Implementation of Vulnerable Elders Survey-13 Frailty Tool to Identify At-Risk Geriatric Surgical Patients

Tedrick L. Vernon III, DNP, CRNA, Andi N. Rice, DNP, CRNA, J. Frank Titch, DNP, CRNA, Brandyce F. Hill, MSN, CRNA, Virginia C. Muckler, DNP, CRNA, CHSE

Purpose: *The primary purpose of this project was to preoperatively identify frail and vulnerable geriatric patients aged 65 or older using the Vulnerable Elders Survey (VES-13) tool, and to use those scores to assist with perioperative decision-making.*

Design: *This feasibility study was implemented as a quality improvement initiative with a postimplementation group only.*

Methods: *The VES-13 was introduced to the perioperative nursing staff and anesthesia providers and then added to the traditional preoperative assessment. The VES-13 scores were correlated to hospital length of stay, postanesthesia care unit stay, altered mental status, and morbidity.*

Findings: *Increased identification of older adult surgical patients at risk for increased length of stay, altered mental status, and morbidity in the preoperative setting was not evident, although the VES-13 was effective in identifying functional deficits in the older adult surgical patient.*

Conclusions: *A detailed and comprehensive preoperative assessment remains the most efficient way to identify frail geriatric surgical patients.*

Keywords: *geriatric, perioperative, anesthesia, frailty, Vulnerable Elders Survey, VES-13.*
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FRAILTY IS A STATE of decreased reserve that presents as dysregulation of multiple metabolic systems and molecular pathways.[1] It is not only a

Tedrick L. Vernon III, DNP, CRNA, Nurse Anesthesia Department, WakeMed Raleigh, Raleigh, NC; Andi N. Rice, DNP, CRNA, Duke University Nurse Anesthesia Program, Duke University School of Nursing, Durham, NC; J. Frank Titch, DNP, CRNA, Duke University Nurse Anesthesia Program, Duke University School of Nursing, Durham, NC; Brandyce F. Hill, MSN, CRNA, Nurse Anesthesia Department, Nash General Hospital, Rocky Mount, NC; and Virginia C. Muckler, DNP, CRNA, CHSE, Duke University Nurse Anesthesia Program, Duke University School of Nursing, Durham, NC.

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Address correspondence to Virginia C. Muckler, Duke University Nurse Anesthesia Program, 307 Trent Drive, DUMC 3322, Durham, NC 27710; e-mail address: cscrna71@aol.com.

composite of physiological capacity and functional ability, but also an independent predictor of adverse health outcomes. The physiological decline associated with aging affects all organ systems at a rate of 1% per year after the age of 40.[2] This decline in physiological reserve weakens the normal response to stressors, acute illness, anesthesia, and surgery.[2] As the fastest growing population in the United States, with an expectation to increase to 89 million by 2050,[3] geriatric needs for surgical services will also increase.[3] The most recent National Hospital Ambulatory Medical Care Survey reported that there were 28.6 million ambulatory surgery visits in the United States in 2010, of which 19% of procedures were performed on those aged 65 to 74, and 14% performed on those aged 75 and older.[4] Anesthesia associated with these surgeries can precipitate the dysregulation of geriatric physiology.

This project aimed to identify frail and vulnerable geriatric patients using the Vulnerable Elders Survey (VES-13) tool (Appendix A) and correlate their scores to the incidence of postoperative complications. The prevalence of frailty among geriatric patients makes recognition particularly important in the perioperative setting.[1] Identification of at-risk geriatric patients is important in determining the appropriate operative risk and management.[5] In frail patients, the traditional preoperative assessment and physical examination may not always provide the information necessary for an optimal anesthesia plan, which can lead to inadequate or excessive treatment.[6] Specific strategies are vital to accommodate the growing surgical needs of geriatric patients and to promote higher quality of care.[5]

