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PROJECT TITLE: The DISCERN (Discovering Innovative Strategies for prevention of delirium in Cardiac surgery patients through Evaluation of peri-operative Risk and Novel biomarkers) Study – Intermediate and long-term follow up of post-operative health-related quality of life and mental health status.

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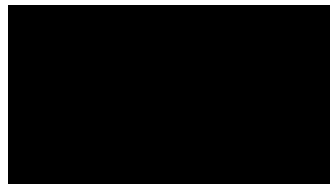
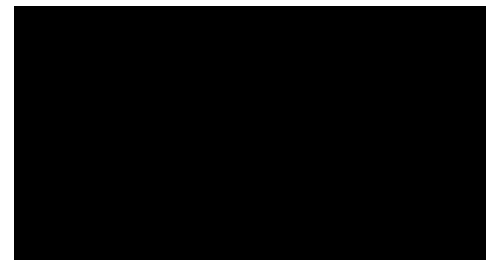
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SUMMARY:

Delirium is an acute form of “brain failure” characterized by fluctuation of attention and cognition. It is the most common neurological complication following cardiac surgery. The incidence of post-operative delirium in surgical patients varies between 10-60%, but can be as high as 73% in the elderly. Our study objectives were: 1) to examine the effect of post-operative delirium on mid- to long-term health-related quality of life (HRQoL) in patients following cardiac surgery, 2) to examine the effect of post-operative delirium on mental health following cardiac surgery and 3) to determine risk factors for each of these conditions.

A prospective observational cohort study was carried out at a tertiary care centre in Winnipeg, Manitoba. Within the study cohort of 197 patients, the rate of post-operative delirium was 21.1% in elective cardiac surgery patients and 30.8% in urgent or emergent patient. Pre-operative predictors of post-operative delirium were higher EuroSCORE II, previous cardiovascular procedure, older age, less than high school education and left ventricular ejection fraction of <35%. Intra-operative predictors of post-operative delirium were increased cardiopulmonary pump time, acute kidney injury, returning to the OR due to post-operative bleeding and new cerebrovascular accident. Delirious patients remained in the ICU almost 4 times longer than non-delirious patients and were hospitalized on average 5 days longer. Patients who suffered from post-operative delirium were 2 times more likely to score below average in the physical health aspect of the SF-12v2 and were nearly 3 times more likely to report having a problem with anxiety or depression.

SIGNATURES:

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INTRODUCTION

Delirium

Delirium is an acute form of “brain failure” characterized by fluctuation of attention and cognition. It is the most common neurological complication following cardiac surgery¹⁻⁴. It is a symptomatic manifestation of acute brain dysfunction during which patients can exhibit behaviour ranging from unresponsive and withdrawn to agitated and combative⁵. Despite landmark studies dating back to the 1940s, the pathogenesis of delirium remains poorly understood⁶. Currently, post-operative delirium is detected using screening tools such as the Confusion Assessment Method (CAM)⁷. The CAM and its ICU variant (CAM-ICU) have been validated to detect delirium as defined in the “Diagnostic Statistical Manual of Psychiatric Disorders” with high specificity and sensitivity^{8,9}. The CAM and CAM-ICU is often used in conjunction with the Richmond Agitation-Sedation Scale (RASS)¹⁰, a scale used to assess a patient’s level of sedation and agitation.

Post-operative delirium in cardiac surgery patients

In recent years, the number of surgeries performed on older patients with more extensive cardiovascular disease have been increasing¹¹. These patients are increasingly frail and have more medical co-morbidities, and thus, are more susceptible to peri-operative and post-operative adverse effects such as post-operative delirium.

In Manitoba, the monthly incidence rate of post-operative delirium ranges between 18%-36% of patients undergoing cardiac surgery between January 2013 to January 2014 (refer to Table 1.) making it the most common neurological complication following cardiac surgery^{4,12}. It has been reported that delirium rates in surgical patients can vary between 10-60%^{1,13,14}, but can be as high as 73%^{1,15} in the elderly, and up to 81% for patients in the intensive care unit (ICU)^{1,16}.

Post-operative delirium is common, with significant associated morbidity and cost¹⁷. Patients with post-operative delirium have increased in-hospital mortality ranging between 4-17%¹⁸. 1-month, 6-month, 12-month, and long-term mortality are also elevated¹⁹⁻²³. Patients with delirium following surgery also face increased post-operative complications such as sepsis³. Post-operative delirium is also associated with prolonged ICU and hospital length of stay^{18,24-26}, higher rates of discharges to a nursing home²⁷, higher hospital costs²⁸, and decrease in health-related quality of life (HRQoL)²⁹.

Health-related quality of life (HRQoL)

Health-related quality of life (HRQoL) is defined as a broad multidimensional concept that usually includes self-reported measures of physical and mental health³⁰. Physical and mental health are not mutually exclusive entities in regards to HRQoL. Impairment in one usually negatively affects the other and thus leads to an overall decrease in quality of life. Long-term HRQoL is an underutilized and often neglected outcome in cardiac surgery patients. It has been reported that the prevalence rate of depression in heart transplant recipients ranges between 9-37%²⁹. Patients with depression show lower physical activity levels and lower adherence to medication intake³¹. Patients with decreased cognitive function immediately after surgery are at an increased risk for long-term cognitive decline³². These factors, combined with other co-morbidities, could decrease the overall long-term survival of cardiac surgery patients.

Impact of post-operative delirium on mid- and long-term health-related quality of life (HRQoL)

Post-operative delirium occur frequently in cardiac surgery patients and carry serious consequences. Therefore, a firm understanding of the potential mid- to long-term harm of post-operative delirium is necessary for appropriate patient selection, decision-making and adequate informed consent. Currently, there is a deficiency in knowledge regarding the mid- to long-term effects (6 months post-procedure) of the occurrence and the duration of post-operative delirium on HRQoL and mental health status. It is imperative that there is a clear understanding on the impact of post-operative delirium on HRQoL and mental health status of this vulnerable group to ensure that these patients not only survive but thrive after cardiac surgery.

This lack of understanding of the mid- and long-term impact of delirium has laid the foundations of our study. Our first objective is to examine the mid- to long-term HRQoL in patients that experienced post-operative delirium following cardiac surgery compared with those who did not suffer from delirium. Secondly, to examine the intermediate to long-term effects of post-operative delirium on mental health in patients following cardiac surgery. Lastly, to determine risk factors for each of these conditions, to help inform future prevention and treatment efforts.

We hypothesize that patients undergoing cardiac surgery that suffer from post-operative delirium are at an increased risk of intermediate to long-term decrease in HRQoL and increased rates of mental health problems (cognition, mood, anxiety or depression) as compared to patients without delirium.

MATERIALS AND METHODS

The study was a prospective observational cohort study that was carried out at St. Boniface Hospital, a tertiary care centre in Winnipeg, Manitoba with a patient catchment area of approximately 1.1 million people. The study was approved by the University of Manitoba Research Ethics Board (REB) and the St. Boniface Hospital Research Review Committee (RRC). Patient recruitment occurred from July 2013 to July 2014.

Inclusion criteria: Patients over the age of 18 and undergoing a cardiac surgery procedure and admitted to the Intensive Care Cardiac Surgery (ICCS) unit were eligible to participate in this study. Exclusion criteria: Patients in whom post-operative delirium could not reliably be identified (e.g., due to previous debilitating stroke, cerebral palsy, severe dementia, severe hearing disabilities or inability to understand English or French, active seizure disorder or Child-Pugh class B or C cirrhosis)^{33–35}.

Various pre-operative, intra-operative and post-operative parameters were collected for consented patient. These data were extracted from the Manitoba Cardiac Surgery (MaCS) Database and the patient's medical records. Pre-operative data included: patient demographics, surgical risk scores (EuroSCORE II), medical history, cardiac risk factors, and cardiac illness severity. Baseline cognition will be assessed using the Montreal Cognitive Assessment (MOCA)^{36,37} for elective patient during their visit to the Cardiac Pre-Operative Assessment Clinic (CPAC). Peri-operative data included: intraoperative anesthesia, cardiopulmonary bypass (CPB) details, return to OR due to bleeding, acute kidney injury, cerebrovascular accident (CVA). Post-operative data includes: ICU and hospital length of stay (LOS), 30-day mortality, and major adverse events (including death, MI, stroke, renal failure requiring dialysis).

