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Gerofit Prehabilitation Pilot Program: Preparing Frail Older Veterans for Surgery.

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### Journal

Journal for Healthcare Quality, 41(2)

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### Publication Date

2019

### DOI

10.1097/JHQ.0000000000000185

Peer reviewed



# HHS Public Access

Author manuscript

*J Healthc Qual.* Author manuscript; available in PMC 2021 April 09.

Published in final edited form as:

*J Healthc Qual.* 2019 ; 41(2): 91–98. doi:10.1097/JHQ.000000000000185.

## Gerofit Prehabilitation Pilot Program: Preparing Frail Older Veterans for Surgery

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### Abstract

Older Veterans are increasingly undergoing surgery and are at particularly high risk of postoperative morbidity and mortality. Prehabilitation has emerged as a method to improve postoperative outcomes by enhancing the patient's preoperative condition. We present data from our prehabilitation pilot project and plans for expansion and dissemination of a nation-wide quality improvement effort. The infrastructure of the existing Veterans Affairs (VA) Gerofit health and exercise program was used to create our pilot. Pilot patients were screened for risk of postoperative functional decline, assessed for baseline physical function, enrolled in a personalized exercise program, and prepared to transition into the hospital for surgery. Patients (n=9) completed an average of 17.7 prehabilitation sessions. After completing the program, 55.6% improved in 2 of the 5 fitness assessments completed. Postoperative outcomes including complications, 30-day mortality and 30-day readmissions were better than predicted by the National Surgical Quality

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Improvement Program Surgical Risk Calculator. We have obtained institutional support for implementing similar prehabilitation programs at VA hospitals nationally through our designation as a VA Patient Safety Center for Inquiry. This is the first multi-institutional prehabilitation program for frail, older Veterans and represents an essential step toward optimizing surgical care for this vulnerable population.

## Keywords

Geriatric; Prehabilitation; Gerofit; Veterans; Patient safety

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## Introduction

Older adults are increasingly undergoing surgery and are at risk for poor postoperative outcomes.<sup>1</sup> Prehabilitation, defined as the enhancement of the preoperative condition of a patient,<sup>2</sup> has recently emerged as a potential mechanism by which to improve surgical outcomes for older adults. There is evidence that physical prehabilitation programs may improve both preoperative physical function (i.e., increased respiratory muscle endurance, improved walking distance, increased oxygen uptake during exercise), and postoperative clinical outcomes (i.e., lower postoperative pain scores, decreased likelihood of postoperative complications, reduced length of stay).<sup>3-6</sup> A recent randomized clinical trial in adults undergoing elective esophagogastric resection showed that patients receiving prehabilitation had improved functional capacity both before and after surgery.<sup>7</sup>

Recently, the surgical community has embraced enhanced recovery protocols (ERPs) as a way in which to improve surgical outcomes.<sup>8</sup> These evidence-based perioperative protocols have been shown to improve clinical outcomes after procedures spanning numerous subspecialties including colorectal surgery, thoracic surgery, orthopedic surgery, gynecologic surgery and urology.<sup>9</sup> As a result, the Clinical Practice Guidelines for Enhanced Recovery After Colon and Rectal Surgery have recommended considering prehabilitation before elective surgery in patients with multiple comorbidities or significant deconditioning.<sup>10</sup>

Despite promising results from early studies and inclusion of prehabilitation in select surgical clinical practice guidelines, research efforts in the field are ongoing, as many studies investigating prehabilitation programs have been limited by small sample size, moderate methodological quality, and variable compliance with protocols.<sup>5</sup> Furthermore, few studies have specifically focused on vulnerable populations that may benefit the most from prehabilitation, such as frail older Veterans.<sup>11</sup>

Our group aims to develop, evaluate and implement a prehabilitation program for frail older Veterans at Veterans Affairs (VA) healthcare systems across the nation. We build upon the infrastructure of the long-standing Gerofit program, which is an exercise and health promotion program for all older Veterans (i.e., not necessarily just surgical patients).<sup>12</sup> Our program uses a multi-disciplinary approach, similar to that successfully implemented by other programs designed to improve clinical outcomes for at-risk older adults, including the Hospital Elder Life Program (HELP).<sup>13</sup> In this manuscript, we present data from a local pilot project at our institution, and describe plans to develop a national quality improvement

effort within the VA specifically to prepare frail older Veterans for elective surgery through a novel prehabilitation program.