Literature Review

Frailty has increasingly become a topic of interest as it has been correlated to the incidence of postoperative complications across surgical specialties in the geriatric population.[7] Consequently, frailty markers represent a promising method of assessment with the potential to aid clinicians in decision-making and risk-factor modification.[1] The VES-13 is a function-based frailty screening tool that can be completed within 5 minutes by medical or nonmedical personnel, in person or over the phone.[8] Older adults with a composite score of 3 or greater have 4.2 times the odds of functional decline or death over the next 2 years when compared with those with a composite score of 2 or less.[6]

Although created with the intention of being a long-term prognosticator, the VES-13 has been shown to be useful in ambulatory and acute settings because of its concise nature. Results with VES-13 have been found to be comparable to the Comprehensive Geriatric Assessment (CGA), a multidisciplinary assessment performed by a geriatrician that examines somatic, functional, and psychosocial domains.[8] The CGA is considered the gold standard for geriatric assessment, yet is time consuming and requires an experienced geriatrician to conduct the assessment.[8] In a prospective study by Kenig et al[8] to validate the accuracy of the VES-13 in screening for frailty syndrome in geriatric surgical patients, both the VES-13 and CGA were completed in a preoperative setting with 106 geriatric surgical patients. The CGA identified 63 patients (59.4%) as frail and the VES-13 identified 48 patients (45.3%) as frail based on a score of 3 or greater.[8] Kenig et al[8] validated that the CGA remains the gold standard for geriatric assessment. However, the VES-13 is a valuable tool in identifying frail patients, especially in busy clinical practices that do not have trained geriatricians or the time required to conduct the CGA.

Advanced age is associated with multiple comorbidities and health deterioration, both of which can lead to health care consumption. The VES-13 allows a broader assessment of older adults and identification of vulnerable elders, which may guide further preoperative interventions that optimize the older adult for surgery. The VES-13 also serves as a predictive tool of mortality and aids in decision-making for various interventions such as preventive services or cancer screening, all of which aim to improve outcomes.[6] Min et al[6] conducted a 5-year longitudinal study to test the VES-13 predictive properties.[6] These investigators recruited 508 geriatric patients aged 75 years and older from two major ambulatory centers. The VES-13 assessment was performed via phone or by proxy if the patients were unable to answer questions.[6] Five years after the initial assessment, the same patients were contacted for a second telephone interview and VES-13 assessment. The mean baseline score for those who, by the second phone interview and assessment, had died, experienced health decline, and survived without health decline were 6.0, 4.8, and 3.1, respectively.[6] The VES-13 score consistently predicted poor outcomes with linear scores related to the odds of death and functional decline, conceivably making it a helpful tool in clinical decision-making for older adults.[6]

The geriatric patient is twice as likely to die from a traumatic injury when compared with younger patients who sustain an injury of similar severity.[9] A prospective observational study by Min et al[9] examined preinjury functional status as an indicator for complications and mortality among geriatric trauma patients. Each point on the VES-13 increased the odds of a complication by 1.53.[9] Although none of the values were statistically significant, Min et al[9] found a correlation with higher VES-13 scores linked to longer hospital length of stay (LOS) and poorer discharge status. Poorer

discharge status meant patients were either discharged to a higher acuity facility from which they were admitted, or they were unexpectedly admitted to the hospital. Despite the small sample size, 21 of the 64 older persons sampled had a mean VES-13 score of 3.7 and experienced perioperative complications, which demonstrates positive predictive value of the tool.[9]

Purpose

The primary purpose of this project was to identify frail and vulnerable geriatric patients using the VES-13 tool to assist decision-making in perioperative anesthesia care. The specific aims were as follows:

1. Assess the feasibility of implementation of the VES-13 tool in the preoperative clinic as part of the preoperative geriatric assessment.
2. Identify geriatric patients as *nonfrail* (no risk; VES-13 score 0 to 3), *frail* (at risk for postoperative complications; VES-13 score 3 to 6), or *severe frailty risk* (VES-13 score 7 to 10).
3. Correlate the specific frailty groups to the incidence of increased LOS, altered mental status, and poorer discharge status.
4. Assess perceived usefulness of the VES-13 to the preoperative nursing staff and anesthesia team via a Likert scale survey postimplementation.

