individuals who are unable to prepare nutritious meals due to illness,

[108] Hospital data either provided by RHA, Individual Hospitals, Personal Care Facilities, or RHA Publications

injury, or inability. In the event of a pandemic, there could be a significant increase in the demand for these services by families and individuals who regularly would not use such a service.

The daily meal requirements of RHA health facilities are quite substantial. While these processing facilities currently deliver custom ordered meals in a "Just In Time" fashion, the system has been designed with a maximum capacity equal to the number of beds and related community meal requirements. When faced with an influx of patients along with a potential decrease of production staff during a pandemic, some RHA administrative authorities suggest that the nutrition requirements of the hospitals, personal care facilities, and community meal programs may be very difficult to meet.

SECTION 12 : MANITOBA NUTRITION SUPPLY PLAN IN THE EVENT OF A PANDEMIC

12.1 Background

The Manitoba Nutrition supply plan draws on the results of the preceding sections as well as the limitations on the scope of this study. Namely these scope limitations are:

- The plan only relates to post farm gate production[109].
- The plan is to use market based solutions wherever possible. That is, the solution should involve the pull, as opposed to push, of food through the chain.
- The plan should account for three waves of pandemic over a 24 month period.
- General absenteeism will be up to 35% during each wave.
- Each wave will last 6 to 8 weeks.
- The wave length between waves may vary.
- Multiple simultaneous disasters do not occur, for example, a pandemic along with a drought.
- Both inter-provincial and national borders close to trade.
- Specified food for unique groups such as vegetarians, kosher or halal will be supplied either from regular food supplies (vegetarian) or home stocks (kosher/halal).
- The plan should account for unique situations (example infant nutritional requirements).

The plan was based on the information in the preceding section, plus a review held in an industry workshop held March 14, 2008 in Winnipeg. The material distributed at the workshop and the workshop facilitator's report is provided in Appendix J.

The plan describes the response to a pandemic wave. Subsequent to each wave the plan should be reviewed and modified as needed.

12.2 Strategy, Tactics and Operations

12.2.1 Strategy

This plan forms the high level strategy in the event that a pandemic occurs. The plan suggests a series of actions based on triggers related to the phases of a pandemic outbreak.

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[109] Direct from farms sales may be able to mitigate some of the risks in rural areas, if/when a pandemic occurred. However, this would need to be accompanied by appropriate inspection procedures.

The plan was based on the premise that the worst case scenario is that food shortage develop, consequently the bias in the layering approach is toward having excess food, rather than too little food. This is necessary simply since 'a priori' there is no concrete information on the actual length and depth (infection rate) of the potential pandemic. While each wave is expected to be 6 to 8 weeks and have a 35% infection rate, the actual event could be longer and have even higher infection rates.

The plan is also based on an immediate call to action for some components of the plan. The most critical of these is the need to ensure that a risk management plan for a pandemic is in place related to potable water supplies. Of secondary importance is to increase the level of readiness in terms of messaging and in the determination of suppliers who may be needed to provide emergency supplies and reacted transportation. Ideally the suppliers and contract terms (perhaps exclusive of costs) will be established many months prior to a pandemic occurrence.

12.2.2 Tactics

As a mitigation strategy in this plan a "rule of three" has been adopted. By adopting three sources, three locations and three transportation providers, the likelihood of simultaneous system failure is reduced. For each vulnerability, a layered approach is used in the plan to provide multiple protections against risk and system failure. The layers are as follows:

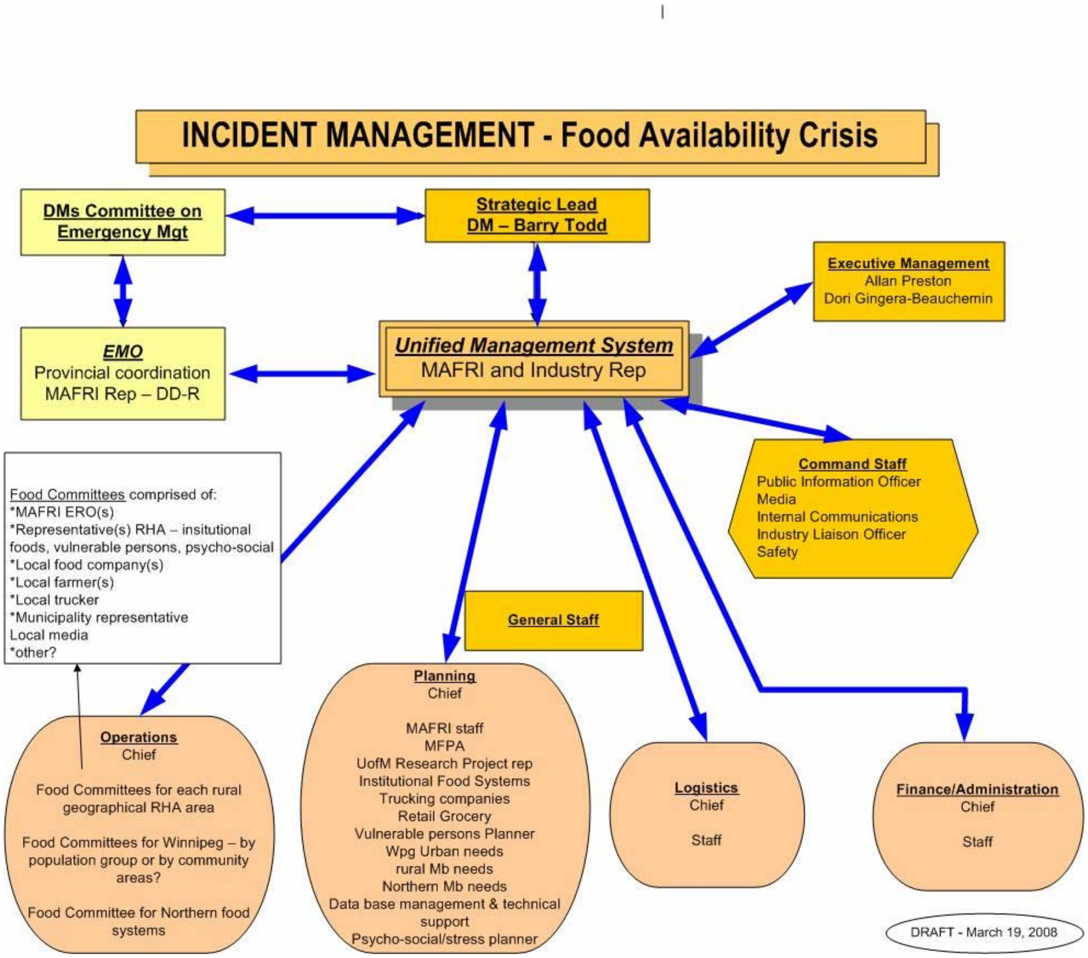
- Layer 1: Protection involves encouraging individual choices by consumers and other stakeholders in the food supply chain.
- Layer 2: Protection involves preventative actions taken by government.
- Layer 3: Protection involves government intervention.

