

Manitoba, Canada System Design Case Study

Vaccine supply chain system design: Integrating vaccines into the government supply chain

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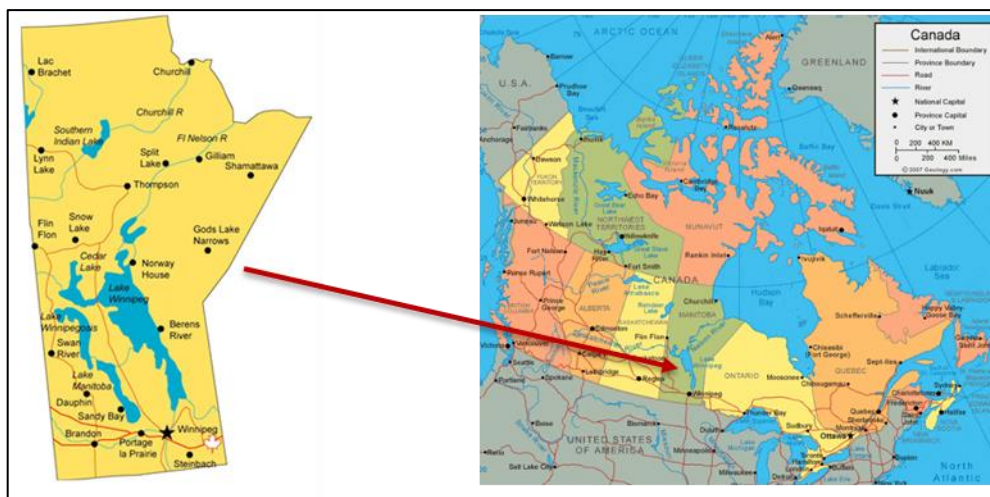
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1. Background

Public health in Canada is managed across three levels of government: federal, provincial (or territorial), and municipal. At the federal level, the Public Health Agency of Canada (PHAC) coordinates activities, contributes to emergency response, stockpiles health commodities, and coordinates with the World Health Organization (WHO) and other countries. All levels of government collaborate and share responsibilities to improve the health of all Canadians.

The province of Manitoba is located in Central Canada, shown in the map below, covering 650,000 square kilometers, approximately the same size as France, but with a population of 1.3 million people. The government, through its department Manitoba Health, Seniors and Active Living (MHSAL), is responsible for providing public health services, including immunization programs, as well as distributing vaccines to over 900 locations across the province.



In Manitoba, vaccines and dry goods are procured and distributed in the province through a centralized, provincial model. There is one central warehouse, located in

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the provincial capital of Winnipeg in southeast Manitoba, which is a facility that is a Special Operating Agency (SOA) of the Manitoba government. This warehouse distributes directly to the health care facilities where the vaccines are administered. Prior to 2012, MHSAL was using the services of a third-party logistics provider (3PL) to manage warehousing and distribution of vaccines and related supplies to the health care providers throughout Manitoba.

This case study focuses on how and why the Manitoba government analyzed and redesigned their immunization supply chain to in-source and integrate its warehousing and distribution, which was already in place and being used for other provincial health programs.

2. Catalyst for Change

Between 2009 and 2011, MHSAL reported several incidents where vaccines were exposed to temperatures outside of the recommended storage temperatures while in the care of the third-party distributor. One particular event resulted in the destruction of over \$1M CAD worth of vaccines due to a temperature excursion. In this case, although the outsourcing agreement ensured that the 3PL had backup generators on site, a power surge caused the cold chain equipment to default to freezing temperatures when power resumed. The backup generator was not an automatic generator and required manual start-up by an employee of the 3PL.

In addition, during the 2009 H1N1 Influenza pandemic, the Government procured vaccines for the entire population with distribution occurring over a short period of time. This emergency need put a strain on the 3PL's cold chain storage capacity to meet the space requirements due to the existing allocated warehouse space being fully utilized. Moving forward, MHSAL needed to ensure that there would be sufficient space to manage future pandemics without putting the other immunization programs at risk.

The previous temperature incidents plus the need for sufficient and resilient storage capacity, as well as the imminent expiration of the contract with the 3PL, prompted a review of the current warehousing and distribution systems. The review was conducted by a working group of Manitoba government employees, including program leads from Public Health, Procurement Services, Insurance and Risk Management and Finance and Administration.

3. System Design Approach

a) Reviewing the current outsourced system

The system design review began with a supply chain assessment that analyzed the current warehousing and distribution systems and whether or not they were

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meeting MHSAL's needs of the present, as well as the future. For example, the immunization program was expanding the immunization schedule in the coming years and, as such, the review of the current distribution location, storage capacity and processes included the ability for MHSAL to incorporate these programmatic changes.