Design

This was a quality improvement (QI) initiative designed to identify frail and vulnerable geriatric patients at a community hospital in the southeast United States by adding the VES-13 to the anesthesia preoperative interview (API). The project included a postimplementation group only. Outcome measures included (1) the number of anesthesiology consults prompted by a VES-13 score of 3 or greater, (2) the incidence of increased LOS, (3) altered mental status, and (4) poorer discharge status. An increase in the number of anesthesiology consults triggered by the VES-13 indicated heightened awareness of the population when indicated. Tracking the number of anesthesiology consults also provided insight into the feasibility of implementation into workflow as the

number of consults is compared with the number of anesthesia providers available per day to provide consults, taking into consideration the caseload for each day. Poorer discharge status was determined if the patient was discharged to a higher acuity facility from which they were admitted, or they were unexpectedly admitted to the hospital.

Methods

Patient Population and Setting

This QI project involved a convenience sample of patients, aged 65 years and older, undergoing general or regional anesthesia (spinal) over a 3-month period. Patients excluded were those who did not speak English, received moderate sedation, or presented for cataract surgery. Demographic data including the American Society of Anesthesiologists physical status and gender (Table 1) were collected.

This project was implemented in the preoperative clinic of a 282-bed community hospital where approximately 150 surgeries per month are performed on geriatric patients receiving general or spinal anesthesia. The hospital has 13 operating rooms, a preoperative clinic staffed by 12 registered nurses, and a 10-bed postanesthesia care unit (PACU). Nurses in the preoperative clinic conduct APIs and assessments in person and over the phone. The anesthesia team included 11 full-time certified registered nurse anesthetists (CRNAs), 15 CRNAs on a pro re nata or as needed basis, two CRNAs contracted as locum employees, and four anesthesiologists.

Evidence-Based Innovation

The VES-13 is a simple, functional-based frailty assessment screening tool created by a panel of geriatric experts who identified prevalent medical conditions among older adults that contribute to morbidity, mortality, and functional decline.[10] Care quality indicators were developed for each condition, translated into a data collection instrument, and used to assess at-risk geriatrics in various settings.[10] All the surveys and tools from RAND Health are public documents, available without charge.[10] No further permissions were necessary. The VES-13 was not integrated into the electronic

Table 1. Patient Demographic Information

Patient ASA Status		Gender	
ASA 2	22.9% (11)	Male	35.4% (17)
ASA 3	72.9% (35)	Female	64.6% (31)
ASA 4	4.2% (2)		

ASA, American Society of Anesthesiologists.

medical record (EMR) during this project because of time constraints and financial resources.

Preoperative nurses assessed mental status before surgery using the Aldrete scoring system. Postoperative nurses assessed patients on arrival to the PACU and on discharge using the same assessment tool. For this QI project, altered mental status was defined as a decrease in postoperative mental status when compared with preoperative mental status according to the quantitative Aldrete scores. The PACU assessment checklist (Appendix B) was a project-specific tool created for frontline users to document project outcome measures. Increased LOS was noted if the patient required invasive or noninvasive positive pressure ventilation in the PACU, greater than average LOS in minutes and hours where geometric LOS is 65 minutes and site-specific LOS is 62.4 minutes, and if the patient required an unanticipated hospital stay.

The Likert scale survey used to assess usability and ease of use of the VES-13 was adopted from the technology assessment module (TAM) and the system usability scale (SUS) for this project, and was not previously tested in this particular setting. The TAM and SUS were founded on the theory that to better predict, understand, and increase end-user acceptance we must understand why people accept or reject newly introduced technologies.[11] It was developed by a research team from the University of Michigan's School of Business Administration with the intention to predict acceptance of newly introduced computer technology.[11] The questions have been modified to accommodate the VES-13. Both the TAM and SUS are free sources to use with proper citation.[11] The survey questions were applicable to this project as one of the measures was feasibility of implementation as it was essential that the VES-13 merge seamlessly into the current workflow. The team

wanted to assess staff perceptions regarding the newly implemented VES-13 and to what degree integration of the tool into the preoperative interview was smooth or difficult as frontline user perceptions can significantly impact the sustainability of new projects.