For each vulnerability the layers form the tactics to mitigate that vulnerability. Each layer is triggered by the phase of the pandemic.

12.2.3 Operations

The tactics form the general structure of the response to each vulnerability. However, the extent of impact of each vulnerability in event that a pandemic occurs will vary, in particular at the regional level. Operationally it will be necessary for decisions to be made on a daily basis as to the requirements and flows of nutrition within Manitoba. As of the date of this report, the hierarchy for operationalising the plan and making the required day to day decisions is shown in Figure 12.1. A working group of government, industry and university representatives will continue to refine an operational plan and mitigation strategies/activities.

Figure 12.1: Draft Incident Command - Food Availability Crisis



The operational plan will follow the principles of incident command/management systems with leadership and decision-making clearly established. Roles and responsibilities for each component of the incident command/management system are outlined and regular briefings will take place to manage expected and unexpected events during the emergency. A monitoring and assessment group will be established at WHO level 4. MAFRI will activate the Unified Management Leads at WHO Level 4.1 who will determine further activation of the Incident Management Response System based on regular risk assessments.

12.3 Responses to System Vulnerabilities to the Manitoba Nutrition Supply Chain

12.3.1 All Trade Ceases

While the broad parameters of the plan are to consider a complete national and international trade shutdown, other potential trade disruptions exist as described in Section 5. This includes cessation of international trade, disruption of domestic trade, and a complete shutdown of all trade. Overall, Manitoba is in a fortunate situation in that trade disruptions generally result in greater available nutrition supplies in Manitoba. While the mix of food stuffs will be limited the overall nutritional availability will be adequate as shown in Section 11.2. The biggest nutritional shortages appear to be minerals and vitamins with the greatest deficit in the North. With trade flow disruptions, the primary issue will be the distribution of food within the province. A plan for trade flow disruptions is unnecessary other than its effects on other parts of the nutrition supply chain (critical ingredients are not available, shortage of transportation equipment and operators, wholesale distributor failure, and retail failure).

The challenges in relation to border closures will be in the food distribution system; re-organizing the distribution of food such that: food is located where Manitobans can purchase it; new storage and transportations systems can be established to accommodate the change and to ensure food is not wasted/spoiled; food supply chain businesses are not forced out of business due to the inability to supply contract commitments and/or inability to sell product in the confusion of the disruption.

12.3.2 Critical Ingredients are not Available

Section 11.2.4 provides details on the relatively few critical ingredients unavailable in Manitoba. Within this list the greatest inventories were held for ingredients needed for cheese making. Respondents did not provide the time period for available inventory for vitamin A. According to the Food and Drug Act milk is required to be fortified with vitamins A and D. As well, in terms of the nutritional balances discussed in Section 6.2, the weakest link in the Manitoba supply is vitamin A. Packaging and sanitation supplies used in plant operations are also critical.

In terms of pandemic planning the suggested approach is as follows;

Layer 1: Processor Inventory (Trigger: Pandemic Phase 3.0)

The onus of preparedness should focus on pre-planning by the processing sector. Accordingly the plan calls for:

- Business Continuity Planning: Prior to phase 4.0, processors should be encouraged to develop business continuity plans, including those related to a pandemic event. The steps should include:
    - Discussion during inspections including provision of planning materials.
    - Messaging to the sector related to the importance of continuity planning.
    - Encouragement to stock non Manitoba based critical ingredients, including packaging and sanitation supplies once phase 4 is breached.
    - Focus on medium and larger processors.

Layer 2: Government Supported Acquisitions (Trigger: Pandemic Phase 4.1)

At layer 2 the government would undertake the following activities:

- Subcontracting with the private sector for reserves of industrial vitamin supplies (A and D), yeast, salt and sugar, packaging and sanitation supplies. An average inventory of 20 days of production would be acquired. The government may wish to pass regulation stipulating the minimum inventories to be held and monitor these as part of the inspection system.
- Alternately, the government may wish to hold equivalent emergency supplies with control residing with the government.
- Establish emergency packaging and labeling rules in anticipation of a future needs.

Layer 3: Distribution of Stocks (Trigger: Pandemic Phase 6.2 and Producer Shortages)

- Make available government purchased resources to processors on a cost recovery basis if this approach is selected. Verify stocks if a regulatory approach is adopted.
- Suspend packaging rules.
- Implement emergency labeling rules related to major allergens.

12.3.3 Shortage of Drinking Water for Human Consumption

This part of the plan provides for emergency drinking water supplies in the event of a water system failure. In this event substitute supplies of bottled water would be needed. Table 12.1 shows the number of firms by pandemic planning area producing bottled water. The bulk of bottled water is produced from water flowing through water treatment plants.

Table 12.1: Number of Firms Producing Bottled Water

Pandemic Planning Area	Number of Suppliers	Spring Fed
Northern	*8*	-
Western	*4*	-
Capital	*39*	*5*

On average, each person requires 3 litres of water per day. Based on the population data provided in Section 3, the daily requirements for each pandemic planning area are as shown in Table 12.2.

Table 12.2: Drinking Water Requirements by Pandemic Planning Area

Drinking Water Requirements by Pandemic Planning Area		
Pandemic Planning Area	**Amount**	**% of Province**
Northern	*210,000 litres*	*6*
Western	*480,000 litres*	*14*
Capital	*2,840,000 litres*	*80*
Total	*3,530,000 litres*	*100*

Obviously it is impractical to attempt to store these volumes of water for a 6 week cycle,.

For water the layers of protection are as follow:

Layer 1: Consumer Messaging (Trigger: Pandemic Phase 4.0):

- Specific messaging to households to stock drinking water. The messaging should include:
    - The need to stockpile up to 21 litres per week per person in the household.
    - The need to have an on hand inventory to last 2 weeks.

Layer 2: Government Emergency Supplies (Trigger: Pandemic Phase 4.1)

- The government would acquire bottled water for a population of 10,000 for 2 weeks (420,000 litres). Acquisition from 1 spring fed source and 2 municipal based sources.
    - Pre-positioning in Brandon and Thompson. ***(Note: Given the size of the population in Winnipeg, it is impractical to attempt to provide an alternate water supply. The Winnipeg system simply can not be allowed to fail).***

Layer 3: Distribution of Government Emergency Supplies (Trigger: Pandemic Phase 6.2 and a Local Water System Failure)

- Distribution of water supplies through food depots (See section 12.6.2) in the affected city/town/village/region.
    - Immediate replenishment to sustain delivery.