The assessment revealed the following:

- There was insufficient cold chain capacity to manage expansions to the immunization program or emergency situations. Any requirements to increase this capacity would result in significant additional costs from the 3PL.
- The back-up generator was insufficient to meet the quality needs and standards for storing vaccines for Manitoba's climate.
- There existed both human and asset capacity within other programmatic supply chains managed by MHSAL.

b) Potential solution for improved service and to meet future demands

The assessment found that expansion through the 3PL would be cost prohibitive; however, moving the storage and distribution services in-house could produce economy of scale efficiencies and reduced insurance costs. Bringing the warehousing and distribution services in-house could also provide additional quality control, although the government may need to put in place new storage systems, processes, and back-up controls to prevent future temperature excursions.

The government identified an existing government SOA storage facility in Winnipeg that could possibly be utilized for vaccine storage and distribution. To determine the feasibility of using this facility, the team collected the following data:

- the number of products to be stored – approximately 40 products of which six required ambient temperature storage
- the storage requirements of the products (fridge or ambient temperature)
- the volumes ordered and distributed each year and each month for each product
- the number of locations and where in Manitoba the orders must ship by which mode of transportation (around 700 locations throughout Manitoba with approximately 6,700 total orders per year)
- the total cost per order shipped – an average of \$85 CAD per order over the term of the agreement

c) Cost comparisons

The SOA team reviewed the above information and provided a proposal to the working group. The working group conducted a site visit, analyzed the proposal, and conducted an impact assessment, which included the impact on insurance coverage costs. This information was compared against the 3PL agreement.

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Importantly, the SOA location review considered information in addition to the storage capacity and operational costs (the SOA within the Government of Manitoba is a not-for profit warehouse and aims only at cost-recovery). As part of the impact assessment, the Manitoba government noted that to move forward, the SOA location in Winnipeg would require a major financial investment to upgrade its facility to meet Health Canada's requirements for a Drug Establishment License (DEL) and Good Manufacturing Practice (GMP) certification.

To meet the standards, the following requirements had to be completed:

- New standard operation procedures (SOPs) were to be put in place.
- A dedicated area in the warehouse was to be assigned to accommodate the MHSAL program.
- New refrigerators were to be purchased to meet the program needs.
- An automatic back-up generator was to be purchased to power the refrigerators and the entire dedicated area in the warehouse in the event of a power failure.
- A state of the art security system was to be put into place that also notified the staff electronically of any temperature deviations.

Following the costing analysis, the working group found that the proposed costs for taking on the storage and distribution, in addition to the facility upgrades, were consistent with the operating costs paid to the 3PL. Therefore, the total investment was deemed as cost neutral.

4. Implementation of In-sourcing to SOA

a) Vaccine Inventory Management System

The Manitoba government focused first on the data and information systems that would drive the system design activities. The SOA warehouse had an existing distribution system in place, as well as an inventory management system that could be customized for the vaccine program.

The existing system was used until 2014 when the Manitoba government introduced a new inventory management system, part of a larger electronic public health (e-health) record that also supports inventory management. The Manitoba government concluded that the e-health record system provided greater benefits than the existing SOA information systems, noting the following benefits:

- meets existing certification requirements set by Health Canada
- supports the ability to view inventory levels both at the central warehouse and locations in the field
- allows providers to identify a product by lot number and link to a patient's immunization record; the inventory is adjusted automatically once the immunization is recorded as administered

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- using information from Panorama to better inform decisions on vaccine ordering and distribution,
- decreasing vaccine wastage

Although the e-health system did not support as wide a range of logistics information as the initial SOA warehouse system, MHSAL concluded that the integration to health data provided better information on vaccine visibility and consumption, supporting more informed decisions on ordering and distribution and decreasing overall vaccine wastage.

b) Human Resources Training

Next, the Manitoba government focused its attention on the human resources needs to in-source the logistics functions. The SOA warehouse staff already had logistics knowledge and expertise due to their management of other health commodities, but MHSAL needed to provide vaccine management and cold chain management/temperature monitoring training.

The working group organized information sessions with staff covering the immunization program, forecasting processes, procurement and contracts, and the overall importance that the immunization program has on the health of Manitobans, including the cost reduction in health services by the prevention of disease. By linking the training to health outcomes of their peer Manitobans, the staff had a greater investment in the training.

Training was also provided by program staff to review the different type of products carried by MHSAL and to identify the more urgent products and develop a process to rush orders and develop an after-hours on-call process to ensure that urgent orders can be processed.