Delirium assessments were routinely carried out for all post-operative cardiac surgery patients using the confusion assessment method (CAM)-ICU (at least every 8 hours) while the patients were in ICU. CAM was also carried out (at least every 8 hours) on the in-patient ward by the bedside RN as part of routine practice. The CAM and CAM-ICU both assess four features of delirium: “acute onset or fluctuating course”, “inattention”, “disorganized thinking” and “altered level of consciousness”. A positive diagnosis of “delirium” results from the first two features and either feature 3 or 4. Delirium data were collected from postoperative day 1-10 in either the ICU or in-patient ward. Patients were classified as having a delirious day if delirium was detected in at least one assessment during the 24-hour period of a given postoperative day.

Patients were contacted and consented via telephone 6-9 months following their cardiac surgery. Once determined eligible to participate in our study, patients underwent a 20-25 minute telephone interview using standardized health surveys chosen specifically to assess current physical health and limitations, HRQoL, and mental health status (cognition, anxiety, depression, and substance abuse).

Health related quality of life (HRQoL) was assessed by the administration of the Short Form-12 (SF-12v2)³⁸ and the EuroQoL-5D-5L (EQ-5D-5L)³⁹. Both the SF-12v2 and the EQ-5D are validated measures of HRQoL and were selected for their simplicity and proven clinical relevance^{40–42}. The SF-12v2 asks the patients questions about their view on their current physical and mental health (including pain, energy level, daily activities, depression and anxiety), which were then converted to a numeric value then standardized and compared to an average healthy individual. The patient received a categorical status of: 1) at or above average, 2) below average, 3) well below average. We considered any score that is below average to be significant. The EQ-5D-5L survey comprises of 2 parts. The first part asked the patient whether they are currently having any difficulty with mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Possible replies included 1) no problems, 2) slight problems, 3) moderate problems, 4) severe problems and 5) extreme or unable to. We considered any response of slight problems or worse as significant. The second component of the EQ-5D-5L was the visual analogue scale, in which the patient was asked how they felt their overall health as of today with 0 being the worst health and 100 being the best health they can imagine. The numeric scores were compared directly between the delirious patient group versus the non-delirious patient group.

Baseline and long-term mood disorders was assessed using the Patient Health Questionnaire-9 (PHQ-9)⁴³. The PHQ-9 has been validated in various studies and incorporates the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) diagnostic criteria for depression. Starting in February 2013, all elective cardiac surgery patients had a pre-operative PHQ-9 that was administered in the CPAC clinic. We directly compared baseline PHQ-9 with follow up PHQ-9 scores for this patient cohort.

Long-term cognition was assessed using the memory impairment screen (MIS)^{44,45} and the Category Fluency Test (CFT)⁴⁶. The MIS has been validated as an efficient, reliable and valid screening for Alzheimer’s disease and dementia. The CFT has been validated and used in the studies of Alzheimer’s disease in both literate and illiterate patients. Both the response scores and cognitive status scores from the MIS and CFT were compared directly between the delirious patient group versus the non-delirious patient group.

Post-traumatic stress disorder (PTSD) was assessed using the PTSD Checklist – Civilian Version (PCL-C). The PCL-C is a self-reporting scale for assessing the 17 DSM-IV symptoms of PTSD. It has been validated in numerous studies involving natural disaster survivors and cancer survivors^{47,48}. Screening for alcohol use disorder was carried out using the Alcohol Use Disorder Identification Test – Consumption (AUDIT-C)⁴⁹. The AUDIT-C is a widely used and validated 3-item questionnaire on the alcohol consumption habits of the patient. A numeric score was used to identify patients who are at risk of alcohol use disorder. Katz Activity of Daily Living (ADL)⁵⁰ was used to assess the patient's level of independence. The ADL has been widely used, particularly in the geriatrics population, to determine a patient's capacity to live independently without supervision, direction, assistance or total care. We considered any score of lower than 6/6 on the ADL as significant.

The primary endpoints of the study was HRQoL as measured by the above physical health and mental health status surveys. Scoring of the surveys and cut-off values were based on the criteria of the individual surveys unless otherwise stated above. The primary exposure was the occurrence of post-operative delirium. Secondary endpoints include pre-operative, intra-operative and immediate post-operative data mentioned above. Continuous variables were expressed in median (with interquartile range) and compared using the Mann-Whitney test. Categorical variables were compared using the Chi-Square Test or Fisher Exact Test. Delirious and Non-delirious patient cohorts are compared to each other using an Odds Ratios with a 95% confidence interval.

My role in the project

During the first summer, with the assistance of the study principle investigators (Dr. Rakesh C. Arora, and Dr. Navdeep Tangri), I prepared our submissions to the ethics boards for approval. I also used the month of June 2013 to select the appropriate patient questionnaires as well as preparing the case report form (CRF) for the study. In July 2013, I began to recruit patients for inclusion in this analysis

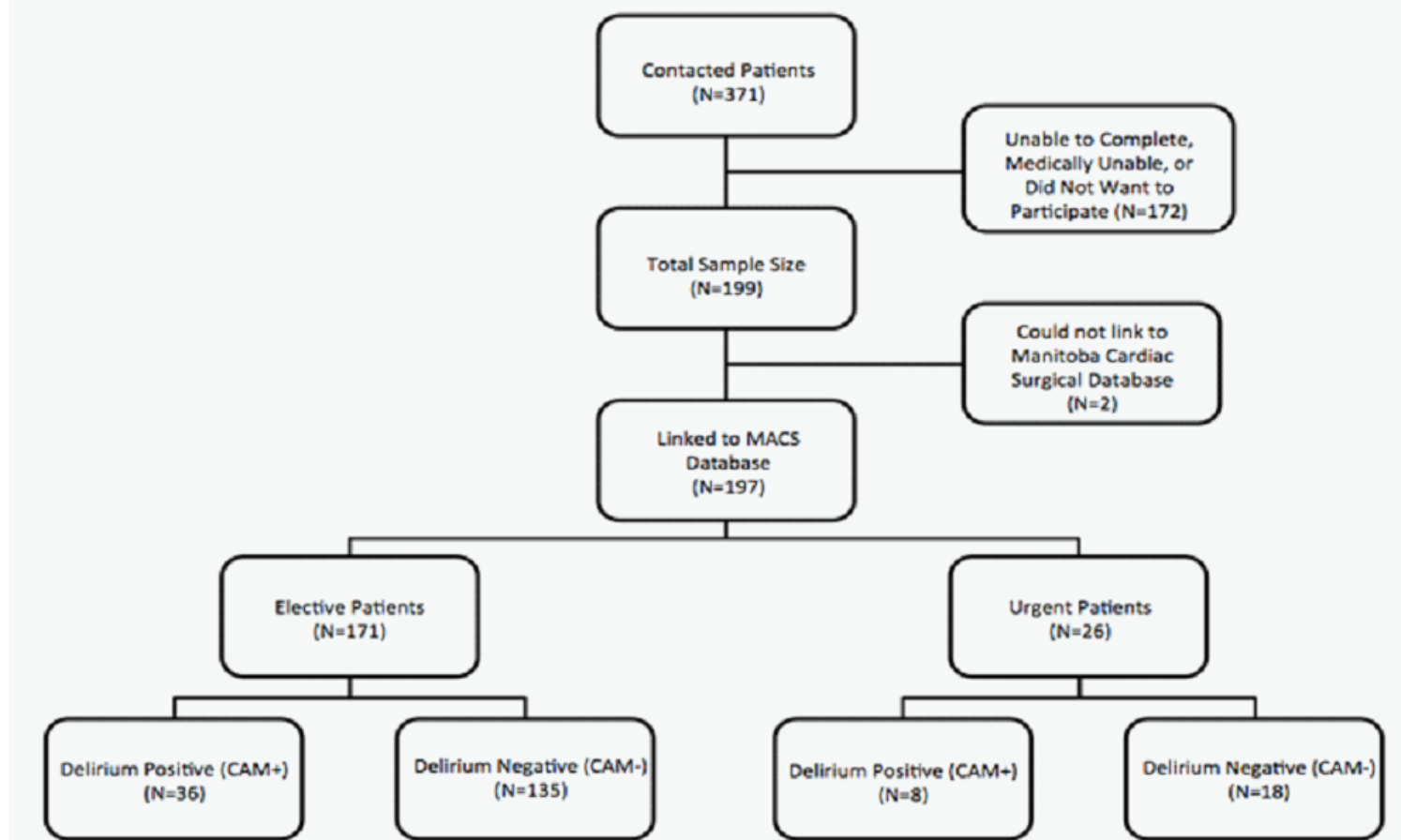
Patient recruitment continued until the end of June 2014. In mid-July, with the assistance of our statistician Brett Hiebert, I began collecting pertinent patient records and began analysing our study data as well as preparing my B.Sc. Med thesis and presentation.

