

American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) Joint Consensus Statement on Patient Reported Outcomes (PROs) within an Enhanced Recovery Pathway

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**Supplemental Digital Content**

**Supplemental Table 1.** Clinical studies that focus on patient reported outcomes (PROs) within the context of an enhanced recovery program (ERP).

Author/Year	Journal	PROM	Surgical Type	Summary of results
Delaney 2003 <sup>1</sup>	Dis Colon Rectum	Cleveland Clinic Global Quality of Life Questionnaire	Laparotomy & Intestinal Resection	There was no difference between enhanced pathway and traditional patients in quality of life after surgery.
Jones 2013 <sup>2</sup>	Br J Surg	EQ5D	Open Liver Resection	ERP vs standard care. Quality of life was significantly better in ERP group.
Kim 2012 <sup>3</sup>	World J Surg	EORTC QOL questionnaire	Lap Gastrectomy	Fast track vs conventional group. Improved fatigue, appetite loss, anxiety with fast track.
King 2006 <sup>4</sup>	Colorectal Dis	EORTC QLQ-C30 QLQ-CR38	Colorectal cancer	ERP vs historical controls: There was no significant difference in quality of life outcomes
Larsen 2008 <sup>5</sup>	Acta Orthop	EQ-5D	Knee/Hip Arthroplasty	RCT: control vs accelerated perioperative care. EQ-5D scores were higher in both groups at 3 months compared to baseline, but the intervention group had better quality of life scores.
Larsen 2010 <sup>6</sup>	Health Qual Life Outcomes	EQ-5D, SF36	Hip Arthroplasty	Fast track vs population norm data. Hip surgery patients reached population normal levels for HRQOL @ 3 months and exceeded population normal @ 12 months.

**Supplemental Table 1 (continued).** Clinical studies that focus on patient reported outcomes (PROs) within the context of an enhanced recovery program (ERP).

Author/Year	Journal	PROM	Surgical Type	Summary of results
Larsen 2012 <sup>7</sup>	Knee Surg Sports Traumatol Arthosc	EQ 5D, SF 36	Knee Arthroplasty	Fast track vs. population norm data. Patients were below population norms at 4 and 12 months. No or mild pain and good functional ability @ 4 months were associated with high HRQOL at later follow up
Lemanu 2013 <sup>8</sup>	Br J surg	Surgical Recovery Scale	Lap. Sleeve gastrectomy	ERAS vs control. No difference in postoperative fatigue between groups.
Recart 2005 <sup>9</sup>	J Endourol	Quality of Recovery Score	Lap Nephrectomy	Conventional Vs fast track. Quality of recovery scores similar between groups
Shida 2015 <sup>10</sup>	BMC Cancer	QoR-40	Colorectal cancer	ERAS patients. POD#1 and #3 scores significantly decreased with return to baseline on POD#6.
Vlug 2011 <sup>11</sup>	Ann Surg	SF-36, GIQLI	Colonic Surgery	Lap vs open colectomy – fast track or standard care. Quality of life scores similar between the care tracks.
Wang 2010 <sup>12</sup>	J Gastrointest Surg	Spitzer Index	Gastric Cancer	Fast track vs Conventional. Fast track surgery was associated with higher quality of life score on hospital discharge
Wang 2015 <sup>13</sup>	Qual Life Res	EORTC QLQ-C-30, QLQ-CR-29	Colonic Surgery	ERAS vs control. Short term quality of life better using ERAS.

QLQ-C30: European Organization for Research & Treatment of Cancer Quality of Life Questionnaire C30  
 QLQ-CR38: European Organization for Research & Treatment of Cancer Quality of Life Questionnaire Colorectal 38  
 QLQ-CR28: European Organization for Research & Treatment of Cancer Quality of Life Questionnaire – Colorectal 28  
 SF-36: Short Form 36  
 MDASI-GI: Gastrointestinal version of MD Anderson Symptom Inventory  
 MDASI: MD Anderson Symptom Inventory  
 RCT: Randomized controlled trial  
 HRQOL: Health related quality of life  
 ERAS: Enhanced recovery after surgery