5. Key Performance Indicators

In order to measure the government's performance in distributing vaccines, MHSAL uses these key performance indicators:

Indicator name	Collection Method	Purpose
% Accuracy of inventory levels at warehouse	Monthly physical counts and the system report	Used to validate that the physical stock-on-hand is 100% accurate with the electronic inventory system. If discrepancies are found, then corrective action are taken to find the root cause.
% Accuracy of monthly & annual forecasts	Reports generated by system	Used to monitor the accuracy of the forecast versus the reality. This indicator allows improvement to the forecasting activities for the future years.
Vaccine wastage	Reports generated by	Used to measure wastage of vaccine doses during

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Indicator name	Collection Method	Purpose
	system	transportation, storage and administration. It also calculates the return rate of the vaccines to the National warehouse on expired vials.
Cold chain excursions rate	Reports generated by system	Used to measure the occurrence of cold chain excursions during transport activities.
Vaccines contract management	Reports generated by system	Used to track vaccine quantity purchased versus received and time to process orders.
% Accuracy of orders from manufacturers	Reports generated by system	Used to track: quantity & price ordered versus received; estimated date of arrival and actual arrival date; and quality of vaccine at arrival.
Packing performance rate per employee	Reports generated by system	Used to monitor the rate of boxes packed by employee per day. It helps evaluating the employees and controlling over time.
Orders shipped	Reports generated by system	Used to track number of orders shipped compared to previous months and years to specific sites.
% accuracy of order shipped	Reports generated by system	Used to measure if the orders shipped had the correct product, correct quantity, was shipped and arrived on-time and the quality of vaccine at arrival was correct.

6. Results

a) Warehousing security and quality control

Since 2011, there have been no temperature excursions occurring in the refrigerators within the central warehouse. And as a result, there has been no product wasted as a result of temperature excursions in the central warehouse. The fridges are being monitored with the latest technologies, such as remote monitoring via mobile phone and email. This allows the warehouse staff to react in time to avoid any quality issues. When power supply has been interrupted, the backup generator automatically turns on and maintains the temperatures of the fridges and the designated warehouse area accordingly. Staff is also notified electronically if the backup generator has turned on, and can follow up with diagnostics.

b) Distribution Centre performance evaluation

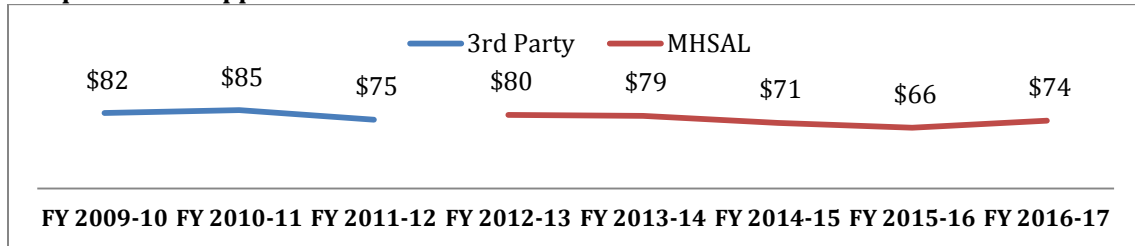
Putting in place new key performance indicators has helped MHSAL to improve their skills in managing vaccine distribution. There were many improvements in 2014 as a result of the implementation of the new e-health system, including:

- The volume required to be on hand at the central warehouse has been reduced as a result of increased ability of MHSAL and the regional health centers to see all the stock on hand. This allows stock to be moved around within the regional health authorities instead of being wasted and it has resulted in requiring less stock ordered overall.
- Temperature excursions can now be tracked in the information system, which also provides data on improving shipping processes.

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- Direct visibility to order and inventory data at the department level has improved program planning and efficiencies.
- MHSAL now has the ability to track the orders in progress, such as: timeliness, accuracy and quality.
- The cost per order has decreased, as per the below table, and is expected to decrease further as MHSAL adds additional programs and providers.

Cost per order shipped - Evolution



As a result of a 47% increase in the number of shipping locations in Manitoba to over 1,000 since moving the storage and distribution services, the number of shipments has increased 34% from 6,700 orders a year to approximately 9,000 orders. As the numbers of orders and delivery sites have increased and the number of products used in the immunization program has increased from 40 to 45, the costs for the storage and distribution has seen only a 25% increase after five years since the services were in-sourced.

The central facility is continuing to review the packaging protocols to reduce the number of temperature excursions that occur during transport. Given the Manitoba climate has drastic temperature changes, the ability to maintain the cold chain during transport to places all over the province, especially remote and isolated communities, continues to be a challenge.

MHSAL has become a reference in Canada in terms of meeting Health Canada's requirement for vaccine distribution.