

***Rotman***

**RSM-8423 – Optimizing Supply Chain Management and Logistics**

Winter 2023

# ComfortHealth Case Study

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Home Health Care



Picture source: Forbes - <https://www.forbes.com/health/healthy-aging/what-is-home-health-care/>

# Introduction

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*ComfortHealth* is a Canadian home care agency that provides support and medical care to patients within their own homes. Similar to other companies in this field, the agency has experienced a significant growth from increasing demand (due, e.g., to the ageing population) and extensive government incentives. Home care is an important strategic area in Canada, especially as it improves the quality of care, postpones institutionalization, and reduces overall operational costs in hospitals.

You were hired as a data consultant to help create a **three-year annual service plan** for ComfortHealth. Your goal is to design a **proposal** detailing the hiring and allocation of the workforce and medical facilities, including how the geographical areas covered by ComfortHealth will be served by the agency during these next three years.

## The Setting

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The home care services at ComfortHealth are provided by health professionals (HPs), each trained on a different short-term specialty related to nursing, wound treatment, and personal support work. ComfortHealth owns four different medical centers that serve as hubs for HPs. A typical day of an HP consists of going to their allocated medical center to collect equipment and medical supplies, visiting patients on a region to provide service, and returning to the medical center to perform final administrative duties. An HP is only allocated to a single medical center throughout their time at ComfortHealth.

Each HP is currently paid a standard rate of **\$37.85** per hour worked (**2023** values), with a governmental-regulated increase of **2.5%** per year. All medical specialties covered by ComfortHealth are paid at this same rate. A regular shift of an HP is **6** (or less) hours per day. Overtime is not allowed for quality-of-care reasons. An HP works at most **250** days a year.

Hiring an HP is an expensive activity in terms of time and costs – it consists of placing ads, conducting interviews, and training, with a total estimated cost of **\$15,000** per person hired. The HP hiring process is handled by each medical center separately. Current HR policies at ComfortHealth specifies that no more than **300** employees may be hired in a year per each service center.

The demand that ComfortHealth serves is divided into regions, each from a given distance to the medical centers. HPs travel to patients using company cars, which adds an expense of **\$0.25** per kilometer and hour worked. For example, if an HP visits a region **10** km away from their medical center, the HP cost per hour is increased by  $\$0.25 * 10 = \$2.5$ . Each home care visit is reimbursed by the government for a rate of **\$42** per hour.

Finally, ComfortHealth is flexible to accept or reject patients applying to its services (i.e., they can decide how many hours to provide each patient). The time to visit multiple patients within a region is considered negligible, as in most cases the patients live in the same neighborhood or building.

# Managerial Questions

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ComfortHealth wishes to design a strategic plan for the next three years. For simplicity, assume your must plan for years **2023** (current) to **2025**. The agency raised the following managerial questions for you:

- There are two new possible medical centers that ComfortHealth surveyed and that can be opened in the first year (Centers “E” and “F”). Are they worth the investment? Why (or why not)?
- How many new HPs should be hired to each medical center during these next three years?
- How should the HPs from each medical center be assigned to the different regions?
- ComfortHealth is concerned about the impact of rejecting too many patients, in that doctors and patients may refrain from suggesting the agency as a viable option to colleagues. How would an (optimal) solution that accepts *all* patients differ from another with full accept/reject flexibility? Is that a viable option for ComfortHealth? If not, why, and how we could make it viable?
- How robust is your solution to changes in demand? For example, what would happen if the realized demand happened to be much higher than previous years, or much lower?

## Data

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ComfortHealth provided the following data for your analysis:

- **Demand.csv:** Demand (in hours of care) for each region served in the **last 10 years**. The demand is based on the number of home care requests that the agency received, regardless if the requests were accepted or rejected by the agency. (Each home care request specifies how many hours of care is needed.)
- **Distances.csv:** Average distance (in km) between customers in each region and medical centers. The distance is calculated by taking the shortest-path car route using Google Maps API.
- **Center.csv:** Specifies opening and annual operating costs per center, including rent and other quantitative factors measured beforehand. The operating costs are expected to remain approximately constant throughout the years. Centers with an opening cost of 0 indicate that they are already in use by the agency. The table also includes the annual maximum center capacity (in hours) and the current number of HPs in **2022**. For the purposes of this strategic study, you are free to reallocate these initial workers to any regions as deemed necessary.

## Deliverables

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The deliverable for this case study are:

- A proposal in **PDF** format that includes your mathematical model and insights, addressing the managerial questions posed by ComfortHealth. The report can be in any format that you desire. It should, however, include an executive summary and a clear suggestion of our allocation/hiring

plan, specifying the total revenues and total costs. Your report must be at most **10 pages or less**, not counting the appendix (which can be of any length).

- Note 1: Please try to provide managerial insights as to why you are suggesting some decisions, as driven by your optimal model solutions (e.g., why a particular region is served by a given medical center?). This is a critical part in creating persuasive narratives and understanding trade-offs.
- Note 2: I would suggest including the mathematical model only in the appendix, focusing on visualizations and readability for the main text. To be mindful of your time, please feel free to write your models in a tablet/paper and attach a picture if you are not comfortable in typing equations at this moment (but please make sure it is readable!)
- The source code (in Python) and any additional tables or datasets that we can use to replicate your results.

## Evaluation

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Your report will be given a raw score out of 100 points using the following scheme:

- *Models* [30 points]: If the models you designed are sound and adequate to the problem.
- *Analysis* [30 points]: if the analysis is sound and comprehensive, addressing the questions posed by the agency.
- *Implementation* [20 points]: If the Python implementation of the models is correct and free of errors or bugs. It must be also well organized and readable.
- *Writing* [20 points]: if the report is well-written and organized.

You will also receive a letter grade associated with your raw score, alongside an explanation of your mark. The letter grade is adjusted based on the relative performance of the class and the difficulty of the case study. Please check the syllabus for more information on the letter grade.

## Suggestions

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- Analyze the demand first and consider how you would like to encode it, which will guide your model formulations.
- Start by creating the **simplest** model that considers, for example, a deterministic demand and no overtime, analyzing its solution and correctness. Consider reducing the dataset to just a few rows in each table so that it is easier for you to inspect the model printouts. Extend the model by adding one component at a time, checking the solution in each step.
- Several models and flexibility options are possible for this problem. Every answer has their own trade-offs. Feel free to choose what you believe is best and make reasonable assumptions regarding the future demand and operational choices, as long as you clearly justify all your modeling decisions in your report.
- Remember that data analytics is an **iterative** and **creative** process, and models are an important part of that. You are free to change the model parameters, constraints, or inputs to evaluate “what-if” scenarios.
- Use your time wisely. Focus on the most fundamental questions first (i.e., allocation of HPs) to ensure your model is correct and you address the main questions first.