## Supplemental Text 1

### Summary of PROMs of Potential Relevance to Enhanced Recovery Pathways

#### *Quality of Recovery Score (QoR) - QoR-9, QoR-15, QoR-40*

The quality of recovery scores, QoR-9, QoR-15, QoR-40 were reported by Myles and colleagues in several studies.<sup>14-16</sup> The goal of the QoR score is to provide a valid, reliable, and responsive measure of quality of recovery after anesthesia and surgery. The most comprehensive measure, the QoR-40, covers five health dimensions related to mental and physical well-being: 1. patient support, 2. emotions, 3. comfort, 4. physical independence and 5. pain, each scored on a zero to ten point scale. The QoR-40 showed superior validity and reliability in comparison to the QoR-9, however it requires approximately ten minutes to administer.<sup>15</sup> Alternatively, the QoR-15 can be completed in 3 minutes and evidence supports its validity, reliability, responsiveness and feasibility in surgical patients in clinical practice.<sup>16</sup> All QoR scores ask patients to evaluate their health with a 24-hour period, which makes them an attractive instrument for the immediate perioperative period. After colorectal surgery, QoR-40 scores were found to drop significantly on postoperative day 1, with significant improvement by postoperative day 3 and return to baseline on postoperative day 6.<sup>10</sup> Compared to a variety of other patient centered tools, the QoR scores have shorter recall periods (24-hours) allowing for their use in the dynamic immediate postoperative phase when most ERP interventions continue.

## *WHODAS 2.0*

The World Health Organization – Disability Assessment Scale 2.0 (WHODAS 2.0) is directly linked to the structural concepts with the World Health Organization's (WHO) International Classification of Functioning, Disability and Health, more commonly known as ICF. <sup>17</sup> Disability is defined by the WHO as a difficulty in functioning at the body, person, or societal level. Disability occurs in one or more life domains, as experienced by an individual with health conditions in interaction with contextual factors. WHODAS 2.0 follows a biopsychosocial model of health and covers 6 domain functions: 1. Cognition: understanding and communication, 2. Mobility: moving and getting around, 3. Self-care: hygiene, dressing, eating and staying alone, 4. Getting along: interacting with other people, 5. Life activities: domestic responsibilities, leisure, work and school, and 6. Participation: joining in community activities. WHODAS 2.0 is a generic assessment instrument for health and disability and can be used across all diseases, including mental, neurological and addictive disorders. It is short, simple and easy to administer (5-20 minutes). It has application in both clinical and general population settings. It is a tool that can be used to produce standardized disability levels and profiles applicable across cultures in all adult populations. <sup>19</sup>

Recently, the WHODAS 2.0 has shown adequate validity, reliability and responsiveness in a diverse surgical population. <sup>18</sup> Five-hundred patients were assessed using the WHODAS 2.0 instrument following surgery. The WHODAS 2.0 correlated with QoR scores at 30 days, and measures of pain interference and physical function at 3, 6, and 12 months after surgery. Patients with increased hospital length of stay or complications

within the first 30 days correlated with a new disability in a life domain.<sup>19</sup> This initial validation within the perioperative setting further supports its possible use within an ERP.

### *PROMIS*

In 2004, the National Institutes of Health began the development of a system of PROs in order to overcome barriers to large scale clinical and research use of patient centered outcomes. The Patient Reported Outcome Measurement Information System (PROMIS-[www.healthmeasures.net](http://www.healthmeasures.net)) leverages modern psychometric principles in order to provide a precise and widely applicable system of PROs.<sup>20</sup> PROMIS measures are administered as item banks that are grouped under the three domains: 1. physical, 2. mental, 3. and social health. Each item bank underwent rigorous development utilizing item response theory (IRT) that maximizes precision in each item bank, increases flexibility and allows for tailored administration. Additionally, PROMIS can utilize Computer Adaptive Testing (CAT) through which questions are selected based on a patient's previous answer. CAT adds the benefit of minimizing the number of questions to be answered without sacrificing reliability in the scores produced. A critical benefit of PROMIS is its use of a standardized metric, the T score. This is normalized to the general population and allows providers to longitudinally "speak the same language" across a variety of care settings. In institutions without the capability for CAT, PROMIS measures also are available in short form item banks (e.g. depression, pain interference) or short form profile instruments (e.g. PROMIS-29).

