

Cost Effectiveness of a Preoperative Diabetes Optimization Program for Patients Undergoing Elective Posterior Spinal Fusion Surgery

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INTRODUCTION: Diabetes mellitus (DM) has been identified as an independent risk factor for a variety of postoperative complications following spine surgery, most notably surgical site infection (SSI). SSI is a major contributor to increased healthcare costs, as it can lead to unplanned hospital readmission, prolonged treatment course, and in some cases, reoperation. Many studies have evaluated the optimal threshold for preoperative HbA1c level associated with reduced risks for SSI. The cost-effectiveness of a preoperative diabetes optimization program in patients with plans to undergo elective posterior spinal fusion (PSF) has not been previously reported.

METHODS:

A decision tree model was designed for a hypothetical adult patient diagnosed with DM, planned to undergo elective PSF. The following two strategies were compared: use of a preoperative diabetes self-management educational and support program or no program. Probabilities for postoperative surgical site infection (SSI) for patients with poor glycemic control (HbA1c \geq 7%) and good glycemic control (HbA1c < 7%) were obtained from literature. Probabilities of achieving glycemic control (HbA1c < 7%) after diabetes self-management educational and support program were obtained from literature. Probabilities for postoperative surgical site infection (SSI) were then subdivided for patients who underwent preoperative 12-month diabetes self-management educational and support program and those who did not. Health utilities were utilized to calculate Quality-Adjusted Life Years (QALYs). A base-case analysis was carried out to obtain the incremental cost and effectiveness (QALYs) of the diabetes optimization program. Probabilistic sensitivity analysis was performed to evaluate uncertainty in the model and to obtain mean incremental costs, effectiveness, and net monetary benefits. One-way sensitivity analyses were also performed to identify the variables with the most impact on the model.

RESULTS: Utilization of a preoperative diabetes optimization program was favored as a strategy in 89% of the iterations. The mean incremental utility ratio for using a preoperative diabetes optimization program demonstrated higher benefit and lower cost, while being lower than the willingness-to-pay threshold of \$100,000 per quality adjusted life years. Base-case analysis for the scenarios demonstrated the following: diabetic patients indicated for PSF that underwent 12-month diabetes self-management education program had an average cost of \$61,524 per 3.07 QALY, and diabetic patients indicated for PSF that opted out of the 12-month diabetes self-management education program had an average cost of \$64,293 per 3.07 QALY. The mean incremental savings of preoperative 12-month diabetes self-management education program in diabetic patients indicated for PSF surgery was \$2,769 (SD: 2,469). Use of preoperative 12-month diabetes self-management education program did not result in any changes in QALYs compared to no program. The mean INMB and ICER of preoperative 12-month diabetes self-management education program diabetic patients indicated for PSF surgery were \$2,926 (95% CI: 2,773 – 3,079) and -\$1,766,460 (95% CI: -4,0137,681- -902,763) at a WTP threshold of \$100,000/QALY, respectively.

DISCUSSION AND CONCLUSION: Use of a preoperative diabetes optimization program is a cost-effective strategy to reduce the risk of postoperative SSI and its associated health-related costs. Use of a preoperative diabetes optimization program should be considered as part of a wholistic, patient-specific preoperative optimization program for elective surgery.

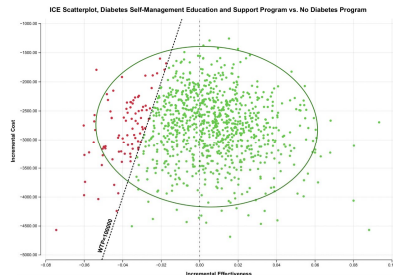
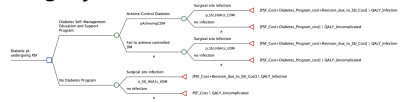


TABLE 1. Input Parameter Estimates

Parameter	Distribution	Estimate	±
Cost of Multilevel PSF (2022 USD)	Normal	45,732.36	4,573.236
Cost of preoperative diabetes optimization program (2022 USD)	Normal	435	43.5
Cost of Revision Multilevel PSF due to SSI (2022 USD)	Normal	52,865.38	5,286.538
Probability (%) of achieving DM control (HbA1c < 7%) after program	Beta	0.28	0.028
Probability (%) of SSI in controlled DM patient	Beta	0.1	0.01
Probability (%) of SSI in uncontrolled DM patient	Beta	0.353	0.0353
5-year QALY for patient with SSI	Normal	3.05	0.305
5-year QALY for patient without SSI	Normal	3.09	0.309

USD, United States Dollars; QALY, Quality Adjusted Life Years
 Controlled DM = HbA1c less than 7%
 Uncontrolled DM = HbA1c higher or equal to 7%