RESULTS

Patient Cohort

During the recruitment period of July 2013 to July 2014, a total of 371 potential patients were contacted for the study (refer to Figure 1.). Of these, 199 patients (53.6%) consented to participate in the study. The remaining 172 patients did not consent, were unable to be contacted after 3 separate attempts or were excluded from the study due to various reasons (e.g. medically unable, not fluent in English, others). 197 consented patients were successfully linked to the Manitoba Cardiac Surgical (MaCS) Database and thus will serve as the study cohort. 171 patients (86.8%) within the study cohort were elective surgical patients and the remaining 26 patients (13.2%) were urgent or emergent surgical patients. Within the 171 elective surgical patients, 36 patients (21.1%) suffered from postoperative delirium (CAM+). Within the 26 urgent or emergent surgical patients, 8 patients (30.8%) suffered from postoperative delirium (CAM+).

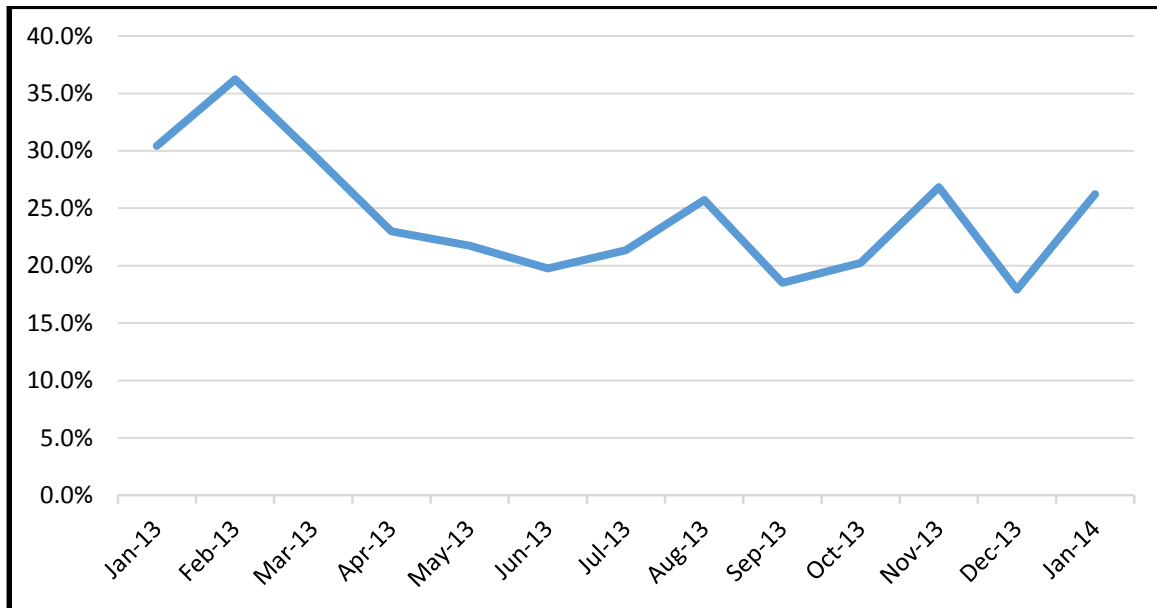
Figure 1. Sample Size Breakdown for DISCERN Study Cohort



The monthly delirium rate for patients undergoing cardiac surgery at the St. Boniface ranged between 18%-36% during the periods of January 2013 to January 2014 with the mean rate of 24.1%. (Refer to Table 1. and Figure 2.).

Month	Delirium Cases	Total Cases	Delirium Rate
Jan-13	21	69	30.4%
Feb-13	25	69	36.2%
Mar-13	19	64	29.7%
Apr-13	20	87	23.0%
May-13	20	92	21.7%
Jun-13	16	81	19.8%
Jul-13	19	89	21.3%
Aug-13	18	70	25.7%
Sep-13	15	81	18.5%
Oct-13	17	84	20.2%
Nov-13	22	82	26.8%
Dec-13	12	67	17.9%
Jan-14	16	61	26.2%
Total	240	996	24.1%

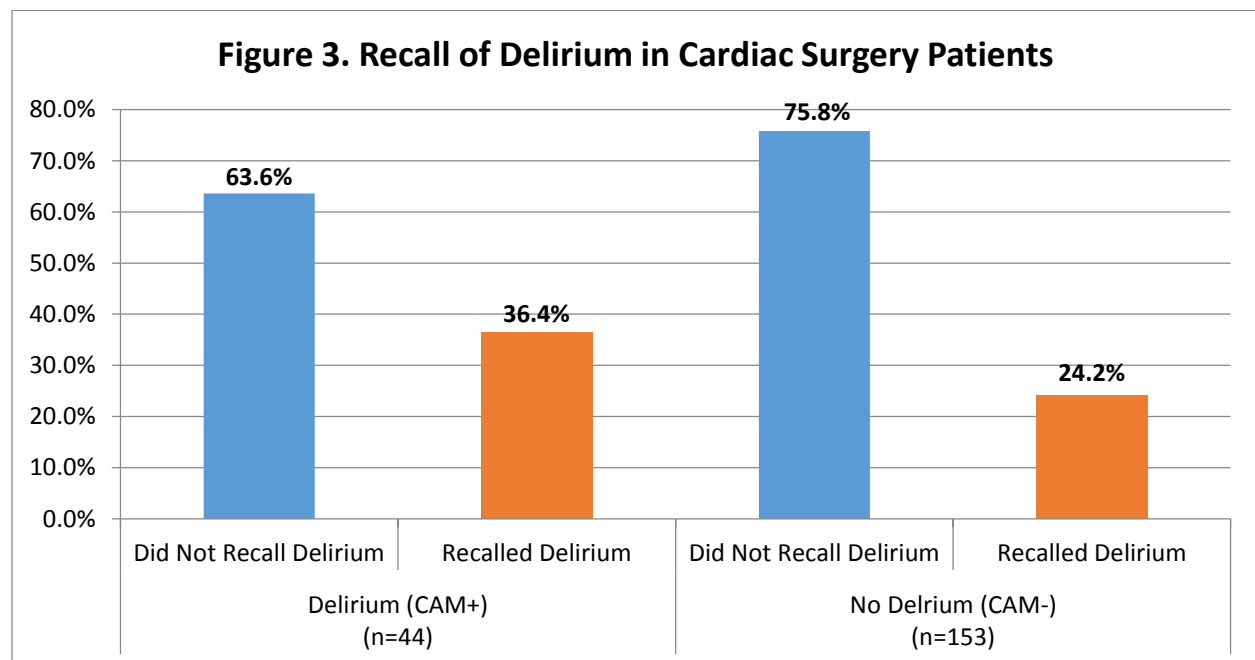
Figure 2. Delirium Rates for Cardiac Surgery Patients at St. Boniface General Hospital.



Self-Recall of Delirium in Cardiac Surgery Patients

Of the 44 patients who were documented to have a positive CAM assessment in the study cohort, only 16 patients (36.4%) were able to recall experiencing delirium/confusion following their cardiac surgery when asked at time of follow-up.

Of the 153 patients who did not screen positive for post-operative delirium in the study cohort, 37 patients (24.2%) self-reported experiencing an episode of confusion following their cardiac surgery at time of follow-up. (Refer to Figure 3.)



Pre-operative predictors of post-operative delirium

Patients with delirium were older, had a higher EUROSCORE II, a lower education, and were more likely to have a lower ejection fraction, and have undergone a previous cardiovascular procedure. No other significant differences in pre-operative characteristics between delirious and non-delirious patients were observed (Table 2.)

Table 2. Association between preoperative patient characteristics and postoperative delirium (CAM+).