PROMIS measures are being integrated rapidly by surgical services (e.g. orthopedics, oncological surgery) and represent a cutting edge opportunity for pain physicians to <sup>21</sup>influence rational evidence-based pain care.<sup>22-26</sup> A scoping review characterized 21 publications where PROMIS measures were used in the perioperative setting.<sup>21</sup> The authors applauded the utility of PROMIS measures to provide standardized, accurate and efficiently captured patient constructs. A PROMIS profile instrument (PROMIS 29- a non-computer adaptive profile) was used in an interdisciplinary opioid reduction program in patients preparing to undergo spine surgery where significant benefits in pain interference occurred throughout the perioperative period.<sup>27</sup>

Additionally, when compared to measures such as WHODAS and EQ5D, PROMIS has displayed similar performance in numerous populations.<sup>28,29</sup> Numerous PROMIS item banks (e.g. Pain Interference, Depression, Sleep Disturbance, etc.) have also shown to be equivalent if not superior compared to reference legacy instruments (e.g. Brief Pain Inventory, Center for Epidemiological Studies Depression Scale, Pittsburgh Sleep Quality Index). PROMIS measures, indexed over a 7-day period, provide the opportunity to assess the impact of ERP interventions and also the ability to act upon biopsychosocial variables that affect recovery in the immediate and sub-acute post discharge phases. Such frequent assessment would allow for construction of expected recovery trajectories where early intervention may further enhance function. PROMIS allows for users to tailor domain measures based on what health status measures they wish to assess. (Table 6) This allows for a tailored approach in a condition specific manner unlike generic measures (e.g. SF-36, EQ5D). While a good prospect for any

PRO program, future work is needed to further establish the utility of PROMIS measures in surgical population with or without an ERP.

## EQ-5D

The EuroQol 5 dimension questionnaire (EQ-5D) is one of the mostly commonly used generic questionnaires to measure health related quality of life.<sup>30</sup> The questionnaire covers five domains: 1. mobility, 2. self-care, 3. usual activities, 4. pain/discomfort, and 5. anxiety/depression. A patient grades their level of disability on a three-grade scale: severe, moderate or none. The EQ-5D-5L asks the same questions but with a 5-point scale instead of a 3-point scale. Conceptually, the EQ-5D was created with a holistic view of health, which is comprised of medical, physical independence, emotional and social functioning components. The questionnaire includes both positive (well-being) and negative (illness) questions. The EQ-5D combines both a questionnaire and a visual analog scale – EQ-VAS. The EQ-5D asks patients to rate their health status "today."

The EQ-5D is used in the National Health System (NHS) in England for assessment of patient outcomes after specific surgical procedures.<sup>31</sup> The NHS has been collecting EQ-5D information since 2009, and this represents an effort to measure patient-reported health in several ways. Between April and June 2016, an increase in general health was recorded for 49% of patients after groin hernia surgery and 47% of patients after varicose vein surgery as measured using the EQ-5D index.<sup>32</sup> The National Joint Registry offers one model for the use of PROMs in comparative effectiveness research.

EQ-5D score was higher at 6 months for unicompartmental knee arthroplasty (UKA) compared to total knee arthroplasty (TKA). UKA patients (n=3519) were more likely to achieve excellent results and be highly satisfied compared to TKA patients (n=10557). These authors concluded that the high revision rate of UKA may not be because of poorer clinical outcome.<sup>33</sup>

Overall, the EQ-5D is a widely used instrument internationally to assess numerous quality indices. However, some studies suggest that EQ-5D has limited content validity, construct validity and responsiveness in the context of surgical recovery.<sup>34</sup> This instrument is not very discriminative and has a significant ceiling effect when used after surgery, particularly with abdominal and thoracic surgery.<sup>35,36</sup> Future work in the perioperative and ERP arena must also focus on its use to provide actionable outcomes to enhance recovery instead of its sole use at remote time point distant from surgical intervention.

