

Outpatient Surgery for Type II Supracondylar Fractures at the Hospital for Sick Children: A Cost-Minimization Analysis

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BACKGROUND & OBJECTIVES

Supracondylar fractures of the humerus (SCH#) are the most common paediatric fractures and account for 10-16% of all paediatric fractures (1). One type of SCH#, Gartland type II, have a low incidence of complications, but often require surgical treatment (1).

Patients with type II SCH# are routinely admitted to the hospital and booked for non-urgent surgical treatment by closed reduction within 1-2 days.

Multiple studies have shown that closed reduction for type II SCH# can be delayed between 24 to 96 hours without increased risk of complications; orthopaedic surgeons at SickKids approved a delay of up to 96 hours with no differences in outcomes (2).

Cost minimization analysis (CMA) is used to compare the costs of different interventions known to have identical outcomes, through identification of perspective and resources used, quantifying them into physical units, and informing decision makers of which interventions cost less (3). A CMA approach is well-suited to exploring the cost of implementing an outpatient surgical option.

The purpose of this study was to quantify and compare the costs of implementing outpatient surgery for patients with type II SCH# compared to the current inpatient management, from the perspective of the health system payer, and to explore the costs associated with the societal perspective.

DATA SOURCES

This study used retrospective data derived from chart reviews and hospital administrative data, containing 1,066 patients between 0 and 18 years of age with SCH#, (372 type II) who presented to SickKids between 2008 and 2014.

The health system payer perspective examined costs associated with the delivery and operations of health care, and the societal perspective examined costs including all health system payer costs in addition to the costs society pays.

Healthcare costs were derived from:

- **Ontario Case Costing Initiative (OCCI)** – Direct costs for care provision, including nursing, OR, diagnostic imaging, pharmacy, labs, and indirect costs (overhead expenses related to running the hospital) (6).
- **Schedule of Benefits** – Costs for physician services in the ED, for orthopaedic surgeon consultations, and for procedures (7).

Societal costs were derived from:

- **Travel Costs and Parking** – Distance between community hospital and SickKids calculated using Google Maps, averaged across patients transferred (8,9). SickKids parking costs derived from the hospital website (10).
- **Productivity Loss** – Using the Human Capital approach, using average income data from Statistics Canada (11,12).
- **Analgesics** – Over-the-counter analgesics (13)

DECISION ANALYTIC MODEL

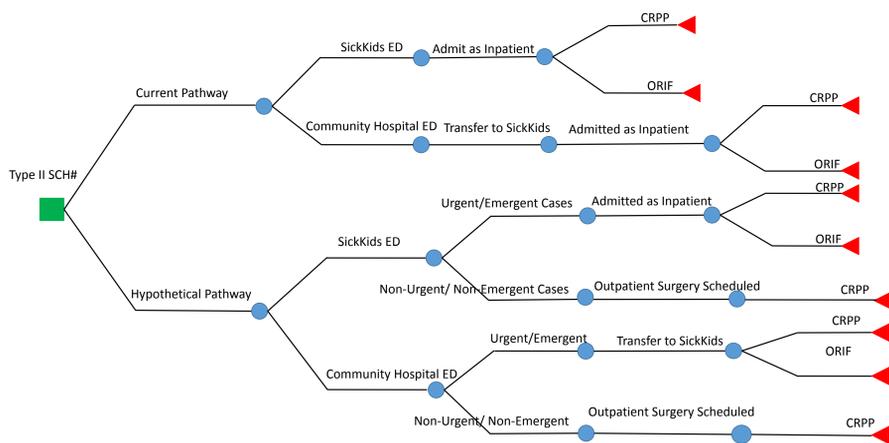


Figure 1: Schematic of decision analytic model

¹ Closed reduction percutaneous pinning
² Open Reduction with internal fixation

DECISION ANALYTIC MODEL CONT.

Two cost-minimization models were constructed, one from the payer perspective, and a second to explore the societal perspective, using TreeAge Software Pro version 2016 (TreeAge Software, Inc., Williamstown, MA) (Figure 1).

The **time horizon** was the episode of care up to discharge following the surgical procedure. Follow-up appointments were deemed to be identical for both pathways.

To assess the robustness of the uncertainties in the model's parameter estimates using sensitivity analyses. Probabilistic sensitivity analyses (PSA) were performed on the same model parameter estimates, using a Monte Carlo simulation.

