The Michigan Surgical Home and Optimization Program is a scalable model to improve care and reduce costs

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Background. *The Michigan Surgical Home and Optimization Program is a structured, home-based, preoperative training program targeting physical, nutritional, and psychological guidance. The purpose of this study was to determine if participation in this program was associated with reduced hospital duration of stay and health care costs.*

Methods. *We conducted a retrospective, single center, cohort study evaluating patients who participated in the Michigan Surgical Home and Optimization Program and subsequently underwent major elective general and thoracic operative care between June 2014 and December 2015. Propensity score matching was used to match program participants to a control group who underwent operative care prior to program implementation. Primary outcome measures were hospital duration of stay and payer costs. Multivariate regression was used to determine the covariate-adjusted effect of program participation.*

Results. *A total of 641 patients participated in the program; 82% were actively engaged in the program, recording physical activity at least 3 times per week for the majority of the program; 182 patients were propensity matched to patients who underwent operative care prior to program implementation. Multivariate analysis demonstrated that participation in the Michigan Surgical Home and Optimization Program was associated with a 31% reduction in hospital duration of stay (*$P < .001$*) and 28% lower total costs (*$P < .001$*) after adjusting for covariates.*

Conclusion. *A home-based, preoperative training program decreased hospital duration of stay, lowered costs of care, and was well accepted by patients. Further efforts will focus on broader implementation and linking participation to postoperative complications and rigorous patient-reported outcomes. (Surgery 2016;■:■-■.)*

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There has been growing interest in surgical risk assessment, especially related to domains such as patient frailty and sarcopenia.[1-6] Although identifying frail, high-risk patients is critical to optimize decision-making for patients and physicians, little focus has been given to mitigating these risks. Preoperative interventions, such as prehabilitation, may offer opportunities to optimize high-risk patients prior to major operations.

Prehabilitation entails patient training during the preoperative period.[1,2,5] Our initial work noted remarkable patient enthusiasm and no harm for a home-based prehabilitation program, motivating us to develop a patient-centered, clinical prehabilitation program.[7] The Michigan Surgical Home & Optimization Program (MSHOP) combines physical, nutritional, and psychological guidance as part of a comprehensive preoperative care program.

MSHOP is home-based and utilizes a technology platform to facilitate implementation across

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complex patient care settings. Previous work has noted generally positive results with prehabilitation in a clinical research setting.[1,7-11] MSHOP is different from these previous research-based prehabilitation programs in several key respects: it is built upon a patient-centered framework; it is designed for broad clinical implementation; it is multidimensional; and it intentionally leverages patient autonomy to augment patient engagement in the perioperative journey.

It is not clear whether MSHOP is scalable within current systems of care. The key outcomes to assess scalability are financial and patient acceptance. With this work, we answer the question of whether there is a viable business case for MSHOP and, more broadly, for preoperative optimization. Within this context, patients who participated in the MSHOP program are compared to a matched cohort of patients prior to the implementation of MSHOP. The primary outcome measures included hospital duration of stay and costs of care.

METHODS

MSHOP clinical program. The goal of MSHOP was to engage patients in a structured, technology-enabled, preoperative optimization program from the time of surgical decision-making until the operative procedure. The program was made available to all patients receiving major inpatient abdominal and thoracic operative care who had at least 2 weeks between enrollment and the operation date. No specific clinical inclusion criteria were made; surgeons were encouraged to refer patients they thought would benefit from the program. Upon enrollment, patients were given a pedometer, incentive spirometer, a DVD and brochure, and specific training from MSHOP personnel.

The interventions included

(1) A home-based walking program with daily reminders and feedback through automated phone messaging, text messages, or e-mail. Patients log daily walking from the date of enrollment until the day before the operative procedure;
(2) Incentive spirometry instructions starting one week prior to operation;
(3) Education on nutrition, stress management, and care planning; and
(4) Resources for smoking cessation, as appropriate.

More specific details about the program can be found online (http://www.med.umich.edu/surgery/mshop/).

Data source and study population for main effects analysis. This was a single-center, retrospective, matched cohort study. The study population included all patients who enrolled in MSHOP between June 6, 2014, and December 15, 2015 ($n = 644$). These were primarily major elective general and thoracic surgery patients. Three MSHOP patients were excluded from the analysis due to death prior to operation (none related to MSHOP), leaving 641 patients in the "treatment" group.

Measuring engagement. "Engagement" was prospectively defined as recording steps into the system a minimum of 3 times per week for the majority (at least 50%) of weeks the patient was enrolled in the program. If a patient was enrolled for 1 week, he or she was considered engaged if he or she recorded step entries for 3 or more days. Only complete weeks (7 consecutive days) were taken into account to determine engagement status. For example, if a patient's enrollment period lasted 4 weeks and 4 days, engagement was only evaluated for the first 4 weeks. Compliance with incentive spirometry was not considered in the assessment of engagement.

Hospital cost data. The primary outcome measures for this program were total costs and payer costs. Encounter-based cost and length of stay (LOS) data were extracted from the University of Michigan Health System Data Warehouse cost accounting system for both the treatment and control groups.[12-14] Costs were inflation adjusted to January 2015 dollars using the Bureau of Labor Statistics' consumer price index. The LOS, total cost, and payer costs for the primary encounter and for all hospital encounters within 90 days from the primary encounter were considered. Total cost was computed as the sum of direct (patient care) and indirect (overhead) hospital costs as calculated by the cost accounting system. Payer costs were determined based on "estimated payment" for the admission based on the patient's primary insurance. To remove surgeon-to-surgeon variation in billing, professional fees were not included in the analysis.

Control population. A random sample of patients who had major inpatient surgery at the University of Michigan was prospectively entered into the Michigan Surgical Quality Collaborative database. This cohort of patients ($n = 6,653$) had operative care prior to the initiation of MSHOP (July 1, 2006–June 20, 2011). This population of patients was used as the control population for the current analysis. We chose to use historical