## Methods

### Background on Gerofit Program in VA Hospitals

The Gerofit program was originally established in 1986 as an exercise and health-promotion program targeting older Veterans (65 years or older) at risk of functional decline because of deconditioning, chronic disease or limited mobility.<sup>14</sup> Primary care providers refer patients to Gerofit to complete a structured, personalized exercise program and functional capacity is assessed at baseline and at 3, 6, and 12 months after initiation. Gerofit recently secured funding for dissemination to other VA hospitals as a model of care to prevent functional decline,<sup>14</sup> and our institution was one of the first dissemination sites. A recent study of 1-year outcomes at these sites revealed statistically significant improvement in each of the functional tasks compared to baseline (gait speed, 8-foot up and go, 30-second chair stands, 6-minute walk distance; paired t-test significant at  $p < 0.05$ ) and high patient satisfaction ratings (88–94%).<sup>14</sup> The infrastructure from the Gerofit program at our institution was used to create the pilot project for prehabilitation to optimize frail surgical patients.

### Pilot Project Using Gerofit to Prepare Frail Veterans For Major Surgery

The prehabilitation pilot project was developed as a collaboration between geriatrics, anesthesia/critical care, and surgery with the goal of providing a person-centered approach to support quality in geriatric surgery. Patients were referred through a Gerofit prehabilitation consult through the Computerized Patient Record System (CPRS) if they had any of the following trigger factors: assistance with activities of daily living or instrumental activities of daily living, multiple medical comorbidities, polypharmacy, cognitive decline, vision or hearing impairment, and risk factors unique to the Veteran population including chronic opioid use and post-traumatic stress disorder.

**Screening:** Referred patients were contacted by phone and asked if any of the following exclusion criteria were present: (1) unable to perform any activities of daily living; (2) unstable angina; (3) proliferative diabetic retinopathy; (4) oxygen dependent; (5) incontinence; (6) open wounds; (7) no permanent residence; (8) requires VA transportation/travel; (9) cognitive impairment that impairs ability to follow instruction; and (10) history of disruptive behavior or not conducive to group activity. Patients were asked about their use of a mobility aid, current exercise, and barriers to exercise. If deemed a good candidate for the Gerofit prehabilitation pilot based on the telephone interview and if interested in participating, the patient was scheduled for a baseline assessment at the Gerofit gym.

**Baseline Assessment:** Five short physical performance tests were done: (1) Gait velocity as measured by a 10 meter walk; (2) Leg strength as measured by number of chair stands in 30 seconds; (3) Endurance as measured by yards walked in 6 minutes; (4) Balance and mobility as measured by an 8 Foot Up and Go; and (5) Arm strength as measured by number of arm curls in 30 seconds.<sup>15</sup> Percentile rank was provided for each performance test based on patient's gender and age. A physical function survey was performed to assess how

the patient's health limits them in everyday activities. Self-report was obtained for comorbid health conditions, recent emergency department or hospital visits and recent falls.

**Gerofit Gym Program:** Based on the results of the baseline assessment, a personalized exercise program was designed for the patient and they were asked to come to the gym 1–3 times per week as their schedule permits. The program includes aerobic exercise, resistance training with therabands, free weights and resistance machines, and group exercise classes on flexibility, mobility, and balance. Patients were reassessed prior to surgery (usually after 4–6 weeks in the program) using the five performance tests described above and percentile ranks were compared to the baseline assessment and communicated to the referring surgeon.

The following areas were also addressed by the Gerofit staff during the patient's time at the gym: care coordination for medical optimization prior to surgery, mental preparation (e.g. reviewing what to expect in the hospital, risks of surgery based on the American College of Surgeons National Surgical Quality Improvement Program [ACS NSQIP] Risk Calculator), goals of care including peer counseling from previous Gerofit participants, inspiratory muscle training through teaching how to use an incentive spirometer, obtaining patient-centered data about 'Who I Am' (e.g. what patient prefers to be called, who they live with, military history) and 'Patient Preferences' (e.g. hobbies, foods, sleep/wake times).

