

A man with short brown hair, wearing a white sleeveless shirt, dark blue shorts, and orange running shoes, is jogging on a paved road. He is looking towards the right. The road is lined with tall, thin pine trees. In the background, there are more trees and a clear blue sky.

# Optimising Novo Nordisk's Cold Chain

JONATHAN CHARLESWORTH  
South Africa  
Jonathan has type 1 diabetes





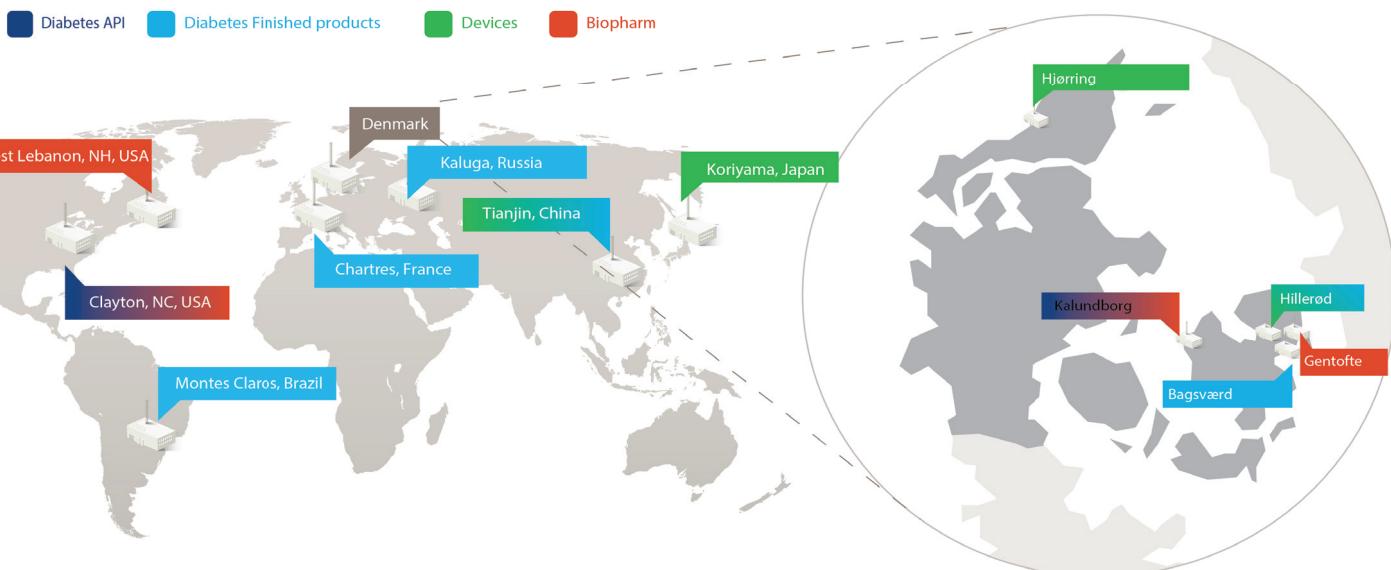


Novo Nordisk production site in Hillerød, Denmark

## Novo Nordisk's **global production** by the numbers

In total, 14,731<sup>a</sup> fulltime employees work to ensure the continuous supply of Novo Nordisk's products, serving almost 28 million people each year. Production takes place in nine countries at

11 large, strategic production sites, and 3 local production plants, altogether covering over 500,000 m<sup>2</sup>, an area which corresponds to the size of almost 70 football fields.



a. As of March 2018  
 b. Map shows all strategic sites and local Russia plant  
 Local plants have also opened in Iran and Algeria

# Cold Chain Optimisation

*A rapidly growing portfolio of products and customers across the world, as well as growing regulatory constraints, has left Novo Nordisk searching for technology to optimise their supply chain performance. How can data be used to innovate the cold chain, versus simply keeping it in compliance for our customers?*

## What is a cold chain?

Cold chain refers to the management of temperature-sensitive products as they move through the supply chain. Especially important for the pharmaceutical industry, this subject now gets a lot of attention. If drug quality is compromised by exposure to inappropriate conditions during transport and storage, drug consumers may suffer adverse consequences.