FINDINGS

Payer Perspective

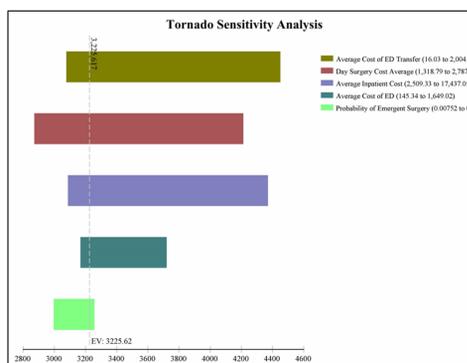


Figure 2: Tornado diagram for healthcare system payer perspective.

The base case analysis from the payer perspective yielded a current pathway cost of CAD \$5,923, the cost for the hypothetical pathway was CAD \$3,226, yielding an incremental cost saving of CAD \$2,697 per episode of care for the hypothetical pathway (decrease of 46%).

One-way sensitivity analyses: The model was not sensitive to changes in parameters. The cost of transferring between EDs is the most important variable driving costs, followed by day surgery cost, average inpatient cost, average cost of ED, and probability of emergent surgery.

Societal Perspective

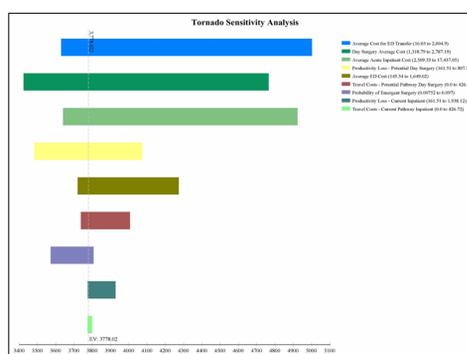


Figure 3: Tornado diagram for societal perspective.

The base case analysis from the societal perspective yielded a cost of CAD \$6,216 for the current pathway and CAD \$3,778 for the potential pathway, giving an incremental cost savings of CAD \$2,438 per episode of care (decrease of 39%).

One-way sensitivity analyses: The societal perspective analysis was not sensitive to uncertainty in the parameters. The Tornado diagram shows that productivity loss for the potential pathway was more influential than the average cost of the ED.

The difference in cost savings between two perspectives is CAD \$269, with the societal perspective generating less savings than the payer perspective.

Probabilistic sensitivity analyses showed that the potential pathway of outpatient surgery led to incremental cost saving in 99.2% of iterations when evaluated from the payer perspective and 97.5% of iterations from the societal perspective.

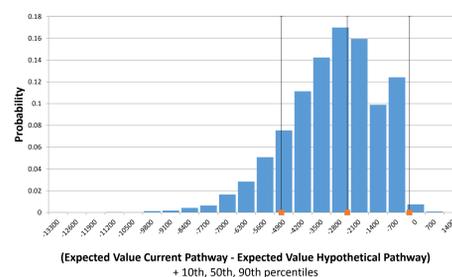


Figure 4: Monte Carlo simulation results Tornado diagram for healthcare system payer perspective.

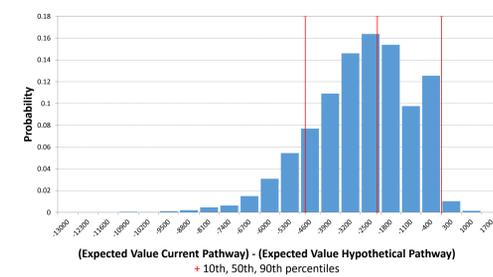


Figure 5: Monte Carlo simulation results for societal perspective, demonstrating the probability of attaining cost savings.

DISCUSSION & IMPLICATIONS

- Implementation of a day surgery option for type II SCH# at SickKids represents significant cost savings to both the healthcare system and society at large. Productivity loss was not the most influential cost driver, however, this and other societal costs absorbed by families should be considered in the decision making process prior to implementing this outpatient surgery pathway.
- SCH# surgeries peak during spring and summer months, therefore, further research may explore the influence of outpatient surgery during certain months of the year (14).
- Findings may be relevant to other paediatric hospitals in Ontario, because they are also likely to receive SCH#'s transfer patients from local community hospitals.

LIMITATIONS

There were limitations present within this study:

- The absence of a meta-analysis with which to quantitatively confirm the insignificance in surgical delay times.
- The use of OCCI costing data for SCH# is not specific to type of SCH#, therefore, it was not possible to identify the inpatient costs for type II fractures only.
- The assumption that the operating room for outpatient surgery would be used such that costs would "break-even", to ensure overhead costs would not invalidate the cost savings. This is relevant because it is unclear if costs associated with under-utilized operating room time would be relevant to the study's conclusions.

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