12.3.4 Shortage of Transportation Equipment

Planning related to transportation equipment involves the following steps.

Layer 1: Business Continuity Planning (Trigger: Pandemic Phase 3.0)

- Transportation firms (including northern air cargo services) should be encouraged to develop business continuity plans, today. The plans should consider the following eventualities:
  - The potential that equipment will be marooned outside Manitoba.
  - Equipment being available but human resources being reduced, affecting not only movement but office functions such as dispatch.

- Determination of the needs of refrigerated trailers for medical purposes by the respective governmental authorities.

Layer 2: Transportation Equipment Contracting (Trigger: Pandemic Phase 4.1)

At layer 2 the government would take the following actions:

- Pre contract for the acquisition of equipment and operators, including
  - A requirement to preposition trucking equipment and operators in Thompson, Brandon and Winnipeg.
  - Air cargo service as needed to remote communities.

- Include one trucking firm that normally operates on winter roads.

Layer 3: Use of Contracted Equipment (Trigger: Pandemic Phase 6.2)

In response to a pandemic event reaching Phase 6.2 the following actions would be undertaken:

- As required, use pre contracted trucking resources to move food supplies to deficit areas.
- As a backstop for remote community supply by air, use the government fleet of aircraft.
- Consider the suspension of road weight restrictions.

12.3.5 Agricultural Production Reduction

As shown in Sections 10 and 11.2.7 a reduction of 35% of agricultural production has little effect on Manitoba nutritional balances. Northern regions tend to have a deficit while southern regions have surpluses. The key is to move food from the south to the north, increasing the importance of planning related to transportation equipment and operators.

In terms of pandemic planning the following actions should be undertaken:

Layer 1: Farm Level Preparedness (Trigger: Pandemic Phase 4.0)

Encourage producers to enter into planning arrangements with farming colleagues:

- To maintain one another's production as feasible during a pandemic, for grains, fruits and vegetables particularly during the crucial planting and harvesting seasons. Steps include:
    - Generic messaging through trade magazines and industry organizations as to the need to prepare continuity plans.
    - Extension education programming.
    - Distribution of business continuity materials

Layer 2: Government Monitoring (Trigger: Pandemic Phase 4.1)

At pandemic status 4.1 the government would take the following monitoring actions:

- Set up processor hotline to report shortages of inputs.
- Inventory monitoring including:
    - Monitor inventories of grains in the primary elevator systems to ensure adequate supplies of grains.
    - Monitor production and supplies of vegetables.
    - Monitor supplies of livestock and poultry available.

Layer 3: Government Assistance (Trigger: Pandemic Phase 6.2)

At pandemic status 6.2 the government would take the following actions:

- Continue inventory monitoring.
- Use the hotline to monitor shortages for processors.
- Mobilize human and other resources to help agricultural producers continue to produce primary livestock and plant ingredients.
- Initiate avian influenza eradication procedures if needed (out of scope of this project)
- Arrange the use of government controlled transportation equipment for the movement of inventory from primary elevators/vegetable storage/livestock producers to areas with processor shortages. Transportation and goods to be provided at cost.

12.3.6 Processor Production Reduction

As shown in Section 11.2.8 processor production declines during a pandemic will not trigger widespread shortages of nutrition for Manitobans if trade ceases. It may however, increase regional vulnerability if local processing sources (small meat packers, bakeries etc.) are unable to produce. Most larger processors ship their goods to many locations through wholesalers and distributors mainly situated in Winnipeg.

Related to this vulnerability the layers of the plan are as follow:

Layer 1: Processor Preparation (Trigger: Pandemic Phase 3.0)

- Encourage processors to develop contingency plans, focusing on the smaller local processors. Key elements of the plan should be:
  - Storage plan.
  - Transportation - if the common carrier they use or their private fleet is not available how will they mitigate the risk?
  - Human resources.

Layer 2: Government Request of Readiness (Trigger: Pandemic Phase 4.1)

- Processors requested to:
  - Ready storage, transportation and human resources plans.
  - Increase their inventory of current critical ingredients. The government may wish to pass regulation stipulating that these ingredients be inventoried and monitor these as part of the inspection system.
  - Establish emergency packaging and labeling rules in anticipation of a future needs.
- Consideration must be given to supporting the financing of the extra inventories through loan guarantees[110].
- At this stage the government officials would also ask processors to plan for alternate uses of their facilities. This process would include:
  - Providing information on the possible other uses for the facility.
  - Barriers to redeployment (critical ingredients etc.).

Layer 3: Government Assistance (Trigger: Pandemic Phase 6.2)

In response to a pandemic event reaching Phase 6.2 the government would act to:

- Require processors to report production and inventories available as well as input shortages they are experiencing.

[110] This may be through emergency assistance programs.

- Use processor production and inventories to move supplies to regions in short supply, preferably through the wholesale/distributor and retail supply chain.
- Encourage the reassignment of processor resources as needed to meet nutrition needs.
- Provide any government held inventory of critical ingredients and transportation resources as needed at cost.

12.3.7 Wholesaler/Distributor Failure

The wholesaler/distributor sector is fundamental to the retail sector necessitating a primary planning objective with the goal of mitigating risk at this level. Failure of this sector could result from:

- Worker shortages.
- Equipment shortages in moving product from processor to distributors or from wholesaler/distributor to retailer.
- Trade cessation which limits available supplies (in the event of a trade disruption it is estimated that supplies at this level will last two weeks).

At the wholesaler/distributor level the layers of the plan are:

Layer 1: Wholesaler/Distributor Preparation (Trigger: Pandemic Phase 3.0)

The key to mitigating wholesaler/distributor risk during a pandemic is preparedness today. The plan calls for:

- Distributors to develop contingency plans in the event of a pandemic. The plan should include:
    - Consideration of human resource losses.
    - Planning for the loss of trucks for the movement of product through its supply chain.
    - Inventorying critical ingredients as requested by their processor customers.

Layer 2: Government Encourages Warehousing (Trigger: Pandemic Phase 4.1)

As the pandemic status passes to Phase 4.1 the government would take the following actions:

- Request for distributors to maximize inventories of key foods - milk (fresh and dried), eggs, breads and related ingredients, infant foods, meats, canned/frozen fruit and vegetables.
- Notify distributors of timing of the messaging related to the need to build home stockpiles.