Implementation

Ethical considerations included formal evaluation using an internal checklist created by the Institutional Review Board and school of nursing that determined the project to be QI rather than human subject's research; therefore, this project did not require Institutional Review Board approval. The VES-13 and PACU assessment checklist were introduced during the preoperative clinic staff meeting and anesthesia care team meeting. The presentation detailed the VES-13, its benefits, proper usage, supporting literature, inclusion criteria, and project logistics. Staff members who did not attend their respective meetings were educated on an individual basis until 100% of staff were educated in preparation for project implementation. After frontline user education, the VES-13 was integrated as part of the routine anesthesia preoperative assessment for all patients who met inclusion criteria. The VES-13 was distributed in the preoperative clinic and the paper copy remained with the patient's chart throughout the perioperative process until the time of discharge from the PACU, or admission to the floor. After discharge, the forms were stored in a secured location behind the nursing station until they could be collected for data analysis.

Each copy of the VES-13 had three corresponding stickers with patient identification numbers assigned based on chronological order. At the time of assessment, the nurse placed one sticker on the VES-13, one on the patient chart and one on the master operating room schedule next to the patient's name to flag the patient and ensure that every patient who met inclusion criteria was assessed. All remarkable findings, including a score of 3 or higher, were documented on the VES-13 and the anesthesiologist on call was notified. The anesthesiologist on call used the information obtained from the VES-13 to aid in further clinical decisions regarding the patient's care. Charts in the PACU with a patient identification number prompted the PACU nurse to complete the PACU

assessment checklist (Appendix B) before patient discharge. All patients admitted to the hospital were followed postoperatively for 3 days and then reassessed for altered mental status, increased LOS, and discharge status.

After completion of data collection, all members of the anesthesia department and preoperative clinic received a postimplementation survey assessing ease of use and usefulness of the VES-13. The surveys were voluntary and submitted anonymously via an online-based survey forum to encourage honest and open dialogue.

Data Analysis

Descriptive statistics (n, %) were calculated to summarize demographic data (Table 1). The feasibility of implementation of the VES-13 tool in the preoperative clinic as part of the preoperative geriatric assessment was assessed at postimplementation with descriptive statistics (n, %). The number of patients eligible for VES-13 assessment was compared with the number of patients assessed with the VES-13 within same time frame.

To identify geriatric patients as nonfrail (no risk; VES-13 score 0 to 2), frail (at risk for postoperative complications; VES-13 score 3 to 6), or severe frailty risk (VES-13 score 7 to 10), descriptive statistics (n, %) were conducted. Nonparametric tests for the three risk categories were completed and associated with whether an anesthesiology consult occurred using likelihood ratio (LR) χ^2 tests with Bonferroni adjusted pairwise comparisons. The percentage of patients with a score of 3 or greater on the VES-13 that prompted a consult was calculated and is presented in Figure 1.

To examine whether increase in LOS (coded as Yes or No) was associated with risk group, an LR χ^2 test with Bonferroni adjusted pairwise comparisons was conducted. Altered mental status and discharge status of the aggregated risk groups were compared using two separate LR χ^2 tests with Bonferroni adjusted pairwise comparisons. To assess perceived usefulness and ease of use of the VES-13, descriptive statistics (means, SDs) were conducted on each item of the surveys. Data analysis was conducted using IBM SPSS version 24.

Findings

A total of 103 patients completed the VES-13 survey. Of those, 48 (46.6%) were linked to a PACU assessment form and were acceptable for data analysis. The remaining 55 patients' data could not be linked to a name for purposes of chart review because of a frontline user error and were discarded because of ineligibility. The original project goal was to collect data on 50 patients, yet due to time constraints, the committee deemed a sample size of 48 to be acceptable because of the QI nature of the project.