### *Short Form – 36 Health Survey*

The Short Form – 36 Health Survey (SF-36) was created in 1992 by the Medical Outcomes Study as part of the RAND Corporation.<sup>37</sup> The SF-36 was designed for use in clinical practice, research, health policy evaluations and general population surveys. SF-36 was built on the premise that good medical care should result in a more "effective life" and preserve function and well being. SF-36 can be self-administered, collected via telephone or in-person interview. One potential critique of the SF-36 is that it was

designed for use in medical populations; however, there are studies contributing evidence for the measurement properties of the SF-36 in surgical populations.<sup>38</sup>

The SF-36 contains 8 health concepts: 1. Limitation of physical activities – health problems, 2. Limitation of social activities - physiological/emotional, 3. Limitation – usual role activities – physical health problems, 4. Bodily pain, 5. General mental health, 6. Limitation – usual role activities/emotional problems, 7. Vitality (energy/fatigue) and 8. General health perceptions. The SF-36 has been employed in thousands of studies, undergone hundreds of separate validations, and translated into more than 50 languages/cultures. The SF-36 contains items that are queried over various timeframes such as “compared to one year ago,” “on a typical day,” and “during the last 4 weeks.” Several studies have made use of the SF-36 in surgical patients where it was commonly administered at remote time points, such as 30 days postoperatively and beyond.<sup>39-41</sup> In one example, the SF-36 did not find differences in patients who had open versus laparoscopic abdominal surgery.<sup>38,42</sup> While this may relate to the validity of the SF-36 in ERPs, it suggests that measurement during the immediate post discharge phase throughout standard surgical follow up appointments (e.g. 30 days) is possibly needed to detect possible opportunities for further enhancement of recovery.

### Short Form 12 and Short Form 1 Health Survey

The Short Form 12 (SF-12) and Short Form (SF-1) are both derivatives of the SF-36 that have been used in clinical practice to assess health related quality of life. The SF-

12 questionnaire has been developed to calculate and reproduce the physical component score and mental component score of the SF-36.<sup>43</sup> The SF-12 has been validated in the general population, and patients following myocardial infarction, stroke, and on dialysis.<sup>43-46</sup> The SF-12 has been used for surgical patients undergoing spine, renal and major surgery.<sup>47-49</sup>

The SF-1 utilized the first question of the SF-36 to assess patients HRQOL: "In general, would you say your health is: Excellent, Very Good, Good, Fair or Poor?"(Gill) The SF1 has been used as a general indicator of self-reported wellbeing, an indicator for future health care use and mortality, and is in the Australian Health Survey.<sup>50-52</sup> Although the SF1 is straightforward in its utility, it does not evaluate the mental, physical or social domains of a patient's quality of life.

### *EORTC QLQ- C30*

The European Organization for Research and Treatment of Cancer, QoL C30 (EORTC QLQ-C30) consists of 9 multi item scales.<sup>53</sup> The EORTC-QLQ-C30 is currently used in all major oncology trials in Europe as a measure of quality of life. The survey incorporate 5 functional scales (physical, role, cognitive, emotional, social), 3 symptom scales (fatigue, pain and nausea/vomiting), global health and a quality of life scale. The average time to perform the EORTC QLQ-C30 is 11 minutes. A number of symptoms that are commonly reported by cancer patients, e.g. dyspnea, loss of appetite, insomnia, constipation, and diarrhea, are included in the survey. The survey also

inquires about the financial impact of the disease. The EORTC-QLQ-C30 was found to contain a high number of meaningful measures of recovery.<sup>34</sup>

### *Other instruments*

There are many other instruments that can be used to measure patient reported outcomes after surgery. These include the Postoperative Recovery Index (PORI)<sup>54</sup> and the Gastrointestinal Quality of Life Index (GIQLI)<sup>55</sup> as examples. The PORI is a quality of recovery scoring system that is self-reported and multi-dimensional. This measure has applicability across various surgeries and surgical settings, from immediately post-surgery throughout discharge and covering the first 30 days of recovery. The GIQLI was an instrument designed to measure quality of life specifically for patients with gastrointestinal disease.

