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Applications of Big Data Analytics within a Dynamic Simulation Modeling Platform to Inform Osteoarthritis Care in Alberta

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Introduction

Osteoarthritis (OA) is a leading cause of chronic disability. There is need to leverage administrative data to support OA policy analysis. Our objective was to develop and apply a multidimensional data cube as an input parameter repository using health administrative data to populate an OA simulation model.

Objectives and Approach

Health administrative data including practitioner claims, inpatient and ambulatory visits from 1994 to 2013 were integrated into a multidimensional data cube. OA cases were identified using validated algorithms, and followed through stages of care (primary, specialist, acute and post-operative). The cube provided rate calculations, duration and average cost for each stage of care across the model dimensions (age categories, sex, comorbidity status and geographic zones). The rates were then linked to the model as input parameters to simulate patient flow across the continuum of care. We used the model to predict direct costs across all dimensions from 2010 to 2035.

Results

Using the model, total number of patients with OA in Alberta will increase from 312,000 in 2010 to 1.4 million in 2035. The average annual cost per OA patient also increases from $2,800 to $4,900, and the total cost increases from $450 million in 2010 to 2.2 billion in 2035. The majority of the patients were at earlier stages (non-surgical 78%, surgical 22%), with lower average cost (non-surgical $3,300 vs. surgical $16,400) in 2010. As new administrative data are being provided routinely, the data cube is capable of providing real-time updates for the input parameters of the model, which will aid in validation of the model results and improving the precision of projections.

Conclusion/Implications

The data cube has significantly improved our ability to manage and analyze administrative data within a simulation model to project the burden of OA in Alberta. The integrated model can be used as a real time decision-support tool to inform osteoarthritis service planning and variations in resource utilization.

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