Layer 3: Government Assistance (Trigger: Pandemic Phase 6.2)

In response to a pandemic event reaching Phase 6.2 the government would monitor inventory levels at wholesalers/distributors. Steps include:

- Daily reporting of available inventories of key foods.
- Ensuring distribution to retail level in areas of shortages.
- Ensuring distribution, if needed, to government food warehouse space in Thompson, Brandon and Winnipeg.
- Providing government contracted transportation resources as needed at cost.

12.3.8 Retail Network Failure

With respect to the pandemic plan, the objective is to maintain the retail network as long as possible which is contingent on success at the wholesaler/distributor level. At the same time it is important to ensure that potentially disruptive practices such as price gouging are monitored and avoided.

The layers of the plan are as follows:

Layer 1: Retail Trade Preparation (Trigger: Pandemic Phase 3)

The plan calls for:

- Development of retail level specific plans to provide food in the event of a pandemic.

    - Development of individual business continuity planning human resource plan to prevent failure of the system due to the pandemic event at the store(s) itself. The emphasis would be on smaller firms.

Layer 2: Food Emergency Supplies Built (Trigger: Pandemic Phase 4.1)

At layer 2 the government would undertake the following activities:

- Request for retail outlets to maximize in store inventories of key foods - milk (fresh and dried), eggs, breads and related ingredients, infant foods, meats, canned/frozen fruit and vegetables.
- Request that contributions to the inventories of local food banks are maximized.
- Consumer messaging in regard to increasing inventories of foods to last 2 weeks.
- Contract for the acquisition and storage of meals - ready to eat (MREs) sufficient to feed 10,000 persons for two weeks.
- Pre-position MRE inventory in Thompson, Brandon and Winnipeg.

- Establishment of the Manitoba Food Pandemic hot line with the goal of providing a one-stop service for Manitobans to report local shortages and access advice on preparing locally available products. Mobilize commodity groups and cuisine groups assist in this service. As well, the hotline would be used to monitor price increases when the pandemic has occurred.
- Strategize arrangements with various social service agencies to increase capacity for families/housing units to store more food (freezers, storage facilities etc.)

Layer 3: Distribution of Emergency Food Stocks (Trigger: Pandemic Phase 6.2 and Localized Shortages)

- Make available government controlled resources to feed Manitobans as needed.

    - Make available contracted transportation equipment as needed to facilitate shipments from distributors to retail (for movement of Manitoba based food to distributors and from distributors to retail outlets.) at cost.
    - Assure continued supply from retail distributors/warehouses to small locally based independent retailers and food banks.
    - Consider rationing.
    - Make available MRE food supplies in areas of need through depots. The need would be verified through local Food Committee lead by MAFRI.
        - Immediate replenishment of MREs.

12.4 Response to Human Related Vulnerabilities to the Manitoba Nutrition Supply Chain

12.4.1 Feeding Requirements for Infants

Layer 1: Household Stockpiling (Trigger: Pandemic Phase 4.0)

At this stage the following activities are required:

- Generic messaging related to the threat of a pandemic.
- Investigation of infant formula and/or infant food production possibilities at the Food Development Centre.
- Specific messaging to parents of infants related to home safety stocks of infant foods. The messaging should include;
    - The need to stockpile for up to 6 weeks of absence of infant food on supermarket shelves.
    - Rotate the food in daily use, maintaining the overall household inventory level.

Layer 2: Build up of Emergency Safety Stocks (Trigger: Pandemic Phase 4.1)

In the second layer of protection the government will either acquire or contract through the private sector safety stocks of infant formula and strained food which would be warehoused in Manitoba.

At this layer the following activities will occur:

- Consumer messaging related to home preparations of nutritionally adequate formula and infant foods.
- Acquisition of a mix of infant food based on the requirements described in Section 11.3.1 and Table 12.3.
- Pre-positioning inventory in Thompson, Brandon and Winnipeg. Using the ratio of pregnant and nursing females by Manitoba region as shown in Section 3, 15% of the total inventory should be pre-positioned in Thompson for the northern pandemic planning area, 15% in Brandon for the western pandemic planning area, and 70% in Winnipeg for the central pandemic planning area.

Layer 3: Government Assistance (Trigger: Pandemic Phase 6.2 and Local Shortages)

At this stage the following activities will occur:

- Distribution of infant food supplies:
    - Verification of the number and age of infants in the household.
    - Restocking of warehouses:
        - Emergency shipments from other locations outside Manitoba.
        - Preparation locally within Manitoba.
            - At home using recipes that are distributed.
            - Through the Food Development Centre.
            - Other processors.

12.4.2 Shortage of Transportation Equipment Operators and Maintenance Workers

The plan related to operators follows the sequence of the approach related to transportation equipment.

Layer 1: Business Continuity Planning (Trigger: Pandemic Phase 3)

- Transportation firms (including northern air cargo services) should be encouraged to develop business continuity plans, today. The plans should consider the following eventualities:
    - Equipment being available but human resources being reduced, affecting not only movement but functions such as dispatch and equipment repair.

Layer 2: Transportation Equipment Operator Contracting (Trigger: Pandemic Phase 4.1)

At Layer 2 the government would take the following actions:

- Request the industry and Manitoba Public Insurance mobilize as many qualified drivers as possible from the pool of licensed drivers in the province.
- Pre contract for the acquisition of operators, including
  - A requirement to preposition trucking equipment and operators in Thompson, Brandon and Winnipeg. The contract would specify provisions to ensure adequate levels of maintenance staff are available.
  - Air cargo or barge service as needed to remote communities.

- Include one trucking firm that normally operates on winter roads.

Layer 3: Government Assistance (Trigger: Pandemic Phase 6.2)

In response to a pandemic event reaching Phase 6.2 the government would take the following steps:

- Use pre-contracted trucking resources to move food supplies to deficit areas as needed.
- As a backstop for remote community supply by air, use the government fleet of aircraft.
- Require qualified, healthy drivers enlist in serving the needs for food transport.
- Temporarily suspend trucker hours of operation rules, allowing operators extended hours to meet emergency needs.
- Ensure government staff and pilots are available in the event that government air services are needed to move food to remote communities.

12.4.3 Failure to Have Business Continuity Plans

As shown in Section 11.3.3 there is a general failure to put business continuity planning in place for most members of the Manitoba nutrition supply chain, except for large retailers. The need for improved planning for these members of the chain was discussed above. This section focuses on the need to improve planning at the processor and logistics level, particularly amongst smaller firms. In terms of pandemic planning the layers of the plan are as follow:

Layer 1: Processor and Logistic Firm Preparation (Trigger: Pandemic Phase 3.0)

- At this stage the encouragement will be provided to small and medium sized processors and logistics firms to formalize continuity/pandemic plans. Steps include:

  - Generic messaging through trade magazines and industry organizations as to the need to prepare continuity plans.
  - Distribution of business continuity materials.