## Supplemental References

1. Delaney CP, Zutshi M, Senagore AJ, Remzi FH, Hammel J, Fazio VW. Prospective, randomized, controlled trial between a pathway of controlled rehabilitation with early ambulation and diet and traditional postoperative care after laparotomy and intestinal resection. *Diseases of the colon and rectum*. 2003;46(7):851-859.
2. Jones C, Kelliher L, Dickinson M, et al. Randomized clinical trial on enhanced recovery versus standard care following open liver resection. *The British journal of surgery*. 2013;100(8):1015-1024.
3. Kim JW, Kim WS, Cheong JH, Hyung WJ, Choi SH, Noh SH. Safety and efficacy of fast-track surgery in laparoscopic distal gastrectomy for gastric cancer: a randomized clinical trial. *World journal of surgery*. 2012;36(12):2879-2887.
4. King PM, Blazeby JM, Ewings P, et al. The influence of an enhanced recovery programme on clinical outcomes, costs and quality of life after surgery for colorectal cancer. *Colorectal disease : the official journal of the Association of Coloproctology of Great Britain and Ireland*. 2006;8(6):506-513.
5. Larsen K, Sorensen OG, Hansen TB, Thomsen PB, Soballe K. Accelerated perioperative care and rehabilitation intervention for hip and knee replacement is effective: a randomized clinical trial involving 87 patients with 3 months of follow-up. *Acta Orthop*. 2008;79(2):149-159.
6. Larsen K, Hansen TB, Soballe K, Kehlet H. Patient-reported outcome after fast-track hip arthroplasty: a prospective cohort study. *Health and quality of life outcomes*. 2010;8:144.
7. Larsen K, Hansen TB, Soballe K, Kehlet H. Patient-reported outcome after fast-track knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc*. 2012;20(6):1128-1135.
8. Lemanu DP, Singh PP, Berridge K, et al. Randomized clinical trial of enhanced recovery versus standard care after laparoscopic sleeve gastrectomy. *The British journal of surgery*. 2013;100(4):482-489.
9. Recart A, Duchene D, White P, Thomas T, Johnson DB, Cadeddu JA. Efficacy and Safety of Fast Track Recovery Strategy for Patients Undergoing Laparoscopic Nephrectomy. *J of Endourology*. 2005;19(10):1165-1169.
10. Shida D, Wakamatsu K, Tanaka Y, et al. The postoperative patient-reported quality of recovery in colorectal cancer patients under enhanced recovery after surgery using QoR-40. *BMC cancer*. 2015;15:799.
11. Vlug MS, Wind J, Hollmann MW, et al. Laparoscopy in combination with fast track multimodal management is the best perioperative strategy in patients undergoing colonic surgery: a randomized clinical trial (LAFAs-study). *Annals of surgery*. 2011;254(6):868-875.
12. Wang D, Kong Y, Zhong B, Zhou X, Zhou Y. Fast-track surgery improves postoperative recovery in patients with gastric cancer: a randomized comparison with conventional postoperative care. *Journal of gastrointestinal surgery : official journal of the Society for Surgery of the Alimentary Tract*. 2010;14(4):620-627.
13. Wang H, Zhu D, Liang L, et al. Short-term quality of life in patients undergoing colonic surgery using enhanced recovery after surgery program versus conventional perioperative management. *Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation*. 2015;24(11):2663-2670.
14. Myles PS, Hunt JO, Nightingale CE, et al. Development and psychometric testing of a quality of recovery score after general anesthesia and surgery in adults. *Anesthesia and analgesia*. 1999;88(1):83-90.
15. Myles PS, Weitkamp B, Jones K, Melick J, Hensen S. Validity and reliability of a postoperative quality of recovery score: the QoR-40. *British journal of anaesthesia*. 2000;84(1):11-15.