Variable	Full Cohort (N=197)	Delirious (N=44)	Not Delirious (N=153)	P-Value
Age	69.9 (60.7 - 76.2)	72.6 (67.8 - 79.6)	68.7 (59.4 - 75.1)	0.0079
Gender (Female)	60 (30.5%)	12 (27.3%)	48 (31.4%)	0.6025
BMI	28.7 (25.8 - 32.1)	29.1 (24.7 - 33.5)	28.6 (25.9 - 31.6)	0.5370
Urgent Case	26 (13.2%)	8 (18.2%)	18 (11.8%)	0.2677
Lives Alone	36 (18.3%)	6 (13.6%)	30 (19.6%)	0.3664
Less Than High School Education	76 (38.6%)	24 (54.6%)	52 (34.0%)	0.0136
Caucasian	174 (88.2%)	37 (84.1%)	137 (89.5%)	0.3210
Hypertension	154 (78.2%)	34 (77.3%)	120 (78.4%)	0.8698
MI	33 (16.8%)	6 (13.6%)	27 (17.7%)	0.5301
Diabetes	50 (25.4%)	13 (29.6%)	37 (24.2%)	0.4713
Renal Insufficiency (Cr>176)	4 (2.0%)	1 (2.3%)	3 (2.0%)	1.0000
Dialysis	2 (1.0%)	1 (2.3%)	1 (0.7%)	0.3977
Congestive Heart Failure	29 (14.7%)	6 (13.6%)	23 (15.1%)	0.8178
COPD	19 (9.6%)	2 (4.6%)	17 (11.1%)	0.2548
CVA	7 (3.6%)	3 (6.8%)	4 (2.6%)	0.1871
Atrial Fibrillation	28 (14.2%)	6 (13.6%)	22 (14.4%)	0.9010
Ejection Fraction < 35%	15 (9.1%)	7 (18.9%)	8 (6.3%)	0.0446
Previous Cardiovascular Procedure	22 (11.4%)	11 (25.0%)	11 (7.4%)	0.0012
Procedure				0.4183
CABG	69 (35.0%)	13 (29.6%)	56 (36.6%)	
Valve	67 (34.0%)	14 (31.8%)	53 (34.6%)	
CABG + Valve	26 (13.2%)	9 (20.5%)	17 (11.1%)	
Other	35 (17.8%)	8 (18.2%)	27 (17.7%)	
PHQ 9 - Baseline ##	2.0 (1.0 - 3.0)	1.5 (1.0 - 3.0)	2.0 (1.0 - 3.0)	0.9564
PHQ 9 Status (Depressed) ##	25 (16.0%)	6 (17.7%)	19 (15.6%)	0.7707
MOCA Score - Baseline ##	25.0 (23.0 - 28.0)	24.5 (20.0 - 27.0)	25.0 (23.0 - 28.0)	0.0660
EuroSCORE II (%)	1.6 (1.1 - 3.3)	3.1 (1.5 - 8.1)	1.6 (1.0 - 2.7)	<0.0001

Continuous variables are expressed as median (interquartile range) and compared using Mann-Whitney Test

Categorical variables are expressed as N (%) and compared using Chi-Square Test or Fisher Exact Test

Variable was collected for Elective Patients Only (N=171)

Intra-operative Predictors of Delirium and Post-operative patient outcomes

Patients who had intra-operative complications were at higher risk of post-operative delirium. In particular, a return to the OR for bleeding, cardiac arrest or an episode of acute kidney injury was associated with a 5-fold increase in risk of post-operative delirium. Importantly, an intra-operative cerebrovascular accident increases the risk of developing post-operative delirium by 15-fold. (Table 3.1)

Delirious patients remained in the ICU almost 4 times longer than non-delirious patients and remained hospitalized on average 5 days longer. (Table 3.2)

Table 3.1 Association between intraoperative and postoperative characteristics and postoperative delirium (CAM+).

Variable	Odds Ratio	95% Confidence Interval	P-Value
Pump Time (60 Minute Increase)	1.70	1.21 - 2.37	0.0019
Return to OR - Bleeding	5.44	1.78 - 16.68	0.0030
Pneumonia	2.86	0.94 - 8.75	0.0651
Cerebrovascular Accident	15.20	1.65 - 139.78	0.0162
New Dialysis	3.73	0.89 - 15.55	0.0713
Cardiac Arrest	5.52	0.89 - 34.16	0.0660
Acute Kidney Injury (>50% Increase in Cr)	5.26	1.83 - 15.12	0.0021

Table 3.2 ICU and Hospital Length of Stay Comparisons Between Delirious and Non-Delirious Patients

Variable	Full Cohort (N=197)	Delirious (N=44)	Not Delirious (N=153)	P-Value
ICU LOS (Hours)	25.8 (21.5 - 70.2)	81.1 (41.1 - 165.9)	23.2 (20.5 - 46.3)	<0.0001
Hospital LOS (Days)	7.0 (6.0 - 12.0)	12.0 (8.0 - 23.5)	7.0 (5.0 - 9.0)	<0.0001

Continuous variables are expressed as median (interquartile range) and compared using Mann-Whitney Test
Categorical variables are expressed as N (%) and compared using Chi-Square Test or Fisher Exact Test

Long-term Physical Disability in Patients with Post-Operative Delirium

Patients who suffered post-operative delirium were 2 times more likely to score below average in the physical health aspect of the SF-12v2 ($P = 0.0392$). This remained significant ($P = 0.0452$) after adjusting for EuroSCORE II, age and whether or not patient lived alone pre-operatively.

Patients who suffered post-operative delirium were also 3.5 times more likely to report having a problem with providing self-care on the EQ-5D-5L ($P = 0.0249$) and 3 times more likely to have an activity of daily living score of <6 ($P = 0.0233$). The remainder of the EQ-5D-5L, including the VAS scale, was statistically insignificant. (Table 4.)

Table 4. Association between postoperative delirium (CAM+) and physical disability six months following cardiac surgery.

Variable	Unadjusted Model - Delirium			*Adjusted Model - Delirium		
	Odds Ratio	95% Confidence Interval	P-Value	Odds Ratio	95% Confidence Interval	P-Value
SF 12 - Physical Below Average	2.07	1.04 - 4.11	0.0392	2.15	1.02 - 4.54	0.0452
EQ-5D - Mobility Issue (>1)	1.25	0.62 - 2.52	0.5337	1.15	0.53 - 2.47	0.7279
EQ-5D - Self Care Issue (>1)	3.43	1.17 - 10.06	0.0249	2.66	0.83 - 8.57	0.1006
ADL - Active Daily Living (<6)	3.18	1.17 - 8.63	0.0233	2.05	0.62 - 6.80	0.2422

*Model is adjusted to include age, EuroSCOREII, and whether or not patient lives alone

Long-term Cognitive Impairment and Depression in Patients with Post-Operative Delirium

Patients who suffered from post-operative delirium were nearly 3 times more likely to report having at least a slight problem with anxiety or depression issues on the EQ-5D-5L, and 3 times more likely to have cognitive impairment using the Memory Impairment Screen (MIS). After the model was adjusted for EuroSCORE II, age and whether or not the patient lived alone pre-operatively, the latter became statistically insignificant. (Table 5.)

Table 5. Association between postoperative delirium (CAM+) and cognitive impairment/depression six months following cardiac surgery.

Variable	Unadjusted Model			*Adjusted Model		
	Odds Ratio	95% Confidence Interval	P-Value	Odds Ratio	95% Confidence Interval	P-Value
SF 12 - Mental Below Average	0.92	0.9 - 2.93	0.8877	1.79	0.50 - 6.43	0.3698
EQ-5D - Anxiety/Depression Issue (>1)	2.04	0.97 - 4.26	0.0589	2.64	1.16 - 5.99	0.0201
PHQ 9 Status (Depressed)	1.19	0.57 - 2.49	0.6541	1.48	0.65 - 3.39	0.3507
GDS Depressed (Age 65+ Only)*	1.00	0.36 - 2.77	1.0000	0.60	0.18 - 2.02	0.4089
MIS Cognitive Impairment	3.15	1.40 - 7.09	0.0057	1.73	0.68 - 4.38	0.2471
CFT Cognitive Impairment	1.60	0.73 - 3.50	0.2362	1.40	0.59 - 3.33	0.4433

*Model also includes age, EuroSCOREII, and whether or not patient lives alone

DISCUSSION

In our prospective study of patients undergoing cardiac surgery, we found that the incidence of delirium was 21.1% in the elective cohort and 30.8% in the urgent and emergent patient cohort. Patients who suffered from delirium had a longer ICU and hospital length of stay, and suffered from significant downstream adverse outcomes. In particular, post-operative delirium was associated with a nearly 3 fold higher likelihood of anxiety/depression, and a 2 fold higher risk of diminished physical function 6-9 months after their surgery. These findings were independent of age, EuroSCORE II and baseline independence, and suggest that the impact of delirium on the cardiac surgery patient lasts well beyond the incident hospitalization.

The post-operative delirium rate in the elective surgery cohort was comparable to the yearly average rate of observed post-operative delirium rate of 24.1%. This is reassurance that our study cohort is very representative of the general cardiac surgery patient population in Manitoba. The higher rate of post-operative delirium in urgent and emergent patients may be attributable to the smaller sample size in this sub-group of patients or, more likely, due to the higher severity of illness of these patients prior to surgery.