## Why do we care about the cold chain?

In addition to the overall goal of patient safety, there is a major reason to pay attention to cold chain issues: there is increasing regulatory scrutiny. During an inspection you need to be able to answer the usual quality-focused questions about your cold chain integrity: "How do you know? Can you prove it?" Anyone compliant with GxP who manages any link in the supply chain needs to be prepared for these questions.

## What are some of the challenges surrounding cold chain monitoring?

Human interaction – The cold chain is highly human reliant: humans must bridge the gap between storage facilities, transportation and distribution.

Vast and dissimilar chains – The volumes of pharmaceuticals are increasing, but also is the geographic region the cold chain must reach. Securing a complete cold chain from United States to Kenya relies that both places have adequate infrastructure and infrastructure quality. If the Kenyan airport terminal does not have the infrastructure to keep the products cold, the entire cold chain cannot be completed.

Varying compliance requirements - Regulatory requirements and guidelines differ among countries, authorities, agencies and organizations. Making sure each cold chain is compliant to the specific guidelines can be a challenge.

Temperature loggers – The temperature loggers are IoT sensors that sit on each device only track temperature and time. There are not really any sensors currently on the market that could give us more valuable information at a decent price. We only receive data from the loggers after the

data has been gathered manually from completed shipment's loggers by removing the logger and plugging it into a computer to download.

## Novo Nordisk Shipping Department

Novo Nordisk ships over 12,000 shipments a year with 10 different freight forwarders (DHL, Khuhne&Nagel, etc.) to over 170 different countries. Shipments are sent either directly from a production plant, or through Novo's shipping hub, located in Greve, DK.

For our finished products that are on their way to the customer, shipments must be sent over the controlled cold chain, with temperature limits varying for each product; however, as a general rule you should use: shipments that reach close to 25, are at a higher risk of becoming unusable.

Our shipments are packaged in a variety of material (known as the shipment's equipment), in order to keep the temperature levels within specified requirements. Shipments by road are sent in refrigerated trucks while shipments by sea are sent in refrigerated containers (consistently plugged into power). With air shipments, we do not have that luxury, and alternative and more expensive solutions must be put to use. Novo spends over 25m dkk on equipment per year.



## Task background:

We have collected and visualised data for many years, in order to report our compliance to the authorities. We now want to do more with our data and that is where we need your help! We have created three cases surrounding our shipment and temperature tracer data. The cases have been purposefully created very open-ended, to allow for your ideas and creativity – nothing is off limits!

### Case 1:

What external data sources, and how, can we use the data to improve the cold chain by providing new insights. Can we find external data that further explains shipments' temperature patterns?

### Case 2:

Using data, can we confidently conclude that a switch to a cheaper equipment is viable, keeping the same standards of compliance? Using historical data given from 2 specific lanes DK -> Japan and DK -> Canada, determine under what conditions we could dynamically switch the equipment used.

### Case 3:

If it were possible to purchase a IoT device capturing any data imaginable about the shipment at any time, what benefit could be gained in transport control? How could the new data be used to optimize the cold chain in new ways? Where in the supply chain would that information be beneficial?



## Formalities:

Data and additional information can be found at <https://github.com/nnsanalytic/CBSFall2018>

Teams should consist of 3-4 people, and each team should choose one case.

Your discoveries and recommendations should be summarised into a one page executive summary (+appendix) and submitted to [CRLJ@novonordisk.com](mailto:CRLJ@novonordisk.com) by EOD November 5, 2018.

After being reviewed, the top 5-6 teams will be asked to present their ideas in a 15 minute (7 slide max) presentation in class to a Novo Nordisk panel on November 13.

The winning team members will be offered an interview for a Novo Nordisk internship/student position/masters thesis collaboration.

We look forward to hearing your results!





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