

Preoperative Predictors for 30-day Postoperative Emergency Department Visit after a Bariatric Surgery

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Abstract

Quality improvement has been widely used in healthcare in the last few decades. The US healthcare sector has made significant strides in quality improvement, technological advancement, and innovations in the last century, yet it is often referenced as a complex, expensive and an industry with many inefficient processes and systems. One of the widely used key performance metrics in US hospitals is the 30-day emergency department visit after a surgical procedure. ED visits within 30 days of a surgical procedure are considered one of the key quality outcome measures, adding millions of dollars each year as a cost burden to US healthcare. This study aimed to identify key predictors that are known prior to the patient's surgery date contributing to undesirable ED visits within 30 days of a bariatric surgical procedure. The study was conducted in three phases. The first phase of the study engaged a panel of experts to narrow down important preoperative factors for patients undergoing bariatric surgery in the form of a Delphi study. The second phase of the study included quantitative data analysis, which utilized the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program Participant Use Data File from 2019 to identify statistically significant preoperative factors that can contribute to the likelihood of patients returning to the emergency department within 30 days of bariatric surgery. There were N = 193,774 cases with complete information from 868 MBSAQIP-accredited bariatric surgery centers across the United States in the Data File among which 15,533 (8% of the total cases) visited an ED without needing admission as inpatients. Examining the feasibility of developing a predictive model with only statistically significant factors and checking if the model has an acceptable fit was also part of the analysis. The third phase of the study reengaged the same panel of experts from the first phase to validate the findings from the second phase and to document the subject matter experts' perception regarding the model developed and the overall findings. Out of 33 preoperative variables, only 9 variables were selected in the first phase of the study with the help of a panel of experts. Out of the 9 selected variables, 8 variables i.e., Pre-Op GERD requiring medication, Number of Hypertensive Medications, Pre-Op BMI closest to bariatric surgery, Highest Recorded Pre-Op BMI, Pre-Op vein thrombosis requiring therapy, Pre-Op diabetes mellitus, Pre-Op history of COPD, and Pre-Op Steroid/Immunosuppressant Use for Chronic Condition significantly contributed to the likelihood of patients coming back to ED within 30 days of a bariatric procedure. The second phase of the study also yielded a predictive model using only the statistically significant and weighted variables, and each predictor exhibited statistical significance. Although Omnibus Tests of Model Coefficients showed that the Chi-square value was highly significant

($\chi^2=505.052$, $df=8$, $p<0.001$) suggesting the revised model after addition of exploratory variables being statistically significant, Hosmer & Lemeshow test suggested that the revised model was not a good fit to the data ($\chi^2=22.152$, $df=8$, $p<0.05$). In the third phase of the study, a panel of experts weighted in mostly with positive feedback deeming the study to be clinically and operationally valuable for the bariatric patient population. Practical implication of this study is that the model can be used by the MBSAQIP Centers to determine the probability of patient's likelihood of coming back to ED after a bariatric surgical procedure. Based on the set criteria, if the patient has higher chance of coming back to ED, care team can take interventions during and in the first few days or weeks of the discharge to prevent potential ED visit. Limitations of this study include but is not limited to the timeframe of the data was limited to only one year i.e., 2019 and size of the panel of experts was limited to 5. For future research studies, subject matter experts recommended taking the study to the next level by applying the findings to prevent future ED visits that are avoidable. Researchers can also take the findings from this study and expand the research by increasing the timeframe of the dataset and explore other variables that could also be important from day-to-day operations perspective which were not part of this study.

Keywords

Predictors, quality, 30-day ED visit, healthcare, binary logistics regression.

Biographies

Pawan Bhandari is a Principal Health Systems Engineer with Mayo Clinic's Strategy Department in the Southwest Minnesota Region, where he provides business consultative and management engineering services from discovery to execution at various levels of the Mayo Clinic organization. He holds a Bachelor and Master of Science in manufacturing engineering technology from Minnesota State University and expects to receive PhD in Technology Management from Indiana State University in May 2022. He is also an Instructor in Health Care Systems Engineering with the Mayo Clinic College of Medicine and Science. He is also an adjunct faculty in the College of Science, Engineering, and Technology at Minnesota State University, Mankato, Minnesota. He is a member of the American Society for Quality (ASQ), Association of Technology, Management and Applied Engineering (ATMAE), and Industrial Engineering & Operations Management Society (IEOM). He is an ASQ Certified Six Sigma Black Belt and ASQ Certified Quality Improvement Associate. His research interests are quality and process improvement, technology management, quality systems, performance improvement in healthcare, and business analytics which includes but is not limited to machine learning, Artificial Intelligence, and data science.

M. Affan Badar, PhD, CPEM, IEOM Fellow is Professor and former Chair of the Department of Applied Engineering and Technology Management at Indiana State University, USA. From 2016 to 2018, he was Professor and Chair of the Department of Industrial Engineering and Engineering Management at the University of Sharjah, UAE. He received a PhD Degree in Industrial Engineering from the University of Oklahoma in 2002, MS in Mechanical Engineering from King Fahd University of Petroleum and Minerals in 1993, and MSc in Industrial Engineering in 1990 and BSc (Hons) in Mechanical Engineering in 1988 from Aligarh Muslim University.

Christopher Kluse, Ph.D., is an associate professor of Quality Systems in the Department of Engineering Technologies at Bowling Green State University. Christopher earned his PhD in Technology Management with a specialization in Quality Systems from Eastern Michigan University in 2012. Christopher has over 25 years of industrial experience in quality systems with most of the time spent in the automotive sector as a quality and manufacturing professional. Additionally, Christopher is an ASQ Certified Manager of Quality/Organizational Excellence and has published multiple articles focusing on quality systems, lean manufacturing, and competency-based education.

Suhansa Rodchua is a professor and graduate program coordinator in the School of Technology at University of Central Missouri, Warrensburg, Missouri. She received a PhD in Technology Management, Quality Systems, from Indiana State University. Prior to teaching, she worked as an assistant project manager in the consulting company and a system cost analyst in the garment and textile industry. Dr. Rodchua's primary research and teaching interests are in the areas of industrial management, quality systems, applied research, and business analysis. She has published in Quality Costs in Manufacturing, Effective System Design, Measurement and Good Practice of Distance Learning, and others. Her studies and research have been presented in the national and international conferences. Dr. Rodchua is a senior member of American Society for Quality (ASQ) and Association of Technology, Management, and Applied Engineering (ATMAE). She holds certifications in Project Management Professional (PMI/PMP), Manager of

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