- Extension education programming.
- Monitoring state of planning during inspections

Layer 2: Follow-up (Trigger: Pandemic Phase 4.1)

- At this stage government staff would follow-up directly with firms to attempt to ensure plans are in place. This would involve:
  - Reviewing information collected through inspections.
  - Following up with firms that indicate they do not have plans.
  - Providing planning guidelines to firms that indicate they do not have plans.

Layer 3: **No actions**: Firms can not be compelled to plan.

12.4.4 Public Resistance to Consumption of a Major Food Source

Layer 1: Allay Fears (Trigger: Pandemic Phase 4.0)

At this stage private sector organizations would be encouraged to deliver messaging to the public. The intent of the messaging would be:

- That poultry or other food while the precursor to the pandemic is not the direct source.
- Consumer messaging related to the safe handling and cooking of poultry or other antecedent.
- That standards exist in Manitoba to ensure that transmission has not occurred.

Layer 2: Government Action (Trigger: Pandemic Phase 4.1)

At this stage the government would:

- Use supportive information to back private messaging.
- Follow avian influenza eradication plan.

Layer 3: Government Assistance (Trigger: Pandemic Phase 6.0 and Reduced Consumption of Poultry)

- Follow avian influenza eradication response plan (out of scope of this study).

12.4.5 Lower than Expected Home Food Safety Stocks

As shown in Section 8.2, Manitobans are likely to stock up on food in the event of a pandemic, although they tend to believe a pandemic is not that likely and have done little planning for such an event. A potential vulnerability is that Manitobans will not stock up. To mitigate this risk the following approaches can be used.

Layer 1: Consumer Messaging (Trigger: Pandemic Phase 4.0)

- Specific messaging to households to stock food. Advance notice to processors, wholesalers/distributors and retailers to ensure sufficient stocks are available to the consumer. The messaging should include:
    - That a pandemic is likely to occur in the near future.
    - Potential food shortages may occur.
    - The need to stockpile food for the household that is non perishable (dry goods, canned and frozen).
    - The need to have an on hand inventory to last up to 6 weeks.
    - Special messaging related to infant foods and formula.

Layers 2 and 3: Action and Intervention (Trigger: Pandemic Phases 4.1 and 6.2)

These phases use the food and water resources described under the following sections:

- Shortage of Drinking Water for Human Consumption
- Retail Network Failure
- Feeding Requirements for Infants

Triggers would occur on the basis described in those sections.

12.4.6 Unexpected Migration

Manitobans are unlikely to migrate in the event of a pandemic, particularly if they live in rural or northern parts of the province as shown in Section 8.2. Persons in Winnipeg however show a slightly higher propensity to migrate. If there were a migration, the problem is assuring that the nutrition is available in the regions persons migrate to. As shown in the scenario analysis of Section 10, flows will change only a relatively small amount if migration does occur. This is not likely to have a significant adverse effect. The tactics to deal with this potential risk are as follows:

Layer 1: Consumer Messaging (Trigger: Pandemic Phase 4.0):

- Specific messaging to Manitobans in relation to the need to maintain their location at their current residence. The messaging should include:
    - That a pandemic is likely to occur in the near future.
    - The need to maintain their current residency. Plans are in place to ensure food will be available beyond what they have stockpiled.

Layer 2 and Layer 3 are not part of the plan since in the event persons do decide to migrate it would not be possible for government, short of some fairly intrusive methods, to prevent the movement.

12.5 Unique Circumstances

There are two unique circumstances related to the MB Pandemic Nutrition plan. These relate to food banks and hospitals and other health centres.

12.5.1 Food Banks

A noted in Section 11.4.1 the requirements of food banks need to be considered in the pandemic planning, especially given an expectation that demand for these services will increase as people are unable to work.

The plan related to food banks is as follows.

Layer 1: Food Bank Preparation (Trigger: Pandemic Phase 3)

The plan calls for:

- Development of plans by individual food banks. Components of the planning should include:
    - Human resource plans to be able to staff the food bank in the event of a pandemic.

Layer 2: Creation of Emergency Safety Stocks (Trigger: Pandemic Phase 4.1)

At Layer 2 Government and Food Banks undertake the following activities:

- Acquisition of food stuffs to provide hampers for 3 weeks, plus an allowance of 35% for new users of food banks. In total, food stuffs for about 120,000[111] hampers are required.
    - Pre-positioning food stuffs for hampers in Thompson, Brandon and Winnipeg.
    - Government assist in establishing these emergency safety stocks (see layer 3).

[111] The specific items to be acquired and stored are provided in Appendix K.

Layer 3: Distribution of Hamper Food Stuffs (Trigger: Pandemic Phase 6.2)

- Make available government controlled food stocks to food banks.
    - Make available transportation equipment as needed to facilitate shipments to food banks.
    - Providing government contracted transportation resources as needed to move food between food banks.

12.5.2 Hospitals, Personal Care Homes, and Meals on Wheels

Section 11.4.2 provides background with respect to this unique circumstance. The planning requirement for this group is largely within the mandate of Manitoba Health and the RHAs. It is incumbent upon those groups to develop plans for this group in the event of a pandemic and cross reference plans with the commercial food system to ensure functionality of each plan.

12.6 General Logistics Plans

12.6.1 Warehouse Space

If the government decides to implement government controlled warehousing of food for distribution at pandemic Level 6.2, Table 12.3 shows the estimated level of emergency supplies by pandemic planning area for each strategic commodity.

Table 12.3: Emergency Safety Stock Inventories[112]

Strategic Commodity	***Northern***	***Western***	***Capital***
Water	30,000 litres	60,000 litres	330,000 litres
MREs	30,000 MREs	75,000 MREs	415,000 MREs
Infant food : canned formula	1,000 (680 gr.)	1,500(680 gr.)	7,500 (680 gr.)
Infant food: cereal	2,500 (227 gr. box)	3,000 (227 gr. box)	18,000 (227 gr. Box)
Infant food: strained	40,000 (128 ml jar)	45,000 (128 ml jar)	265,000 (128 ml jar)
Vitamin A	-	80 litres	500 litres
Vitamin D	-	10 litres	40 litres
Yeast	1,000 (kg)	3,000 (kg)	17,000 (kg)
Sugar	2,000 (kg)	4,000 (kg)	24,000 (kg)
Salt	1,500 (kg)	4,000 (kg)	21,000 (kg)
Food Stuffs for Hampers[113]	8,000 hampers	17,000 hampers	95,000 hampers

[112] Based on general population except for infant food which is a based on the population up to 12 months.
[113] See Appendix L for details on the contents of each hamper.