Only 36.4% of the patients who had post-operative delirium could recall their experience of confusion or delirium when asked during the 6-9 months follow-up interview. A large proportion of patients who suffer from post-operative delirium are unable to recall their episode of delirium. This is an indication that some patients who were experiencing post-operative delirium may also have their memory impaired. According to Cheryl Misak⁵¹, patients who do not recall their episode of delirium are more at risk to develop PTSD and long-term depression.

Of the patients who were not classified as delirious during their hospital stay, 24.2% claimed to have experienced confusion or delirium when asked during the 6-9 months follow-up interview. This indicates that this group of patients may have experience a milder sub-type of delirium (i.e. subsyndromal delirium) that the CAM-ICU delirium assessment tool was unable to detect or that their episode(s) of delirium were brief and thus not detected by the health care providers. It is also a possibility that, perhaps, they were too embarrassed to disclose their symptoms to their healthcare providers (as recently discussed by Dr. Cheryl Misak, previous delirium survivor and keynote speaker at the 4th Annual American Delirium Society Conference). According to Meagher et al.⁵², some patients may meet all DSM-IV criteria for delirium but are classified to have subsyndromal delirium due to their Delirium Rating Scale (DRS-R98) cut-off scores. The Intensive Care Delirium Screening Checklist (ICDSC), developed by Bergeron et al.⁵³ in 2001, can be used to detect subsyndromal delirium. Using the ICDSC, Ouimet et al.⁵⁴ reported in 2007 that subsyndromal delirium affected up to one third of cardiac surgery patients in the ICU and is associated with a five-fold increase in ICU mortality. These are serious consequences for a group of patients who otherwise would be classified as non-delirious.

We found that the pre-operative predictors most strongly associated with the occurrence of post-operative delirium were higher EuroSCORE II, previous cardiovascular procedure, increased age, less than high school education, and ejection fraction of less than 35% respectively. Our findings are consistent with Bucerius et al.²⁵, who reported that previous cardiac surgery and ejection fraction of less than 30% are independent predictors of delirium. Parikh et al.¹³ suggested that older patients have decreased cerebral neuronal density, blood flow, metabolism and levels of neurotransmitters, which may account for the increased predisposition to post-operative delirium. They also suggested that pre-operative depression is also a predisposing factor of delirium¹³. We were unable to find any association between pre-operative depression and post-operative delirium with our baseline PHQ-9 data. We also found that delirious patients also had a lower baseline MOCA score. A significant association was not found however, which may be due to our relatively small sample size.

Intra-operative predictors most strongly associated with post-operative delirium in our patient cohort were increased cardiopulmonary pump time, acute kidney injury, returning to the OR due to post-operative bleeding and new cerebrovascular accident respectively. Our findings are consistent with Nevin et al.⁵⁵, who indicated that hypoperfusion and microemboli are two potential factors in the development of post-operative delirium. In addition, patients with more severe illnesses require more complex surgeries correlating with an increased cardiopulmonary bypass time, increased risk of bleeding, CVA, kidney failure and ultimately a higher risk of post-operative delirium.

There were strong associations between post-operative delirium and ICU length of stay and hospital length of stay in our patient cohort. Delirious patients remained in the ICU almost 4 times longer than non-delirious patients. These patients also remained hospitalized on average 5 days longer. These findings are consistent with previous publications indicating that post-operative delirium prolongs ICU and hospital stay. In 2012, Andrejaitiene et al. reported that post-operative delirium prolongs ICU stay by 8 days and hospital stay by 24 days⁵⁶.

We found that patients who suffered from post-operative delirium were 2 times more likely to score below average in the physical health aspect of the SF-12v2 and nearly 3 times more likely to report having a problem with anxiety or depression at time of follow-up. These findings were independent of age, EuroSCORE II and baseline functional independence. This suggests that post-operative delirium is a predictor of physical disability, anxiety and depression 6-9 months following cardiac surgery. There is no current data available comparing long-term physical disability, anxiety or depression between delirious and non-delirious cardiac surgery patients. Therefore long-term follow up of these patients is warranted.

LIMITATIONS

There are several limitations of our analysis that are worthy of discussion. Firstly, our analysis was limited by the relatively small sample size (N = 197). Several pre-operative, peri-operative and post-operative factors trended towards a positive association with post-operative delirium. However, a statistically significant association could not be made. Secondly, we were unable to capture several intermediate to long-term outcomes that may have strong associations with post-operative delirium. Intermediate to long-term outcomes such as re-admission to hospital, new medications, anti-depressant use, and mental health screen results could yield valuable information on the effects of post-operative delirium on patient recovery. Thirdly, our consent rate for the study thus far is 53.6%. We believe that modifying the consent process, such as consenting patient pre-operatively in clinics, will yield a higher consent rate

resulting in a larger study cohort and thus making the study more efficient overall. Lastly, our study report HRQoL at a mid- to long-term follow-up. Long-term implications of delirium on HRQoL is required.

FUTURE DIRECTIONS

Upon reviewing our analysis, we have identified potential refinements of our methodology to improve future investigations. We plan to capture more detailed pre-operative data to better understand baseline functional status of our patients. We have begun to extract the Canadian Health Outcomes for Better Information and Care (C-HOBIC) functional status from patient initial assessments in the Cardiac Pre-admission Clinic (CPAC). We will also be capturing more post-operative data, such as new hospital admissions, medication status and access to health services through linkages to the Manitoba Centre for Health Policy to understand the long-term impact of delirium on health care service utilization.

We are currently implementing the second phase of our study, the long-term outcome study. We will begin to contact our patients for their 18-month follow up.

CONCLUSIONS

In our study cohort of 197 patients, the rate of post-operative delirium was 21.1% in elective cardiac surgery patients and 30.8% in urgent or emergent patient. Delirious patients remained in the ICU almost 4 times longer than non-delirious patients and were hospitalized on average 5 days longer. The mid-term impact on post-discharge HRQoL; patients who suffered from post-operative delirium were 2 times more likely to score below average in self-reported physical health and were nearly 3 times more likely to report having a problem with anxiety or depression. It would appear that patient with post-operative delirium would benefit from more comprehensive and early follow up, knowledge translation to their primary care practitioners and a need to develop interventions to prevent or mitigate adverse outcomes to ensure that they not only survive, but thrive in the community.

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APPENDIX TO BE ATTACHED.

RASS and CAM-ICU Worksheet

Step One: Sedation Assessment

The Richmond Agitation and Sedation Scale: The RASS*

Score	Term	Description	
+4	Combative	Overtly combative, violent, immediate danger to staff	
+3	Very agitated	Pulls or removes tube(s) or catheter(s); aggressive	
+2	Agitated	Frequent non-purposeful movement, fights ventilator	
+1	Restless	Anxious but movements not aggressive vigorous	
0	Alert and calm		
-1	Drowsy	Not fully alert, but has sustained awakening (eye-opening/eye contact) to <i>voice</i> (≥ 10 seconds)	} Verbal Stimulation
-2	Light sedation	Briefly awakens with eye contact to <i>voice</i> (< 10 seconds)	
-3	Moderate sedation	Movement or eye opening to <i>voice</i> (but no eye contact)	} Physical Stimulation
-4	Deep sedation	No response to voice, but movement or eye opening to <i>physical</i> stimulation	
-5	Unarousable	No response to <i>voice or physical</i> stimulation	

Procedure for RASS Assessment

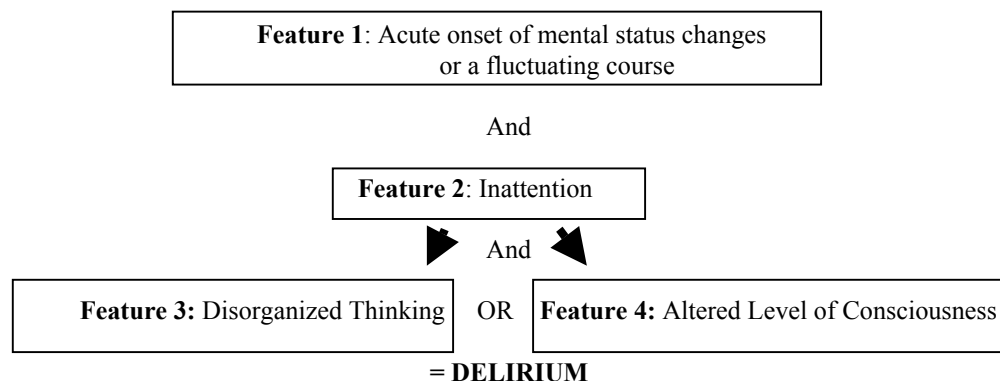
1. **Observe patient**
 - a. Patient is alert, restless, or agitated. (score 0 to +4)
2. **If not alert, state patient's name and say to open eyes and look at speaker.**
 - a. Patient awakens with sustained eye opening and eye contact. (score -1)
 - b. Patient awakens with eye opening and eye contact, but not sustained. (score -2)
 - c. Patient has any movement in response to voice but no eye contact. (score -3)
3. **When no response to verbal stimulation, physically stimulate patient by shaking shoulder and/or rubbing sternum.**
 - a. Patient has any movement to physical stimulation. (score -4)
 - b. Patient has no response to any stimulation. (score -5)

If RASS is -4 or -5, then **Stop** and **Reassess** patient at later time

If RASS is above -4 (-3 through +4) then **Proceed to Step 2**

*Sessler, et al. AJRCCM 2002; 166:1338-1344. Ely, et al. JAMA 2003; 289:2983-2991.