**Transition Into the Hospital:** Gerofit staff helped reinforce perioperative instructions with the patient prior to surgery (e.g. medications to start or stop, bowel preparation). The patient-centered 'Who I Am' and 'Patient Preferences' were included in CPRS as a Gerofit progress note so staff caring for the patient after surgery could review the information. Patients were also followed by the Gerofit team daily while in the hospital to promote early mobilization with the assistance of undergraduate pre-medical student volunteers.

## Analysis

Preliminary data from the first 9 participants in the pilot project are presented including patient demographics (e.g. age, gender), number of trigger factors, number of prehabilitation sessions completed, percentile ranks for baseline and pre-surgery performance tests, and outcomes after surgery (e.g. length of stay, complications, readmission). The pilot project was considered quality improvement and did not require Institutional Review Board (IRB) approval from our institution. Future research plans for alpha- and beta-testing described in this manuscript will require IRB approval, which is currently pending.

## Results

### Prehabilitation to Optimize Functional Status Prior to Surgery is Feasible.

To date 9 participants have completed the Gerofit prehabilitation pilot prior to an elective surgical procedure. Participants had a mean age of 73 years, an average of 2.2 trigger factors, and completed an average of 17.7 prehab sessions (Table 1). Three patients underwent colorectal surgery (open right hemicolectomy, ileostomy reversal, and sigmoid colectomy), three patients underwent cardiac surgery (1-vessel coronary artery bypass graft, mitral valve replacement with 2-vessel coronary artery bypass graft, and aortic valve

replacement), two patients underwent orthopedic surgery (total knee arthroplasty), and one patient underwent urologic surgery (transurethral incision of bladder neck).

Patients demonstrated improvement in the following fitness outcomes: gait velocity (1 of 8 improved), chair stands (5 of 8 improved), 6 minute walk (2 of 8 improved), 8 foot up and go (2 of 8 improved), and arm curls (5 of 7 improved) (Table 1). Five patients improved in two or more of the fitness assessments completed.

According to the ACS NSQIP Risk Calculator, patients had a mean predicted 15% chance of serious complication, and 17.9% chance of any complication (Table 2). Only one patient (11%) had a postoperative complication, which was cellulitis. Patients had a mean 1.3% chance of death within 30 days according to the NSQIP Surgical Risk Calculator, and there were no 30-day deaths. As of June 2018, only one patient died and this occurred 8 months postoperatively and was due to causes unrelated to the operation. Seven of 9 patients (77.8%) had a length of stay (LOS) that was equal to or less than that predicted by the NSQIP Surgical Risk Calculator. NSQIP predictions for discharge to skilled nursing facility (SNF) ranged from 1.9 – 47.4%. Four out of 9 patients (44%) were discharged to a non-home location, including both SNF and acute rehab. The mean predicted rate of readmission was 9.7% according to the NSQIP Surgical Risk Calculator and zero patients were readmitted within 30 days of discharge.

### **Capacity Building and Expansion as a Patient Safety Center of Inquiry (PSCI): Center for Complex Patient Care Transition Safety.**

The data from this pilot project was used to obtain funding from the National Center for Patient Safety for our institution to become a PSCI. PSCIs, located in VA medical centers around the country, research specific areas of patient safety and develop, disseminate and implement innovative interventions to improve patient safety at the bedside.<sup>16</sup> Our institution is a new PSCI, the Center for Complex Patient Care Transition Safety, that focuses on two specific Veteran populations with complex care needs: 1) Veterans hospitalized on general medical services with complex social needs and 2) elderly Veterans requiring hospitalization for surgery. The Transitions in Geriatric Surgery project addresses the second population of Veterans and aims to identify high-risk frail older Veterans undergoing elective inpatient surgery and address transitions of care across the perioperative period. Prehabilitation to improve mental and physical fitness prior to elective surgery through an individualized exercise and provision of care coordination prior to surgery are key components of this project.