An estimate of the amount of warehouse space required is shown in Table 12.4.

Table 12.4: Warehouse Space Requirements

Warehouse Space Requirements	
Warehouse Location	**Square Feet Required**
Thompson	4,500
Brandon	6,500
Winnipeg	31,000

The square footage requirement can be accommodated by racking supplies resulting in smaller floor space requirements.

As part of the space acquisition plan the specification should include the requirement for a business continuity plan, including the loss of up to 35% of staff in the event of a pandemic event.

The government could either directly lease such space, or enter into an agreement with private sector firms to have space and human resources to operate the space available.

12.6.2 Food Depots

The plan calls for the distribution of government warehoused stocks through depots. It is envisioned that the depots will be community centres or curling rinks. Other possibilities were considered including schools and hospitals. Schools were ruled out simply to ensure that the negative aspects of a pandemic event does not become tied to any particular school. The consequence of tying in the public eye might be the refusal to use the school after the event. While the same can be said of community centres, they are lower priority in terms of ongoing public need, and lower cost in the event of the need for replacement. Hospitals and medical centres were ruled out since these facilities are likely to be already overburdened in the event of a pandemic.

Food distribution at depots would be controlled by public administration staff (provincial and local). Depot locations will be directed by Area Food Committees (see Figure 12.1) who will establish requirements by location and respond to requests. Security arrangements will be needed to ensure food stuffs are secure.

12.6.3 Transportation Equipment

In calculating the daily transportation requirements for the Manitoba food industry, the assumption was made that pallets would be used to package and secure loads. Based on the accounts of several processors and distributors, a standard (40” x 48”) pallet holds between 2000-2500 pounds (909-1136 kilograms). This information was used along with the pallet weights of some “special” cases of products to calculate the total number of pallets used by Manitoban processors. Based on the assumption that pallets would not be stacked during travel, the number of pallets used was multiplied by the area occupied by each type of pallet (a bakery "tray" is much smaller than a standard pallet). This was then used to determine the number of 53 foot trailers[114] and cube vans needed in each RHA to move a day's worth of production. The daily required number of 53 foot trailers (dry-van and refrigerated) and cube vans (dry and refrigerated) are found in Tables 12.5 to 12.9. The estimates in these tables numbers represent full units with mixed loads of products leaving (or operating within) the RHA, allowed to operate 24 hours per day, with no downtime.

Table 12.5 shows the estimated number of dry vans trailers based on these assumptions.

Table 12.5: Estimated Daily Requirements: 53 Foot Dry Van Trailers

	53' Dry Van Trailer	Destination												
		Assiniboine	Brandon	Central	Winnipeg	S. Eastman	N. Eastman	Interlake	Parkland	Norman	Burntwood	Churchill	Outside MB	**Province**
Origin	Assiniboine	1	0	0	8	0	0	0	0	0	0	0	0	**9**
	Brandon	0	2	0	0	0	0	0	0	0	0	0	0	**2**
	Central	0	0	1	48	0	0	0	0	0	0	0	34	**83**
	Winnipeg	1	1	1	13	1	1	1	1	1	0	0	11	**32**
	S. Eastman	0	0	0	1	1	0	0	0	0	0	0	0	**2**
	N. Eastman	0	0	0	0	0	1	0	0	0	0	0	0	**1**
	Interlake	1	1	0	0	0	1	0	0	1	0	0	0	**3**
	Parkland	0	0	0	1	0	0	0	1	0	0	0	0	**2**
	Norman	0	0	0	0	0	0	0	0	1	0	0	0	**1**
	Burntwood	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Churchill	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Winnipeg[115] Redistribution	4	6	6	28	4	4	4	4	2	5	2	22	**134**
	Province	**7**	**10**	**8**	**99**	**6**	**7**	**5**	**6**	**5**	**5**	**2**	**67**	**227**

From Northern	***0***
Within Northern	***2***
From Western	***10***
Within Western	***4***
From Capital	***36***
Within Capital	***108***

Overall, approximately 227 53-foot Dry-Van trailers are needed to distribute food amongst and within the various RHA's (and outside Manitoba). The majority (166) of these trailers are needed in the Winnipeg RHA. These trailers are used by both

[114] Rather than a trailer this could be a 53 foot container with the underlying trailer unit used in its movement.
[115] Winnipeg Redistribution represents shipments that originate in other RHA's but are shipped to Winnipeg to be redistributed throughout the province.

Winnipeg based processors (32) and distributors (134), represented in Winnipeg Redistribution. After Winnipeg, the greatest daily demand of trailers is found in the Central RHA (83). On a daily basis, approximately 44% of the total trailers needed in the province are destined for Winnipeg (99), while 30% are destined for locations outside of the province.

On a regional area basis, for use within Manitoba only, the requirement is 2 trailers to operate within northern Manitoba, 10 from western Manitoba to other parts of Manitoba, 4 within western Manitoba, 36 from the capital pandemic planning area to other parts of Manitoba and 108 within the capital pandemic planning area.

Table 12.6 shows the number of refrigerated trailers needed.

Table 12.6: Estimated Daily Requirements: 53 Foot Refrigerated Trailers

53' Refrigerated Trailer		Destination												
		Assiniboine	Brandon	Central	Winnipeg	S. Eastman	N. Eastman	Interlake	Parkland	Norman	Burntwood	Churchill	Outside MB	Province
Origin	Assiniboine	1	0	0	21	0	0	0	0	0	0	0	8	30
	Brandon	0	3	0	5	0	0	0	0	0	0	0	20	28
	Central	1	1	1	34	1	0	0	0	0	0	0	1	39
	Winnipeg	1	1	1	18	1	0	1	1	0	1	0	8	33
	S. Eastman	0	1	1	4	1	0	1	0	0	0	0	3	11
	N. Eastman	0	0	0	0	0	1	0	0	0	0	0	0	1
	Interlake	2	1	0	0	0	1	0	0	1	0	0	0	5
	Parkland	0	0	0	1	0	0	0	1	0	0	0	0	2
	Norman	0	0	0	1	0	0	0	0	1	0	0	0	2
	Burntwood	0	0	0	0	0	0	0	0	0	0	0	0	0
	Churchill	0	0	0	0	0	0	0	0	0	0	0	0	0
	Winnipeg Redistribution	4	6	6	32	4	4	4	4	2	5	2	24	97
	Province	**9**	**13**	**9**	**116**	**7**	**6**	**6**	**6**	**4**	**6**	**2**	**64**	**248**

From Northern	***1***
Within Northern	***2***
From Western	***28***
Within Western	***5***
From Capital	***39***
Within Capital	***109***

The pattern is similar to dry vans but the quantities needed are slightly larger.