Step Two: Delirium Assessment



CAM-ICU Worksheet

Feature 1: Acute Onset or Fluctuating Course	Positive	Negative
Positive if you answer 'yes' to either 1A or 1B.		
1A: Is the pt different than his/her baseline mental status? <div style="text-align: center;">Or</div> 1B: Has the patient had any fluctuation in mental status in the past 24 hours as evidenced by fluctuation on a sedation scale (e.g. RASS), GCS, or previous delirium assessment?	Yes	No
Feature 2: Inattention	Positive	Negative
Positive if either score for 2A <u>or</u> 2B is less than 8. Attempt the ASE letters first. If pt is able to perform this test and the score is clear, record this score and move to Feature 3. If pt is unable to perform this test <u>or</u> the score is unclear, then perform the ASE Pictures. If you perform both tests, use the ASE Pictures' results to score the Feature.		
2A: ASE Letters: record score (enter NT for not tested) <i>Directions:</i> Say to the patient, "I am going to read you a series of 10 letters. Whenever you hear the letter 'A,' indicate by squeezing my hand." Read letters from the following letter list in a normal tone. <div style="text-align: center;">S A V E A H A A R T</div> Scoring: Errors are counted when patient fails to squeeze on the letter "A" and when the patient squeezes on any letter other than "A."	Score (out of 10): _____	
2B: ASE Pictures: record score (enter NT for not tested) Directions are included on the picture packets.	Score (out of 10): _____	
Feature 3: Disorganized Thinking	Positive	Negative
Positive if the combined score is less than 4		
3A: Yes/No Questions (Use either Set A <u>or</u> Set B, alternate on consecutive days if necessary): <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> Set A 1. Will a stone float on water? 2. Are there fish in the sea? 3. Does one pound weigh more than two pounds? 4. Can you use a hammer to pound a nail? </div> <div style="width: 45%;"> Set B 1. Will a leaf float on water? 2. Are there elephants in the sea? 3. Do two pounds weigh more than one pound? 4. Can you use a hammer to cut wood? </div> </div> Score ____ (Patient earns 1 point for each correct answer out of 4)	Combined Score (3A+3B): _____ (out of 5)	
3B: Command Say to patient: "Hold up this many fingers" (Examiner holds two fingers in front of patient) "Now do the same thing with the other hand" (Not repeating the number of fingers). *If pt is unable to move both arms, for the second part of the command ask patient "Add one more finger" Score ____ (Patient earns 1 point if able to successfully complete the entire command)		
Feature 4: Altered Level of Consciousness	Positive	Negative
Positive if the Actual RASS score is anything other than "0" (zero)		
Overall CAM-ICU (Features 1 and 2 and either Feature 3 or 4):	Positive	Negative

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SF-12v2™ Health Survey

(SF-12 v2 Standard, US Version 2.0)

To be completed by the PATIENT

Identification Number

Event

Directions: This survey asks for your views about your health. This information will help you keep track of how you feel and how well you are able to do your usual activities. If you need to change an answer, completely erase the incorrect mark and fill in the correct circle. If you are unsure about how to answer a question, please give the best answer you can.

Today's Date (MM/DD/YY)

		/			/		
--	--	---	--	--	---	--	--

Shade circles like this:



Not like this:



Mark only one answer for each question. Please do not mark outside the circles or make stray marks on the questionnaire.

	Excellent	Very Good	Good	Fair	Poor
01. In general, would you say your health is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The following questions are about activities you might do during a typical day. Does <u>your health now limit you</u> in these activities? If so, how much?</i>					
	Yes, limited a lot	Yes, limited a little	No, not limited at all		
02. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
03. Climbing several flights of stairs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
<i>During the <u>past 4 weeks</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of your physical health</u>?</i>					
	All of the time	Most of the time	Some of the time	A little of the time	None of the time
04. Accomplished less than you would like	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
05. Were limited in the kind of work or other activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>During the <u>past 4 weeks</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of any emotional problems</u> (such as feeling depressed or anxious)?</i>					
	All of the time	Most of the time	Some of the time	A little of the time	None of the time
06. Accomplished less than you would like	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
07. Did work or activities less carefully than usual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>During the <u>past 4 weeks</u>, how much did <u>pain</u> interfere with your normal work (including both work outside the home and housework)?</i>					
	Not at all	A little bit	Moderately	Quite a bit	Extremely
<i>These questions are about how you feel and how things have been with you during the <u>past 4 weeks</u>. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the <u>past 4 weeks</u>...</i>					
	All of the time	Most of the time	Some of the time	A little of the time	None of the time
09. Have you felt calm and peaceful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Did you have a lot of energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Have you felt downhearted and depressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. During the <u>past 4 weeks</u>, how much of the time has your <u>physical health or emotional problems</u> interfered with your social activities (like visiting friends, relatives, etc.)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Date: _____

Study Number: _____

EQ-5D-5L Descriptive System Score Questionnaire

Under each heading, please tick the ONE box that best describes your health TODAY

Mobility

- I have no problems in walking about ☐
- I have slight problems in walking about ☐
- I have moderate problems in walking about ☐
- I have severe problems in walking about ☐
- I am unable to walk about ☐

Self-Care

- I have no problems washing or dressing myself ☐
- I have slight problems washing or dressing myself ☐
- I have moderate problems washing or dressing myself ☐
- I have severe problems washing or dressing myself ☐
- I am unable to wash or dress myself ☐

Usual Activities (eg. work, study, housework, family or leisure activities)

- I have no problems doing my usual activities ☐
- I have slight problems doing my usual activities ☐
- I have moderate problems doing my usual activities ☐
- I have severe problems doing my usual activities ☐
- I am unable to do my usual activities ☐

Pain/Discomfort

- I have no pain or discomfort ☐
- I have slight pain or discomfort ☐
- I have moderate pain or discomfort ☐
- I have severe pain or discomfort ☐
- I have extreme pain or discomfort ☐

Anxiety/Depression

- I am not anxious or depressed ☐
- I am slightly anxious or depressed ☐
- I am moderately anxious or depressed ☐
- I am severely anxious or depressed ☐
- I am extremely anxious or depressed ☐

Date:_____

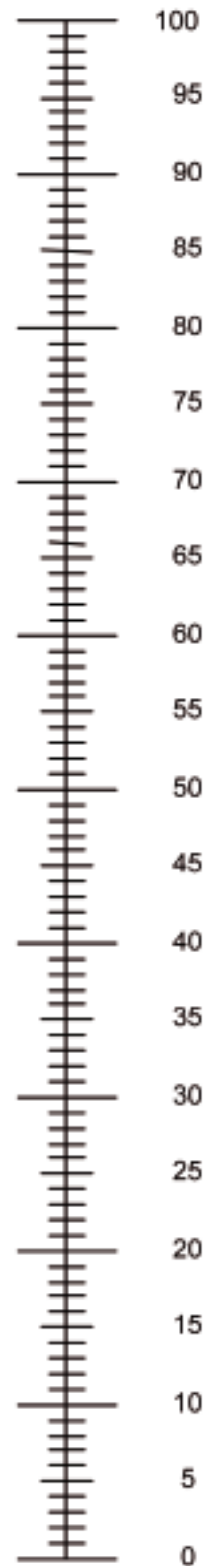
Study Number:_____

EQ-5D-5L Visual Analogue Scale

- We would like to know how good or bad your health is today
- Mark an X on the scale to indicate how your health is today
 - 100 means the best health you can imagine
 - 0 mean the worst health you can imagine
- Now, please write the number you marked on the scale in the box below

Your Health Today =

The best health
you can imagine



The worst health
you can imagine

2. Scoring the EQ-5D-5L descriptive system

The EQ-5D-5L descriptive system should be scored, for example, as follows:

