Business analytics and healthcare

An interview with Opher Baron

Opher Baron is Distinguished Professor of Operations Management at the Rotman School of Management, University of Toronto. His research interests are broad and varied, covering everything from business analytics in relation to healthcare, to autonomous vehicles. Recently, his work has had huge practical impact, as he and his colleagues Professor Philipp Afèche, Ming Hu, and Dmitry Krass launched the COVID PPE Help platform, a service which has facilitated the exchange and distribution of personal protective equipment across Canada. Research Outreach were privileged to catch up with him about his research background, his current work, and his intentions going forward.

Professor Baron’s research highlights the fruitful intersection between business analytics and healthcare. Applying robust analytics to the field of healthcare, he argues, has the potential to drastically improve the way our health services are managed. This is due largely to the inordinate amount of data generated within the field of healthcare, data which can be studied and modelled in order to optimise healthcare outcomes. Professor Baron highlights that by utilising prescriptive analytics, we might be able to make important interventions at just the right time, potentially bolstering the provision of personalised healthcare, as well as facilitating earlier and more accurate diagnoses. His research has already had sizable real-world impact in Canada, as the PPE Help platform brought vast quantities of PPE to Canadians in the early days of the COVID pandemic.

We spoke to Professor Baron about this work, and about his research more broadly.

Could you give us a brief introduction to your research background and current area of research interest?

Broadly, I am working on operations management that is related to the management of processes that transform inputs, such as raw material, funds, machines and HR, to more valuable outputs, such as products and services. Much of this study is related to matching the supply with the demand, e.g., in supply chain management. In both theory and practice this has been a data-driven discipline for many years, and thus there are many recent advancements in this area with the increased availability of data. Many people who are involved in this subject are members of the INFORMS (Institute for Operations Research and Management Sciences) professional society; I am also a member of CORS (the Canadian Operations Research Society).

Within operations management theory, my main methodology is operations research. I am an expert in stochastic models that consider uncertainty in things. For example, when one plans their logistic services, they wish to prevent shortages and long delays. The required input for an effective inventory ordering is a demand forecast that by nature is very uncertain. As another example, when one needs to plan staffing in emergency departments, the uncertainty in patients’ arrivals and severity of their situation is important to consider. Another area of my expertise is optimisation, which is the study of how to take the best decision, e.g., to find the actions that maximise the profit. Both methodologies rely on data, are quantitative, and are a part of the foundation of business analytics. Stochastic methodologies are extremely important for predictive and comparative analytics and to many, optimisation is the most critical methodology when performing prescriptive analytics.

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Within operations management application, I am focused on the study of service systems. An emergency department is a great example, and so are call centers. I also worked a lot on other applications such as inventory management, especially for perishable items, and facility location, etc.

Your recent paper looks at business analytics in service operations. How did the field of healthcare help you to develop your analytic framework?

There is a surge in analytics in many disciplines and in business analytics within management. One of the places where business analytics has the most potential impact is in healthcare, where lots of transactions and patient level data are being recorded. I believe society would benefit significantly from applications of business analytics in healthcare, e.g., in support of personalized healthcare provisioning, including preventative and early diagnosis. There is also an increase in training and hiring of analytics in the healthcare profession, including some of the students in the Master of Management in Analytics program at the Rotman School of Management where I serve as academic director.

When surveying literature on healthcare analytics work, I noticed that this, as with many other business analytics applications, has four components (further details can be found at https://doi.org/10.1002/nav.22011).

- Descriptive analytics describes past performance of existing systems.
- Predictive analytics predicts future performance of systems.
- Comparative analytics compares performance of systems under different interventions.
- Prescriptive analytics prescribes interventions to improve future performance of systems.

Moreover, my own work is often focused on prescriptive analytics and discussion with colleagues suggested that they have a different understanding of what this term means. I thus coined the term prescriptive analytics. The inclusion of this term provides a clear distinction – finding the impact of any specific intervention, and the prescriptive analytics problem of recommending on the right level of a good, optimal, robust intervention.

Do you feel that utilizing business analytics in relation to healthcare might have a potentially transformative impact on the way healthcare is managed?

Yes. This is a combination of many different factors, from managing waiting times and accessibility to service in general, via personal treatment, and to preventive and diagnostic medicine. All of these would benefit from business analytics in the next decades. It will allow us to improve the quality of life of people at a lower cost.

In your view, what should the next steps be when it comes to analytic projects and research?

One important limitation of modern machine learning tools is their lack of interpretation – this makes using them for comparative and prescriptive analytics extra challenging. The other two main challenges are (1) lack of legislation – which make some data sets likely to be manipulated (e.g., in the context of on-line reviews), not to mention without sufficient guards for personal and confidential data, and (2) existing data that is based upon existing decisions may lead to problematic business analytics solutions (e.g., unethical usage of AI).

Could you tell us about the successful Covid PPE Help platform you launched with your colleagues Professor Philipp Aboce, Ming Hu, and Dmitry Krass?

The main idea was to enable the operations of the market for PPE that was at a halt early in the pandemic days. Based on our experience, one way to improve the efficacy of markets is to increase the visibility of demand and supply in the market. The platform helped this significantly and was instrumental in moving millions of PPE in Canada in the first few months of the pandemic.

What plans do you have for your own future research?

I wish to focus on a couple of directions that are related to business analytics in healthcare and for the usage of modern data-driven tools to improve the operations of services and manufacturing based upon advance data-driven (transaction-level) tools. Such tools will enable detailed comparative analytics by using appropriate and well calibrated process simulation models and will support prescriptive analytics that is to me the hallmark of business analytics.