Demographics

For the 48 patients, the mean age was 74.19 years (SD = 6.38) and consisted of mostly female patients (n = 31, 64.6%). Most had an American Society of Anesthesiologists score of 3 (n = 35, 72.9) and the average length of PACU stay was 1.60 days (SD = 0.74).

Risk Category

Of the 48 patients included in data analysis, 16 (33%) were considered no risk (VES-13 score < 3), 19 (40%) were considered at risk (VES-13 score 3 to 6), and 13 (27%) were considered severe risk (VES-13 score ≥7). On the basis of their risk category, the percentage of patients that properly received an anesthesiologist consult was statistically significant, χ^2 (N = 48, 2) = 43.64, $P < .001$.

There was no association between risk category and incidence of increased LOS, LR χ^2 (N = 48, 2) = 1.73, $P = .421$. The no risk, at risk, and severe risk category patient percentages with an increased LOS were 18.8%, 5.3%, and 15.4%, respectively. The incidence of altered mental status was not associated with risk category as the preoperative VES-13 score identified the patient as no risk for frailty. Risk category was not associated with poorer discharge condition, LR χ^2 (N = 48, 2) = 1.06, $P = .589$. The no risk, at risk, and severe risk groups' incidence of poorer discharge condition was 6.3%, 5.3%, and 15.4%, respectively.

Usefulness and Ease of Use

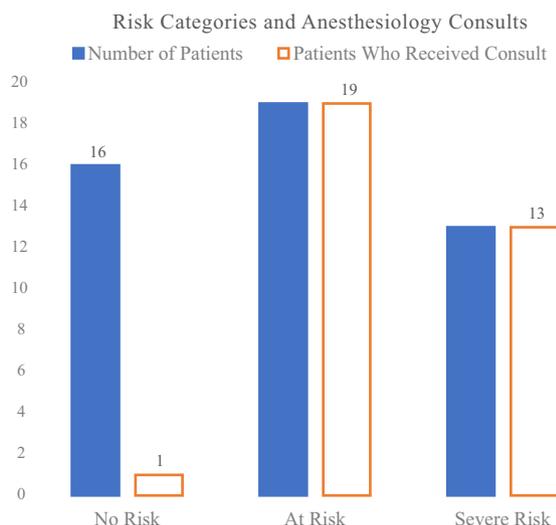After data collection, a 20-item Likert scale survey was disseminated among staff to assess

Risk Categories and Anesthesiology Consults

Figure 1. Risk categories and anesthesiology consults. This figure is available in color online at www.jopan.org.

VES-13 perceived usefulness and ease of use. Users (n = 3) did neither indicate the highest score of 5, "strongly agree," for any items when assessing perceived usefulness nor did they indicate the lowest score of 1, "strongly disagree" when assessing ease of use.

Most notably 100% of staff who participated in the survey "somewhat disagreed" that the VES-13 supported critical aspects of their practice. Similarly, 66% of survey participants "somewhat disagree" that overall the VES-13 was useful to their job. In assessing the ease of use, 100% of survey participants found the VES-13 easy to use and felt very confident using the tool.

Discussion

Although effective in identifying functional deficits in the older adult surgical patient, the VES-13 showed no benefit in identifying surgical patients at risk for increased LOS, altered mental status, and morbidity in the preoperative setting. Because of the lack of statistical significance or supporting evidence, no practice change was recommended. Forty-eight of 103 surveys were used for data analysis, and the remaining surveys were deemed ineligible. The frontline user error that occurred involved the erroneous shredding of patient docu-

mentation that was needed to identify VES-13 patients. It is possible that user error may not have occurred if the VES-13 had been implemented into an existing EMR. However, incorporation into the EMR was not feasible for this project. Furthermore, the implementation site used a combination of paper and electronic charting, which logistically complicated the adoption of the VES-13. In retrospect, implementation of the VES-13 may have been more optimal after complete transition to the EMR and may have facilitated greater success of the project.