Under each heading, please tick the ONE box that best describes your health TODAY		Levels of perceived problems are coded as follows:
MOBILITY		
I have no problems in walking about	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Level 1 is coded as a '1'
I have slight problems in walking about	<input type="checkbox"/>	<input type="checkbox"/>
I have moderate problems in walking about	<input type="checkbox"/>	<input type="checkbox"/>
I have severe problems in walking about	<input type="checkbox"/>	<input type="checkbox"/>
I am unable to walk about	<input type="checkbox"/>	
SELF-CARE		
I have no problems washing or dressing myself	<input type="checkbox"/>	<input type="checkbox"/> Level 2 is coded as a '2'
I have slight problems washing or dressing myself	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I have moderate problems washing or dressing myself	<input type="checkbox"/>	<input type="checkbox"/>
I have severe problems washing or dressing myself	<input type="checkbox"/>	<input type="checkbox"/>
I am unable to wash or dress myself	<input type="checkbox"/>	<input type="checkbox"/>
USUAL ACTIVITIES (e.g. work, study, housework, family or leisure activities)		
I have no problems doing my usual activities	<input type="checkbox"/>	<input type="checkbox"/> Level 3 is coded as a '3'
I have slight problems doing my usual activities	<input type="checkbox"/>	<input type="checkbox"/>
I have moderate problems doing my usual activities	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I have severe problems doing my usual activities	<input type="checkbox"/>	<input type="checkbox"/>
I am unable to do my usual activities	<input type="checkbox"/>	<input type="checkbox"/>
PAIN / DISCOMFORT		
I have no pain or discomfort	<input type="checkbox"/>	<input type="checkbox"/> Level 4 is coded as a '4'
I have slight pain or discomfort	<input type="checkbox"/>	<input type="checkbox"/>
I have moderate pain or discomfort	<input type="checkbox"/>	<input type="checkbox"/>
I have severe pain or discomfort	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I have extreme pain or discomfort	<input type="checkbox"/>	<input type="checkbox"/>
ANXIETY / DEPRESSION		
I am not anxious or depressed	<input type="checkbox"/>	<input type="checkbox"/> Level 5 is coded as a '5'
I am slightly anxious or depressed	<input type="checkbox"/>	<input type="checkbox"/>
I am moderately anxious or depressed	<input type="checkbox"/>	<input type="checkbox"/>
I am severely anxious or depressed	<input type="checkbox"/>	<input type="checkbox"/>
I am extremely anxious or depressed	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

This example identifies the health state '12345'.

NB: There should be only ONE response for each dimension

NB: Missing values can be coded as '9'.

NB: Ambiguous values (e.g. 2 boxes are ticked for a single dimension) should be treated as missing values.

3. Scoring the EQ VAS

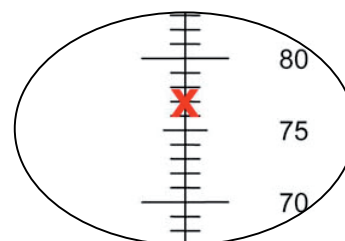
The EQ VAS should be scored, for example, as follows:

The best health you can imagine

100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
The worst health you can imagine

- We would like to know how good or bad your health is TODAY.
- This scale is numbered from 0 to 100.
- 100 means the best health you can imagine.
- 0 means the worst health you can imagine.
- Mark an X on the scale to indicate how your health is TODAY.
- Now, please write the number you marked on the scale in the box below.

YOUR HEALTH TODAY = 77



For example this response should be coded as 77

NB: Missing values should be coded as '999'.

NB: If there is a discrepancy between where the respondent has placed the X and the number he/she has written in the box, administrators should use the number in the box.

Patient Health Questionnaire – PHQ-9

Patient name: _____ Date: _____

1. Over the last 2 weeks, how often have you been bothered by any of the following problems?

	Not at all (0)	Several days (1)	More than half the days (2)	Nearly every day (3)
a. Little interest or pleasure in doing things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Feeling down, depressed, or hopeless.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Trouble falling/staying asleep, sleeping too much.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Feeling tired or having little energy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Poor appetite or overeating.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Feeling bad about yourself, or that you are a failure, or have let yourself or your family down.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Trouble concentrating on things, such as reading the newspaper or watching TV.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Moving or speaking so slowly that other people could have noticed. Or the opposite; being so fidgety or restless that you have been moving around more than usual.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Thoughts that you would be better off dead or of hurting yourself in some way.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. If you checked off any problem on this questionnaire so far, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

☐ Not difficult
at all

☐ Somewhat
difficult

☐ Very
difficult

☐ Extremely
difficult

TOTAL SCORE _____

Instructions – How To Score The PHQ-9

Major depressive disorder is suggested if:

1. Of the 9 items, 5 or more are checked as at least ‘more than half the days’
2. Either item a. or b. is positive, that is, at least ‘more than half the days’

Other depressive syndrome is suggested if:

1. Of the 9 items, a., b., or c., are checked as at least ‘more than half the days’
2. Either item a., or b. is positive, that is, at least ‘more than half the days’.

Also, PHQ-9 scores can be used to plan and monitor treatment. To score the instrument, tally each response by the number value under the answer headings, (not at all=0, several days=1, more than half the days=2, and nearly every day=3). Add the numbers together to total the score on the bottom of the questionnaire. Interpret the score by using the guide listed below.

Guide for Interpreting PHQ-9 Scores

Score	Action
0-4	The score suggests the patient may not need depression treatment
5-14	Mild major depressive disorder. Physician uses clinical judgment about treatment, based on patient’s duration of symptoms and functional impairment.
15-19	Moderate-major depressive disorder. Warrants treatment for depression, using antidepressant, psychotherapy or a combination of treatment.
20 or higher	Severe major depressive disorder. Warrants treatment with antidepressant, with or without psychotherapy, follow frequently.

Functional Health Assessment

The instrument also includes a functional health assessment. This asks the patient how emotional difficulties or problems impact work, things at home, or relationships with other people. Patient responses can be one of four: Not difficult at all, Somewhat difficult, Very difficult, Extremely difficult. The last two responses suggest that the patient’s functionality is impaired. After treatment begins, functional status and number score can be measured to assess patient improvement.

5-Point Geriatric Depression Scale

Circle the answer that describes how you felt over the past week.

- | | | |
|---|-----|----|
| 1) Are you basically satisfied with your life? | Yes | No |
| 2) Do you often get bored? | Yes | No |
| 3) Do you often feel helpless? | Yes | No |
| 4) Do you prefer to stay at home rather than going out and doing something new? | Yes | No |
| 5) Do you feel pretty worthless the way you are now? | Yes | No |

5-Point Geriatric Depression Scale Scoring Key

Instructions: Score 1 point for each **BOLDED** answer. A score of 2 or more suggest depression

Circle the answer that describes how you felt over the past week.

- | | | |
|---|-------------------|------------------|
| 1) Are you basically satisfied with your life? | Yes | <u>No</u> |
| 2) Do you often get bored? | <u>Yes</u> | No |
| 3) Do you often feel helpless? | <u>Yes</u> | No |
| 4) Do you prefer to stay at home rather than going out and doing something new? | <u>Yes</u> | No |
| 5) Do you feel pretty worthless the way you are now? | <u>Yes</u> | No |

Memory Impairment Screen (MIS)

Instructions for Administration

1. Show patient a sheet of paper with the four items to be recalled in 24-point or greater uppercase letters (example Wordlist below), and ask patient to read the items aloud.
2. Tell patient that each item belongs to a different category. Give a category cue and ask patient to indicate which of the words belongs in the stated category (e.g., “Which one is the game?). Allow up to 5 attempts. Failure to complete this task indicates possible cognitive impairment.
3. When patient identifies all 4 words, remove the sheet of paper. Tell patient that he or she will be asked to remember the words in a few minutes.
4. Engage patient in distractor activity for 2-3 minutes, such as counting to 20 and back, counting back from 100 by 7, spelling WORLD backwards.
5. FREE RECALL – 2 points per word: Ask patient to state as many of the 4 words he/she can recall. Allow at least 5 seconds per item for free recall. Continue to step 6 if no more words have been recalled for 10 seconds.
6. CUED RECALL – 1 point per word: Read the appropriate category cue for each word not recalled during free recall (e.g., “What was the game?”).

Word	Cue	Free recall (2 pts.)	Cued recall (1 pt.)
Checkers	Game		
Saucer	Dish		
Telegram	Message		
Red Cross	Organization		

Scoring

The maximum score for the MIS is 8.