Table 12.7 displays the estimated number of non refrigerated cube vans needed assuming all movements were made using cube vans.

Table 12.7: Estimated Daily Requirements: Non Refrigerated Cube Vans

Cube Vans (Dry)		Destination												
		Assiniboine	Brandon	Central	Winnipeg	S. Eastman	N. Eastman	Interlake	Parkland	Norman	Burntwood	Churchill	Outside MB	Province
Origin	Assiniboine	1	0	0	22	0	0	0	0	0	0	0	0	23
	Brandon	0	6	0	0	0	0	0	0	0	0	0	0	6
	Central	0	0	1	130	0	0	0	0	0	0	0	93	224
	Winnipeg	1	1	1	36	1	1	1	1	1	0	0	30	74
	S. Eastman	0	0	0	1	3	0	0	0	0	0	0	0	4
	N. Eastman	0	0	0	0	0	1	0	0	0	0	0	0	1
	Interlake	2	1	0	0	0	2	0	0	1	0	0	0	6
	Parkland	0	0	0	1	0	0	0	2	0	0	0	0	3
	Norman	0	0	0	0	0	0	0	0	1	0	0	0	1
	Burntwood	0	0	0	0	0	0	0	0	0	0	0	0	0
	Churchill	0	0	0	0	0	0	0	0	0	0	0	0	0
	Winnipeg Redistribution	11	15	14	76	9	10	10	9	5	14	5	58	236
	Province	**15**	**23**	**16**	**266**	**13**	**14**	**11**	**12**	**8**	**14**	**5**	**181**	**578**

From Northern	***0***
Within Northern	***2***
From Western	***25***
Within Western	***9***
From Capital	***80***
Within Capital	***281***

On a regional basis, for use within Manitoba only, the requirement is 2 cube vans to operate within Northern Manitoba, 25 from Western Manitoba to other parts of Manitoba, 9 within Western Manitoba, 80 from the Capital pandemic planning area to other parts of Manitoba, and 281 within the Capital pandemic planning area.

Table 12.8 shows the distribution of refrigerated cubes vans if they were used instead of refrigerated trailers.

Table 12.8: Estimated Daily Requirements: Refrigerated Cube Vans

		Destination												
		Assiniboine	Brandon	Central	Winnipeg	S. Eastman	N. Eastman	Interlake	Parkland	Norman	Burntwood	Churchill	Outside MB	Province
Origin	Assiniboine	1	0	0	56	0	0	0	0	0	0	0	20	77
	Brandon	0	7	0	12	0	0	0	0	0	0	0	53	72
	Central	2	2	2	91	2	0	0	0	0	0	0	2	101
	Winnipeg	2	2	2	48	2	0	1	1	0	1	0	22	81
	S. Eastman	0	1	1	10	2	0	1	0	0	0	0	9	24
	N. Eastman	0	0	0	0	0	1	0	0	0	0	0	0	1
	Interlake	4	1	0	0	0	3	0	0	2	0	0	0	10
	Parkland	0	0	0	1	0	0	0	1	0	0	0	0	2
	Norman	0	0	0	1	0	0	0	0	1	0	0	0	2
	Burntwood	0	0	0	0	0	0	0	0	0	0	0	0	0
	Churchill	0	0	0	0	0	0	0	0	0	0	0	0	0
	Winnipeg Redistribution	10	15	15	86	9	9	9	9	4	14	4	66	250
	Province	**19**	**28**	**20**	**305**	**15**	**13**	**11**	**11**	**7**	**15**	**4**	**172**	**620**

From Northern	***1***
Within Northern	***2***
From Western	***70***
Within Western	***9***
From Capital	***86***
Within Capital	***280***

Table 12.9 provides a summary of requirements based on the foregoing assumptions for each pandemic planning area.

Table 12.9: Daily Transportation Requirements: Minimum

Pandemic Planning Area/Destination	53 foot Dry-Van Trailer	53 foot Refrigerated Trailer	Cube Van (Dry)	Cube Van (Refrigerated)
From Northern	*0*	*1*	*0*	*1*
Within Northern	*2*	*2*	*2*	*2*
From Western	*10*	*28*	*25*	*70*
Within Western	*4*	*5*	*9*	*9*
From Capital	*36*	*39*	*80*	*86*
Within Capital	*108*	*109*	*281*	*280*
Province	***160***	***184***	***397***	***448***

Based on operating assumptions of 16 hour of service per day (to account for load and unload time and other downtime), 10% time for maintenance, and pallets stacked 3 high, on average, results in the suggested requirements shown in Table 12.10[116].

Table 12.10: Daily Transportation Requirements: Operating Assumptions

Pandemic Planning Area/Destination	53 foot Dry-Van Trailer	53 foot Refrigerated Trailer	Cube Van (Dry)	Cube Van (Refrigerated)
From Northern	0	2	*0*	2
Within Northern	*1*	*0*	*1*	*1*
From Western	*6*	*16*	*41*	*38*
Within Western	*2*	*3*	*5*	*5*
From Capital	*20*	*22*	*44*	*47*
Within Capital	*59*[117]	*60*	*154*	*153*
Province	***88***	***103***	***245***	***246***

For larger shipments between pandemic planning areas, the use of larger vehicles is desirable. Consequently, for movements between pandemic planning areas it is suggested that 53 foot trailers be used. Within pandemic planning areas where shipment sizes will be smaller, it is suggested that cube vans be used outside the capital pandemic planning area. A general shortage of refrigerated cube vans suggests that additional 53 foot trailers be used in that pandemic planning area. Accordingly, the cube van refrigerated requirement has been decreased to one half the requirements in the capital pandemic planning area with that portion of requirement being filled with 53 refrigerated units. The result is shown in Table 12.11[118].

116 For example the 154 cube vans for within the Capital region was calculated as follows: ((280/.67)x1.10)/3.

117 As an example of the calculation. From Table 12.9 109 53 foot dry van trailers are needed. Stacked 3 high = 36. Only operable 2/3 of a day means that 54 are needed (36/.67). Maintenance is 10% so the total is 54x1.10 = 59.

118 When the negotiations for equipment are undertaken in each region, the bidding firms are likely to suggested different configurations. The table is meant to provide generally guidance.