16. Stark PA, Myles PS, Burke JA. Development and psychometric evaluation of a postoperative quality of recovery score: the QoR-15. *Anesthesiology*. 2013;118(6):1332-1340.
17. Garin O, Ayuso-Mateos JL, Almansa J, et al. Validation of the "World Health Organization Disability Assessment Schedule, WHODAS-2" in patients with chronic diseases. *Health and quality of life outcomes*. 2010;8:51.
18. Shulman M, Myles P. Measuring perioperative outcome. *Current opinion in anaesthesiology*. 2016;29(6):733-738.
19. Shulman MA, Myles PS, Chan MT, McIlroy DR, Wallace S, Ponsford J. Measurement of disability-free survival after surgery. *Anesthesiology*. 2015;122(3):524-536.
20. Fries JF, Bruce B, Cella D. The promise of PROMIS: using item response theory to improve assessment of patient-reported outcomes. *Clinical and experimental rheumatology*. 2005;23(5 Suppl 39):S53-57.
21. Jones RS, Stukenborg GJ. Patient-Reported Outcomes Measurement Information System (PROMIS) Use in Surgical Care: A Scoping Study. *Journal of the American College of Surgeons*. 2017;224(3):245-254 e241.
22. Dean DM, Ho BS, Lin A, et al. Predictors of Patient-Reported Function and Pain Outcomes in Operative Ankle Fractures. *Foot Ankle Int*. 2017;38(5):496-501.
23. Hedrick TL, Harrigan AM, Thiele RH, Friel CM, Kozower BD, Stukenborg GJ. A pilot study of patient-centered outcome assessment using PROMIS for patients undergoing colorectal surgery. *Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer*. 2017.
24. Makhni EC, Meadows M, Hamamoto JT, Higgins JD, Romeo AA, Verma NN. Patient Reported Outcomes Measurement Information System (PROMIS) in the upper extremity: the future of outcomes reporting? *Journal of shoulder and elbow surgery*. 2017;26(2):352-357.
25. Ozkan S, Zale EL, Ring D, Vranceanu AM. Associations Between Pain Catastrophizing and Cognitive Fusion in Relation to Pain and Upper Extremity Function Among Hand and Upper Extremity Surgery Patients. *Annals of behavioral medicine : a publication of the Society of Behavioral Medicine*. 2017.
26. Perez JL, Mosher ZA, Watson SL, et al. Readability of Orthopaedic Patient-reported Outcome Measures: Is There a Fundamental Failure to Communicate? *Clinical orthopaedics and related research*. 2017.
27. Hassamal S, Haglund M, Wittnebel K, Danovitch I. A preoperative interdisciplinary biopsychosocial opioid reduction program in patients on chronic opioid analgesia prior to spine surgery: A preliminary report and case series. *Scan J Pain*. 2016;13:27-31.
28. IsHak WW, Pan D, Steiner AJ, et al. Patient-Reported Outcomes of Quality of Life, Functioning, and GI/Psychiatric Symptom Severity in Patients with Inflammatory Bowel Disease (IBD). *Inflammatory bowel diseases*. 2017;23(5):798-803.
29. Oak SR, Strnad GJ, Bena J, et al. Responsiveness Comparison of the EQ-5D, PROMIS Global Health, and VR-12 Questionnaires in Knee Arthroscopy. *Orthopaedic journal of sports medicine*. 2016;4(12):2325967116674714.
30. Rabin R, de Charro F. EQ-5D: a measure of health status from the EuroQol Group. *Annals of medicine*. 2001;33(5):337-343.
31. Devlin NJ, Parkin D, Browne J. Patient-reported outcome measures in the NHS: new methods for analysing and reporting EQ-5D data. *Health economics*. 2010;19(8):886-905.
32. NHS Digital. Provisional Quarterly Patient Reported Outcome Measures (PROMs) in England – April 2016 to June 2016. 2016; <http://content.digital.nhs.uk/catalogue/PUB22173>. Accessed April 21, 2017.