- 5-8 No cognitive impairment
- ≤4 Possible cognitive impairment

References

Buschke H, Kuslansky G, Katz M, Stewart WF, Sliwinski MJ, Eckholdt HM, et al. Screening for dementia with the memory impairment screen. *Neurology* 1999;52:231–8.

Kuslansky G, Buschke H, Katz M, Sliwinski M, Lipton RB. Screening for Alzheimer’s disease: the memory impairment screen versus the conventional three-word memory test. *J Am Geriatr Soc* 2002;50:1086–91.

Category Fluency Test (Animals)

BACKGROUND

This simple test can be completed in one minute and is often enjoyed by patients. Due to the brevity of this test, it can and should be used in conjunction with other recommended screening tools. This test's sensitivity is adequate (.88) and the specificity is good (.96).

INSTRUCTIONS

Say to patient:

I am going to give you a category and I want you to name, as fast as you can, all of the things that belong in that category. For example, if I say, “articles of clothing,” you could say, “shirt, tie, hat, etc.” Can you think of other articles of clothing?

(Wait for patient to name two or three items).

That's fine. I want you to name things that belong to another category—animals. I want you to think about all the many different kinds of animals you know. Now I would like for you to tell the names for as many different animals as you can. You will have a minute to do this.

(Interviewer -look at your watch).

Are you ready? Let's begin.

Record all responses.

SCORING

Count the number of unique responses. Repeating responses should only be counted the first time they are given. The chart below provides age-adjusted cutoff scores; a score less than that appropriate for a patient's age group is indicative of cognitive impairment. If the patient scores below the number of responses indicated, further screening tests should be administered.

Age	Responses
65-69	15
70-74	15
75-79	14
80-84	13
85+	11

COMMONLY ASKED QUESTIONS & ANSWERS

- *What if the patient asks me what are considered 'animals'?* Sometimes patients may not realize that bugs, birds, and fish are animals and may ask you to clarify this misunderstanding. If a patient asks you to clarify, you may only repeat the instructions and tell them to use their best judgment.
- *What cutoff scores should be used for patients less than 65 years old?* If a patient is less than 65, you should use a cutoff score of 15.

References

The Layton Aging and Alzheimer's Disease Center, Oregon Health and Science University. The Oregon Brain Aging Study (OBAS). Available online at: <http://www.ohsu.edu/alzheimers/data/obas.3.2003.htm>.

PTSD CheckList – Civilian Version (PCL-C)

Client's Name: _____

Instruction to patient: Below is a list of problems and complaints that veterans sometimes have in response to stressful life experiences. Please read each one carefully, put an "X" in the box to indicate how much you have been bothered by that problem *in the last month*.

No.	Response	Not at all (1)	A little bit (2)	Moderately (3)	Quite a bit (4)	Extremely (5)
1.	Repeated, disturbing <i>memories, thoughts, or images</i> of a stressful experience from the past?					
2.	Repeated, disturbing <i>dreams</i> of a stressful experience from the past?					
3.	Suddenly <i>acting or feeling</i> as if a stressful experience <i>were happening</i> again (as if you were reliving it)?					
4.	Feeling <i>very upset</i> when <i>something reminded</i> you of a stressful experience from the past?					
5.	Having <i>physical reactions</i> (e.g., heart pounding, trouble breathing, or sweating) when <i>something reminded</i> you of a stressful experience from the past?					
6.	Avoid <i>thinking about</i> or <i>talking about</i> a stressful experience from the past or avoid <i>having feelings</i> related to it?					
7.	Avoid <i>activities</i> or <i>situations</i> because they <i>remind you</i> of a stressful experience from the past?					
8.	Trouble <i>remembering important parts</i> of a stressful experience from the past?					
9.	Loss of <i>interest in things that you used to enjoy</i> ?					
10.	Feeling <i>distant</i> or <i>cut off</i> from other people?					
11.	Feeling <i>emotionally numb</i> or being unable to have loving feelings for those close to you?					
12.	Feeling as if your <i>future</i> will somehow be <i>cut short</i> ?					
13.	Trouble <i>falling</i> or <i>staying asleep</i> ?					
14.	Feeling <i>irritable</i> or having <i>angry outbursts</i> ?					
15.	Having <i>difficulty concentrating</i> ?					
16.	Being " <i>super alert</i> " or watchful on guard?					
17.	Feeling <i>jumpy</i> or easily startled?					

PTSD CheckList – Civilian Version (PCL-C)

The PCL is a standardized self-report rating scale for PTSD comprising 17 items that correspond to the key symptoms of PTSD. Two versions of the PCL exist: 1) PCL-M is specific to PTSD caused by military experiences and 2) PCL-C is applied generally to any traumatic event.

The PCL can be easily modified to fit specific time frames or events. For example, instead of asking about “the past month,” questions may ask about “the past week” or be modified to focus on events specific to a deployment.

How is the PCL completed?

- ☐ The PCL is self-administered
- ☐ Respondents indicate how much they have been bothered by a symptom over the past month using a 5-point (1–5) scale, circling their responses. Responses range from **1 Not at All** – **5 Extremely**

How is the PCL Scored?

1) Add up all items for a total severity score

or

2) Treat response categories **3–5** (*Moderately* or above) as symptomatic and responses **1–2** (below *Moderately*) as non-symptomatic, then use the following DSM criteria for a diagnosis:

- Symptomatic response to at least 1 “B” item (Questions 1–5),
- Symptomatic response to at least 3 “C” items (Questions 6–12), and
- Symptomatic response to at least 2 “D” items (Questions 13–17)

Are Results Valid and Reliable?

- ☐ Two studies of both Vietnam and Persian Gulf theater veterans show that the PCL is both valid and reliable (Additional references are available from the DHCC)

What Additional Follow-up is Available?

- ☐ All military health system beneficiaries with health concerns they believe are deployment-related are encouraged to seek medical care
- ☐ Patients should be asked, “**Is your health concern today related to a deployment?**” during all primary care visits.
- If the patient replies “**yes**,” the provider should follow the Post-Deployment Health Clinical Practice Guideline (PDH-CPG) and supporting guidelines available through the DHCC and www.PDHealth.mil

AUDIT-C

Please circle the answer that is correct for you.

1. How often do you have a drink containing alcohol?					SCORE
Never (0)	Monthly or less (1)	Two to four times a month (2)	Two to three times per week (3)	Four or more times a week (4)	_____
2. How many drinks containing alcohol do you have on a typical day when you are drinking?					
1 or 2 (0)	3 or 4 (1)	5 or 6 (2)	7 to 9 (3)	10 or more (4)	_____
3. How often do you have six or more drinks on one occasion?					
Never (0)	Less than Monthly (1)	Monthly (2)	Two to three times per week (3)	Four or more times a week (4)	_____
TOTAL SCORE					
Add the number for each question to get your total score.					_____

Maximum score is 12. A score of ≥ 4 identifies 86% of men who report drinking above recommended levels or meets criteria for alcohol use disorders. A score of > 2 identifies 84% of women who report hazardous drinking or alcohol use disorders.

KATZ ACTIVITIES OF DAILY LIVING

ACTIVITIES	INDEPENDENCE (1 point) NO supervision, direction or personal assistance	DEPENDENCE (0 points) WITH supervision, direction, personal assistance or total care
BATHING Point: _____	(1 POINT) Bathes self completely or needs help in bathing only a single part of the body such as the back, genital area, or disabled extremity.	(0 POINT) Needs help in bathing more than one part of the body getting out of the tub or shower. Requires total bathing.
DRESSING Point: _____	(1 POINT) Gets clothes from closets and drawers and puts on clothes and other garments complete with fasteners. May have help tying shoes.	(0 POINTS) Needs help with dressing self or needs to be completely dressed.
TOILETING Point: _____	(1 POINT) Goes to toilet, gets on and off, arranges clothes, cleans genital area without help.	(0 POINTS) Needs help transferring to the toilet, cleaning self or uses bedpan or commode.
TRANSFERRING Point: _____	(1 POINT) Moves in and out of bed or chair unassisted. Mechanical transferring aides are acceptable.	(0 POINTS) Needs help in moving from bed to chair or requires a complete transfer.
CONTINENCE Point: _____	(1 POINT) Exercises complete self control over urination and defecation.	(0 POINTS) Is partially or totally incontinent of bowel or bladder.
FEEDING Point: _____	(1 POINT) Gets food from plate into mouth without help. Preparation of food may be done by another person.	(0 POINTS) Needs partial or total help with feeding or requires parenteral feeding.
TOTAL POINTS= _____	<i>6 = High(patient independent)</i>	<i>0 = Low (patient very dependent)</i>