Table 12.11: Daily Transportation Requirements: Operating Assumptions - Fewer Refrigerated Cube Vans in Capital Pandemic Planning Area

Pandemic Planning Area/Destination	53 foot Dry-Van Trailer	53 foot Refrigerated Trailer	Cube Van (Dry)	Cube Van (Refrigerated)
From Northern	0	2	*0*	*2*
Within Northern	*1*	*0*	*1*	*1*
From Western	*6*	*16*	*41*	*38*
Within Western	*2*	*3*	*5*	*5*
From Capital	*20*	*22*	*44*	*47*
Within Capital	59	98	*154*	76
Province	**88**	**141**	***245***	**169**

In order to pull the 53 foot trailers an estimated 229 tractor units are required.

12.7 Summary

The following tables summarize actions by pandemic phase.

Table 12.12: Summary: Plan Actions by Pandemic Level Trigger
System Vulnerabilities

Actions by Pandemic Phase (Trigger)					
Pandemic Phase		**3.0**	**4.0**	**4.1**	**6.2**
Response to System Vulnerabilities to the Manitoba Nutrition Supply Chain					
All Trade Ceases		Nutrition Supply improved: No Action			
Vulnerability	Critical Ingredients Not Available	- Encourage business continuity planning for processors.		- Encourage stocking of non Manitoba critical ingredients (privately and/or government held) .	- Make available government held inventories at cost if production shortages. - Suspend packaging rules. - Invoke emergency labeling rules.
	Shortage of Drinking Water		- Consumer messaging to stockpile.	- Government acquisition of emergency supplies. - Pre-position in warehouse space in Thompson, Brandon and Winnipeg.	- Distribution of government held emergency supplies and immediate replenishment.
	Shortage of Transportation Equipment			- Pre contract for equipment and operators (include one firm that operates on winter roads). - Pre-position in Thompson, Brandon and Winnipeg.	- Use pre-positioned equipment as necessary to move ingredients/food. - Backstop remote community supplies with government air services. - Consider suspension of weight restrictions.
	35% Agricultural Production Reduction		- Encourage farmers to plan with other farmers.	- Government monitoring of inventories (grain, vegetables, livestock and poultry). - Set up processor hotline to report shortages.	- Continue monitoring. - If needed provide government acquired transportation (above) to move raw food to processors. - Initiate avian influenza eradication plan if required.
	35% Processor Production Reduction			- Request for readiness: processors requested to ready their storage, transportation and human resource plans. - Increase inventories of critical ingredients. - Provide government alternate use of their facilities and barriers to alternate use.	- Require reporting of production, and inventories and shortages daily. - Use production from excess areas to supply deficit areas through wholesalers/distributors and retailers. - Encourage reassignment of production at facilities to meet needs.

System Vulnerabilities (continued)

Actions by Pandemic Phase					
	Pandemic Phase	**3.0**	**4.0**	**4.1**	**6.2**
Response to System Vulnerabilities to the Manitoba Nutrition Supply Chain (continued)					
Vulnerability	Wholesale/ Distributor failure	- Encourage business continuity planning, human resources, transportation and critical ingredient focus.		- Request to maximize inventories of key foods - milk., eggs, bread and related ingredients, meat, canned/frozen fruits and vegetables, and infant foods.	- Require daily reporting of key foods. - Require distribution to retail level in areas of shortages. - If needed provide government acquired transportation to move food.
Vulnerability	Retail Failure	- Encourage development of business disruption plans. Focus on smaller local/ regional food retailers.		- Request to maximize inventories of key foods - milk., eggs, bread and related ingredients, meat, canned/frozen fruits and vegetables, and infant foods. - Advise consumers to stockpile 2 weeks of food - Request contributions to food banks be maintained - Acquire meals- ready to eat (MREs) - Establish consumer food shortage hot line.	-If needed provide government acquired transportation to move food. - Assure supply from wholesalers/distributors to independent retailers. - Make MREs available. - Consider rationing.

Human Vulnerabilities

Actions by Pandemic Phase					
	Pandemic Phase	3.0	4.0	4.1	6.2
Response to Human Vulnerabilities to the Manitoba Nutrition Supply Chain					
Vulnerability	Feeding requirements for Infants		- Generic messaging related to the pandemic threat. - Specific messaging to stockpile up to six weeks of infant food and rotate the stockpile - Investigate production through Food Development Centre.	- Government acquires emergency safety stock of formula, cereals and strained food. - Pre-position stock in Thompson, Brandon and Winnipeg.	- Distribute government held emergency safety stocks. - Emergency re-stocking. - Encourage local preparation- home recipes, Food Development Centre, other processors etc.
	Shortage of Transportation Equipment Operators	- Encourage business continuity planning: trucking and air services.		- Request industry and MPI mobilize qualified drivers. - Pre contract for operators (include one firm that operates on winter roads). - Pre-position operators in Thompson, Brandon and Winnipeg.	- Use pre-positioned equipment/operators as necessary to move ingredients/food. - Require healthy qualified drivers to support food movement. - Suspension of hours of service restrictions. - Ensure government staff and pilots are available to move food.
	Failure to Have Business Continuity Plans	- Encourage smaller/medium processors to develop plans through messaging, distribution of planning materials, extension education, and as part of plant inspections		- Government staff to follow up with firms.	- No actions: can not compel firms to plan.
	Public Resistance to consumption of a Major Food Source		- Private sector messaging to allay fears.	- Government supportive messaging to back up private sector. - Ramp up avian influenza eradication plan.	- Follow avian influenza eradication plan.
	Lower than Expected Home Food Safety Stocks		- Messaging to stock food. Provide advance notice to processors/ wholesalers and retailers. - Inventory up to 6 weeks of non perishables.	- Use approaches and resources described under "Shortage of Drinking water for Human Consumption", "Retail Network Failure" and "Feeding Requirements for Infants"	- Use approaches and resources described under "Shortage of Drinking water for Human Consumption", "Retail Network Failure" and Feeding Requirements for Infants"
	Unexpected migration		- Messaging to Manitobans about the need to maintain current residency.	No new actions.	No new actions.

Unique Circumstances

Actions by Pandemic Phase					
	Pandemic Phase	**3.0**	**4.0**	**4.1**	**6.2**
Unique Circumstances					
Vulnerability	Food Banks	Food bank planning for disruption. Focus on human resources to meet needs.		- Acquisition of food for 120,000 hampers. - Government assist in acquiring these emergency safety stocks. - Pre-positioning in Thompson, Brandon and Winnipeg.	- Make available food for hampers. - Make government hired transportation equipment available.
	Hospital, Personal Care Homes, Meals on Wheels	No direct action. Part of Health planning. It is likely capacity will be totally utilized.	No direct action. Part of Health planning. It is likely capacity will be totally utilized.	No direct action. Part of Health planning. It is likely capacity will be totally utilized.	No direct action. Part of Health planning. It is likely capacity will be totally utilized.

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