Within the aggregated risk groups, each category of patients appropriately received an anesthesiology consult as indicated per a score of 3 or greater, indicating that this portion of the project was a success as it relates to project feasibility. The interventions prompted by the anesthesiology consults were not documented because they were not a predetermined aim of this project. Anecdotal evidence from on call anesthesiologists indicated that interventions for patients identified as at risk or high risk included reassessments to ensure accuracy, a preoperative conference with the surgeon to verbalize operative risk and expectations, and a standard alert to PACU nursing staff regarding patients at risk or high risk. There were no statistically significant correlations between VES-13 score and LOS, altered mental status, or discharge status. The absence of statistical significance is not an indication of the VES-13 being flawed, but rather, indicative of the timeframe or measures being used. This project was implemented as a feasibility study as the VES-13 had not been used in an acute care setting.

Taking into consideration that there is no true consensus on evaluating frailty in the surgical setting, the VES-13 tool was chosen because of simple and concise nature of the tool. Other common tools available for frailty assessment include the Balducci frailty criteria and the Fried fragility criteria.[12] The Balducci frailty criteria are based on fulfilling certain criteria of the CGA, whereas the Fried fragility criteria identify frailty when a minimum of three of the following are identified: cardiovascular health study tool that takes into consideration unintentional weight loss (10 lbs or greater in the past year), self-reported exhaustion, weakness (grip strength), slow observed

walking speed, or low physical activity based on an algorithm that translates patient-reported activities into kilocalories expended.[12] Our project found that the VES-13 was the best option for our clinical site because of the fast-paced setting, minimal resources, and degree of frailty assessment training and experience staff possessed.

In their article on the training and development of employees, Scott and Jaffe[13] present a theory of the stages of change. They postulate that when faced with an organizational change, adopters are first in denial, then resist change, before deciding to explore, and finally commit to the change. A limitation of this project was the design chosen. Because this was a feasibility study, an implementation science framework would have been helpful, such as reach, effectiveness, adoption, implementation, maintenance (RE-AIM) or "integrated-promoting" action on research implementation in health services (i-PARIHS) framework, to determine barriers and facilitators and more rigorously plan and monitor the implementation. The use of a theory-informed, facilitated implementation process may have improved adherence to the implementation of the VES-13 to assess frailty in the older adults undergoing surgery at our facility.[14] In addition, the prospective application of one of these frameworks would have helped facilitate a multidisciplinary implementation team consisting of stakeholders invested in the project who could help facilitate local adherence in the absence of the facilitator. An additional limitation was the sample size. A priori sample size using G*Power[15] estimated a required sample size of 39 based on the nonparametric χ^2 tests with effect size set to 0.50, power at 0.8, and α set to 0.05. Although the minimum sample size was met, the LR results were interpreted because of the expected cell size violations.[16]

Despite re-education and re-enforcement of project logistics before and throughout the process of data collection, variability in the level of understanding and resistance to change persisted among users. Champions were frontline users that served as site resources and contacts between the project team and other frontline users. Champions were identified at the registration desk, preoperative clinic, and PACU. The project team hosted luncheons periodically throughout various stages of implementation in attempts to build rapport with frontline users. Despite these events, the integration of the VES-13 into the preoperative interview process was an additional task outside the users established workflow, which may have led to decreased participation.

Suggested future frailty assessment projects include the exploration of different assessment methods such as a two-step screening[12] or to compare tools that may be more readily accepted by frontline users. In addition, future projects are needed that compare frailty screening tools among various patient care settings, and those that assist with the individualization of treatment for frail patients and lead to decreased adverse outcomes.

Conclusions

Preoperative assessment remains the foundation of the perioperative process. As the American geriatric population grows, new assessment modalities that address the unique needs of this population will be crucial to ensure safe and efficient care. Heightened vigilance during a detailed and comprehensive preoperative assessment is the fundamental tool to identify at-risk geriatric surgical patients. The use of frailty tools, such as the VES-13 frailty assessment tool, has been shown to improve perioperative care for older adults by identifying higher risk patients and implementing a more proactive than reactive perioperative approach.