The current pilot project will soon be transitioned into alpha-testing, which will include 100–125 patients across six surgical subspecialties: cardiac, orthopedic, urologic, vascular and neurological surgery. Several improvements to the program will be made, including streamlining the clinic assessment to include components of the Denver Frailty score<sup>17</sup>, and offering non-Gerofit gym prehabilitation options (e.g. home based with telephone coaching) for patients with logistical difficulties getting to our institution's Gerofit gym. Other improvements to the pilot project include better measurements of the effectiveness of the prehabilitation program. For example, in addition to pre-surgery assessment of fitness outcomes, we will re-assess fitness outcomes at 30- and 90-days postoperatively to measure

the trajectory of patient recovery. While we do not plan to include a control group, we will use data from the Veterans Affairs Surgical Quality Improvement Program (VASQIP) to compare clinical outcomes of prehabilitation program participants to that of the general population of older Veterans undergoing similar operations.

If the patient is a candidate for prehabilitation based on the clinic assessment then patients will be offered one of the following prehabilitation programs: Gerofit gym at our institution, use of local gym if they have access to one, or home-based phone counseling. Patients who choose the home-based program will be provided with two therabands (one for spouse/family member to use with the patient) and a pamphlet which demonstrates the exercises.

Next, the program will be beta-tested in three VA hospitals, including one with an existing Gerofit program and two that do not have Gerofit programs. We estimate that 150–300 patients will be recruited, with 50–100 from each of the Gerofit sites and 25–50 from each of the two non-Gerofit sites.

We will document implementation activities, resources used, barriers, and successful strategies used to overcome those barriers. We will do so first at our institution in the alpha test phase and then in the other facilities during the beta phase. We will also conduct summative evaluation interviews with beta site key informants to identify strategies to overcome implementation barriers in order to facilitate successful future implementation. Additionally, we will develop and evaluate toolkits including a prehabilitation assessment sheet, an intervention workbook for providers, and an intervention workbook for patients. We will leverage dissemination through the existing Gerofit program, national VA partners such as the Office of Geriatrics and Extended Care, VA stakeholders through the Coalition for Quality in Geriatric Surgery Project, and VA cyberseminars. Ultimately, we plan to disseminate toolkits to facilitate the implementation of prehabilitation programs at VA hospitals nationwide.

### Limitations

There are several limitations to this program. First, many studies have suggested that a multimodal prehabilitation program is most likely to have the most substantial impact on functional outcomes<sup>18</sup> and our program is primarily focused on physical prehabilitation. However, we do recommend consultation with a nutritionist in patients who appear malnourished (e.g., low albumin) and promote mental preparation for surgery in all participants. Second, our program is specific to older Veterans and the program may not be generalizable to other populations. Despite this, older Veterans are a vulnerable population, consume a disproportionate amount of VA resources,<sup>11</sup> and thus are a population in need of improved services. Lastly, we present data only from a pilot project and are not able to show significant improvement in clinical outcomes with our small sample size. Nonetheless, as a PSCI with detailed plans for expansion, evaluation and dissemination, we feel confident that our prehabilitation program will benefit older Veterans undergoing surgery.

## Discussion

The population is aging and the growing number of frail older patients undergoing surgery poses a major healthcare challenge. Older Veterans are in particularly poor health, with over half reporting limitations in functional capacity.<sup>11</sup> Studies have shown that preoperative physical capacity is an important predictor of postoperative course.<sup>19–21</sup> Preliminary results from prehabilitation programs suggest that they may improve physical function prior to surgery and improve outcomes.<sup>3–6</sup> The Exercise Prehabilitation in Colorectal Cancer Delphi Study Group concluded that exercise training should be a part of perioperative care and would be supported by surgeons.<sup>22</sup> The Veteran community is in need of prehabilitation programs for older adults, in order to improve the safety and quality of surgical care in this vulnerable population.

This pilot project showed that a VA Gerofit-based prehabilitation program is feasible and appeared effective at improving preoperative physical function of older Veterans prior to surgery. Feasibility was demonstrated by successful screening and enrollment of appropriate patients, completion of the exercise program at the Gerofit gym, improvements in preoperative physical function, and safe completion of the scheduled operations. At least one patient improved in every one of the fitness outcomes measured, and five patients improved in two or more areas. The rate of postoperative complications was low in this high-risk population and there was only one death, which occurred 8 months after surgery and was unrelated to the surgery. LOS and readmission were lower than expected in the majority of patients. This preliminary data contributed to our group to obtaining the distinction of a PSCI, which will allow the program to expand to six surgical subspecialties and three VA hospitals.