33. Liddle AD, Pandit H, Judge A, Murray DW. Patient-reported outcomes after total and unicompartmental knee arthroplasty: a study of 14,076 matched patients from the National Joint Registry for England and Wales. *The bone & joint journal*. 2015;97-b(6):793-801.
34. Lee L, Dumitra T, Fiore JF, Jr., Mayo NE, Feldman LS. How well are we measuring postoperative "recovery" after abdominal surgery? *Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation*. 2015;24(11):2583-2590.
35. Bejjani J, Fiore JF, Jr., Lee L, et al. Validity of the EuroQol-5 dimensions as a measure of recovery after pulmonary resection. *The Journal of surgical research*. 2015;194(1):281-288.
36. Lee L, Mata J, Augustin BR, et al. A comparison of the validity of two indirect utility instruments as measures of postoperative recovery. *The Journal of surgical research*. 2014;190(1):79-86.
37. Ware JE, Jr., Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Medical care*. 1992;30(6):473-483.
38. Antonescu I, Carli F, Mayo NE, Feldman LS. Validation of the SF-36 as a measure of postoperative recovery after colorectal surgery. *Surgical endoscopy*. 2014;28(11):3168-3178.
39. Busija L, Osborne RH, Nilsson A, Buchbinder R, Roos EM. Magnitude and meaningfulness of change in SF-36 scores in four types of orthopedic surgery. *Health and quality of life outcomes*. 2008;6:55.
40. Grevitt M, Khazim R, Webb J, Mulholland R, Shepperd J. The Short Form-36 Health Survey Questionnaire In Spine Surgery. *J Bone Joint Surg [Br]*. 1997;79-B:48-32.
41. Strain GW, Kolotkin RL, Dakin GF, et al. The effects of weight loss after bariatric surgery on health-related quality of life and depression. *Nutr Diabetes*. 2014;4:e132.
42. Kennedy RH, Francis EA, Wharton R, et al. Multicenter randomized controlled trial of conventional versus laparoscopic surgery for colorectal cancer within an enhanced recovery programme: EnROL. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology*. 2014;32(17):1804-1811.
43. Ware J, Jr., Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Medical care*. 1996;34(3):220-233.
44. Loosman WL, Hoekstra T, van Dijk S, et al. Short-Form 12 or Short-Form 36 to measure quality-of-life changes in dialysis patients? *Nephrol Dial Transplant*. 2015;30(7):1170-1176.
45. Muller-Nordhorn J, Roll S, Willich SN. Comparison of the short form (SF)-12 health status instrument with the SF-36 in patients with coronary heart disease. *Heart (British Cardiac Society)*. 2004;90(5):523-527.
46. Pickard AS, Johnson JA, Penn A, Lau F, Noseworthy T. Replicability of SF-36 summary scores by the SF-12 in stroke patients. *Stroke*. 1999;30(6):1213-1217.
47. Chotai S, Parker SL, Sivaganesan A, Godil SS, McGirt MJ, Devin CJ. Quality of Life and General Health After Elective Surgery for Cervical Spine Pathologies: Determining a Valid and Responsive Metric of Health State Utility. *Neurosurgery*. 2015;77(4):553-560; discussion 560.
48. Kim SB, Williams SB, Cheng SC, Sanda MG, Wagner AA. Evaluation of patient-reported quality-of-life outcomes after renal surgery. *Urology*. 2012;79(6):1268-1273.
49. Maillard J, Elia N, Haller CS, Delhumeau C, Walder B. Preoperative and early postoperative quality of life after major surgery - a prospective observational study. *Health and quality of life outcomes*. 2015;13:12.
50. McCallum J, Shadbolt B, Wang D. Self-rated health and survival: a 7-year follow-up study of Australian elderly. *American Journal of Public Health*. 1994;84(7):1100-1105.

51. Australian Bureau of Statistics. Characteristics of people reported good or better health 2001. In: Australian Bureau of Statistics, ed. Canberra 2004.
52. Australian Bureau of Statistics. National Health Survey 2007-08: Summary of Results. In: Australian Bureau of Statistics. Canberra 2009.
53. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *Journal of the National Cancer Institute*. 1993;85(5):365-376.
54. Butler SF, Black RA, Techner L, et al. Development and Validation of the Post-Operative Recovery Index for Measuring Quality of Recovery after Surgery. *Journal of Anesthesia & Clinical Research*. 2012;03(12).
55. Eypasch E, Williams JI, Wood-Dauphinee S, et al. Gastrointestinal Quality of Life Index: development, validation and application of a new instrument. *The British journal of surgery*. 1995;82(2):216-222.