Supplementary Data

Supplementary data related to this article can be found at http://doi.org/10.1016/j.jopan.2019.01.004.

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Appendix A

School of Nursing VES-13 Implementation Project

1. Age _____   SCORE: 1 Point for Age 75-84 □
                                          3 Points for AGE 85 ≤ □

2. In general, compared to other people your age would you say that your health is:
   - □   Poor* (1 point)
   - □   Fair* (1 point)
   - □   Good
   - □   Very good
   - □   Excellent

> Patient # _____
>
> Patient total score _____
>
> Did you consult the MDA?
>
> Yes □   No □

3. How much difficulty on **average** do you have with following activities:
   *(1 point for each * response; MAX 2 points)*

		No Difficulty	A Little Difficulty	Some Difficulty	A Lot of Difficulty	Unable to Perform
a.	Stooping, crouching, or kneeling?	□	□	□	□*	□*
b.	Lifting or carrying as heavy as 10 pounds?	□	□	□	□*	□*
c.	Reaching or extending arms above shoulder level?	□	□	□	□*	□*
d.	Writing or handling and grasping small objects?	□	□	□	□*	□*
e.	Walking a quarter of a mile?	□	□	□	□*	□*
f.	Heavy housework such as scrubbing floors or washing window?	□	□	□	□*	□*

4. Because of your health or a physical condition do you have any difficulty:
   *(4 points for one or more * answer)*

   a.   Shopping for personal items (like toilet or medicines)?
   □ YES → Do you get help with shopping?   □ YES*   □ NO
   □ NO
   □ DON'T DO → Is that because of your health?   □ YES*   □ NO

   b.   Managing money (keeping track of expenses or paying bills)?
   □ YES → Do you get help with managing money?   □ YES*   □ NO
   □ NO
   □ DON'T DO → Is that because of your health?   □ YES*   □ NO

   c.   Walking across the room? USE OF CANE OR WALKER IS OK
   □ YES → Do you get help with walking?   □ YES*   □ NO
   □ NO
   □ DON'T DO → Is that because of your health?   □ YES*   □ NO

   d.   Doing light house work (washing dishes, straightening up, light cleaning)?
   □ YES → Do you get help with light housework?   □ YES*   □ NO
   □ NO
   □ DON'T DO → Is that because of your health?   □ YES*   □ NO

   e.   Bathing or showering?
   □ YES → Do you get help with bathing or showering?   □ YES*   □ NO
   □ NO
   □ DON'T DO → Is that because of your health?   □ YES*   □ NO

Appendix B

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VES-13 Project PACU Checklist Assessment

Patient Project ID # _____

Please assess the patient using the template below and place in the "Checklist Assessment Folder" located behind the nursing station. Thank You for your participation.   □

Post-Operative Delirium Assessment	YES	NO
A) Is the Aldrete score 9 or greater?		
B) Per the anesthesia provider report what is the patient's baseline mentation? Alert and Oriented X _____		
C) Is the patient at their baseline mentation?		
D) Has the Anesthesiologist determined the need for further treatment or evaluation of Post-operative delirium?		
Increase Length of Stay Assessment		
A) Did the patient require invasive or non-invasive positive pressure ventilation in the PACU?		
B) What is the patients' PACU length of stay in hours and minutes? _____ hours _____ minutes		
C) Is hospital admission required? D) If so was it anticipated? □ Yes □ No □ N/A		
Poorer Discharge Status		
A) Did the patient come to the hospital for this surgery from his/her from home?		
B) If No, what type of facility did the patient come from (circle one) Rehabilitation Nursing home Assisted living facility		
C) Is the patient being unexpectedly admitted to the hospital?		
D) Is the patient being discharged to the location from which he/she presented on the DOS (home, nursing home, rehabilitation center, etc.)?		