The significant contributions of this multi-disciplinary, multi-institutional prehabilitation program, targeted at frail, high-risk older Veterans are twofold. First, it will contribute to the growing body of literature on the effectiveness of prehabilitation programs. Despite overall enthusiasm for prehabilitation as a method by which to improve postoperative outcomes, several systematic reviews and meta-analyses conclude that there is not yet sufficient evidence to demonstrate meaningful improvement in clinical outcomes.<sup>4,18,23,24</sup> Specific weaknesses identified in the existing literature include small sample size, lack of targeting of programs to high-risk groups of patients, as well as non-generalizability of results given the heterogeneity of programs.<sup>5,18</sup> Our group's prehabilitation program overcomes these pitfalls by ensuring a sample size with adequate power to detect small changes in outcome scores, using trigger factors and strict inclusion/exclusion criteria to identify the highest-risk older Veterans to enroll, and implementing a program that is designed to be disseminated across all surgical departments at VA hospitals nationwide.

Despite limited evidence to recommend prehabilitation programs to younger adult patients preoperatively, evidence for the benefit of these programs in older adults is stronger and thus it is essential to create targeted programs and to plan for expansion and widespread implementation. The second significant contribution of this work is that it will produce the tools and methods to facilitate the dissemination of prehabilitation programs at VA hospitals nationwide. With the support of the National Center for Patient Safety, our prehabilitation



program has the potential to spread to VA hospitals across the country and improve the quality of surgical care provided to the vulnerable frail, older Veteran population nationwide.

## Conclusions

The results from this Gerofit prehabilitation pilot show feasibility and preliminary data that suggest that the program can be successfully implemented at VA hospitals. With the support of the National Center for Patient Safety, as a PSCI, we plan to proceed with alpha- and beta-testing phases to eventually implement a multi-disciplinary, multi-institutional prehabilitation program, targeted at frail, older Veterans in order to improve postoperative clinical outcomes.

## Implications

Prehabilitation has recently emerged as a mechanism by which to improve postoperative outcomes. The frail, older Veteran population is particularly vulnerable to postoperative morbidity and mortality. Thus, our prehabilitation program has the potential to improve the quality of care provided to Veterans undergoing elective surgery nationwide. Future directions include adapting this program to other hospital systems to ensure preoperative optimization for all older adults regardless of treatment location.

## Acknowledgments

**Conflicts of Interest and Sources of Funding:** Jill Q. Dworsky receives funding from the Agency for Healthcare Research and Quality (grant T32HS00046) and the American College of Surgeons (grant 20170835). The content is solely the responsibility of the authors and does not necessarily represent the official views of the Agency for Healthcare Research and Quality. Marcia M. Russell is a consultant for Healthgrades and the American College of Surgeons, and receives funding from the Conquer Cancer Foundation of ASCO, the National Institute on Aging (grant 1R03AG056350-01), VA Health Services, Research & Development (grant 1I01HX002278-01A1). This project was funded by the VHA Office of Rural Health and the VHA Office of Geriatrics and Extended Care. For the remaining authors none were declared.

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**Table 1:** Gerofit Prehabilitation Pilot Participants: Comparison Between Baseline and Presurgery Assessments

Patient	Age	Trigger Factors	# of Prehab Sessions	Operation	Gait Velocity, in meters/second (above vs. below average)		Chair Stands, number in 30 seconds (percentile)		6 min walk, in yards (percentile)		8' Up & Go, in seconds (percentile)		Arm Curls, in 30 seconds (percentile)	
					Baseline	Pre-surgery	Baseline	Pre-surgery	Baseline	Pre-surgery	Baseline	Pre-surgery	Baseline	Pre-surgery
1	80	2 – mobility, comorbid	10	Open Right Hemi-colectomy	0.88 (below average)	0.86 (below average)	9 (10–15%)	12 (30–35%)	387 (5–10%)	429 (15–20%)	10.7 (<5%)	9.5 (<5%)	14 (30–35%)	16 (45–55%)
2	70	3 – mobility, comorbid, hearing impairment	11	1 vessel CABG	0.88 (below average)	Unable to test	8 (5%)	Unable to test	383 (5%)	Unable to test	12.0 (5%)	Unable to test	12 (15%)	12 (15%)
3	77	1 – mobility	24	TKA	1.5 (above average)	1.9 (above average)	13 (45%)	19 (65–70%)	652 (75%)	729 (90–95%)	5.5 (55%)	5.6 (55–60%)	Unable to test	Unable to test
4	64	2 – mobility, comorbid	14	Ileostomy Reversal	0.88 (below average)	0.76 (below average)	17 (60–65%)	9 (10%)	447 (<5%)	339 (<5%)	5.6 (20–25%)	6.9 (<5%)	Unable to test	Unable to test
5	78	3-mobility, poly-pharmacy, chronic opioids	24	TKA	0.52 (below average)	* pt. now with increased right knee pain before surgery – declined to walk	12 (30–35%)	6 (<5%)	261 (<5%)	Declined to walk	9.7 (<5%)	33.3 (<5%)	20 (80%)	18 (65%)
6	69	2 – mobility, comorbid	29	MVR with 2 vessel CABG	0.71 (below average)	0.88 (slightly below average)	7 (<5%)	9 (10%)	253 (<5%)	277 (<5%)	10.4 (<5%)	9.7 (<5%)	15 (25%)	20 (65%)
7	74	2-mobility, comorbid,	14	Sigmoid Colectomy	0.98 (slightly below average)	0.89 (below average)	12 (25–30%)	14 (50%)	280 (<5%)	282 (<5%)	9.3 (<5%)	9.37 (<5%)	14 (25%)	17 (50%)
8	70	2 – mobility, comorbid,	9	AVR	Unable to test	Unable to test	Unable to test	Unable to test	Unable to test	Unable to test	Unable to test	Unable to test	16 (40%)	18 (75%)
9	77	2 – comorbid, hx of falls	24	TIUBN	1.2 Normal	1.14 Normal	11 (25%)	14(90–95%)	594 (60–65%)	579 (55–60%)	6.6 (30–35%)	6.2 (40–45%)	16 (45–50%)	23 (90–95%)

AVR = aortic valve replacement, CABG = coronary artery bypass graft, MVR = mitral valve replacement, TKA = total knee arthroplasty, TIUBN = transurethral incision of bladder neck

\* Boxes shaded in grey show improvement

**Table 2:** Gerofit Prehabilitation Pilot Participants' Predicted and Actual Clinical Outcomes

Patient	Operation	NSQIP Predicted Serious Complication (%)	NSQIP Predicted Any Complication (%)	Complications	NSQIP Predicted Death (%)	NSQIP Predicted LOS (days)	Actual LOS (days)	NSQIP Predicted Discharge to SNF (%)	Discharge Location	NSQIP Predicted Readmission (%)	30 Day Readmit
1	Open Right Hemicolectomy	23.0	27.7	None	4.4	7.5	7	21.4	Home	13.8	No
2	1 vessel CABG	11.0	12.7	None	0.9	6	7	9.8	Home	8.1	No
3	TKA	5.3	5.7	Cellulitis	0.2	3.5	2	44	SNF (15 day LOS)	4.0	No
4	Ileostomy Reversal	22.3	27.9	None	1.7	6.5	7	10.4	Home	14.4	No
5	TKA	6.9	6.7	None	0.4	4	4	47.4	SNF (3 day LOS)	5.3	No
6	MVR with 2 vessel CABG	19.7	24.7	None	0.9	7.5	13	19.3	Acute Rehab (12 day LOS)	12.2	No
7	Sigmoid Colectomy	22.2	27.7	None	2.4	7.5	6	15	Home	13.7	No
8	AVR	19.4	23.5	None	1.0	7.5	5	13.1	SNF (17 day LOS)	11.7	No
9	TIUBN	5.1	4.9	None	0.2	0.5	0.5	1.9	Home	4.0	No

AVR = aortic valve replacement, CABG = coronary artery bypass graft, MVR = mitral valve replacement, NSQIP = National Surgical Quality Improvement Program, SNF = skilled nursing facility, TKA = total knee arthroplasty, TIUBM = transurethral incision of bladder neck, UTI = urinary tract infection