Prevalence and outcome of delirium amongst acute general medical in-patients in Cape Town, South Africa

ABSTRACT

Objectives Delirium is a common, serious, underdiagnosed condition in acute medical and surgical inpatients. It is associated with increased risk of mortality and morbidity. Data are largely limited to developed countries in geriatric cohorts. Here we describe prevalence, risk factors and outcomes of delirium amongst general medical patients admitted to two hospitals in Cape Town, South Africa.

Design and Setting Prospective cohort study of patients admitted acutely to a general medical inpatient service, in a secondary and tertiary-level public hospital serving the Metro West area of Cape Town, South Africa.

Participants Patients ≥ 18 years old were recruited daily from all acute medical admissions. Patients were excluded if they were aphasic or had Glasgow Coma Scale < 12/15. In total, 808 patients were included.

Main outcome measures Delirium was diagnosed using the validated confusion assessment method (CAM) tool performed by trained neuropsychologists. Demographic data was collected by a clinical team and short and long-term mortality data were obtained using linkage analysis of hospitalised patients to routinely collected provincial death certification records.

Results: The median age of inpatients was 51 (36-65) years. Twenty nine percent were proven HIV-infected. The overall prevalence of delirium was 12.3%. Multivariate predictors of delirium included: the presence of an indwelling urinary catheter (OR 4.37, CI 2.36-8.03), admission with a central nervous system disease (OR 4.37, CI 2.39-7.98), pre-existing cognitive impairment (OR 2.72, CI 1.11-6.64) and admission with a terminal disease (OR 3.11, CI 1.09-8.89). HIV infection was not associated with increased risk of delirium. Delirium was associated with an increased risk for in-hospital (delirium vs. no delirium: 29% vs 12%; $p < 0.01$) and 12-month mortality (30% vs 20%; $p < 0.01$), as well as increased length of hospital stay (7 days vs 5 days, $p < 0$ .01).

Conclusion: In this cohort of medical in-patients (with a relative young age and high HIV prevalence,) one in eight (12.3%) are delirious**..** Delirium was associated with adverse outcomes. Delirium risk factors in this young cohort are similar to those in geriatric cohorts in developed countries, and neither HIV nor opportunistic infections increased risk.

DECLARATION

I, **Daniël Francois du Plooy**, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.
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Date: 20 January 2020

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CONTRIBUTIONS

A/Prof Raubenheim and A/Prof Peter developed the orinigal validation portion of the RACY study. Faried Abdullah, Cascia Day, Nadia Vorajee and Caryn April enrolled participants and collected the original study data. A/Prof Raubenheimer and Niel du Plooy developed the study protocol. Kathryn Manning and Niel du Plooy analysed study data. Niel du Plooy wrote the initial drafts of the report and MMed dissertation. All authors reviewed and approved the final drafts.

INTRODUCTION

Delirium is disorder of cerebral dysfunction, frequently encountered in acutely ill patients, and especially among elderly patients. The Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-V) considers the following constellation of features diagnostic of delirium: disturbance in attention and awareness; disturbance in cognition and higher functioning; a short onset and fluctuating course; a clear precipitant must be identified, whether an acute illness, drug intoxication or withdrawal; with no other neurocognitive disorder identified to account for presentation.[1,2] Many precipitating factors for delirium have been described, including, many neurological conditions, local and systemic sepsis, metabolic derangements, pain, and iatrogenic interventions (e.g. surgical procedures and catheterisation). Premorbid cognitive dysfunction is an important risk factors for delirium. [3-7]

Delirium is common amongst medical in-patients, with rates of 11- 42% reported. [3,7-9] The higher prevalence is found amongst geriatric populations[10,11] and intensive care units.[12] There are very few studies of delirium in unselected patients, particularly from low- and middle-income countries undergoing epidemiologic transitions, where there may be a greater burden of infectious disease including HIV, and relatively younger age of onset of non-communicable diseases (NCDs). A 2015 systematic review on delirium in Sub-Saharan Africa described the scarcity of literature, with reported cohorts being very small; there were also technical difficulties with regards to terminology, diagnostic criteria and reporting of these studies. In contrast to high-income countries, patients were younger and more likely to have infectious precipitants.[13]

Delirium has been associated with adverse outcomes including longer hospital stays, higher rates of re-admission, and increased short and long-term mortality. Consequently, there are greater individual, social and monetary implications associated with delirium.[3,8,14-22] Early management of delirium has been associated with shorten delirium duration and hospital length of stay, as well as improved functional outcomes.[23,24] Recognition of risk-factors is an important aid in the prevention of incident delirium. Measures to improve delirium assessment and management may have benefits in terms of improving healthcare for in-patients[25,26], and incident delirium is used as part of quality assurance in many hospitals. Nevertheless, delirium is often undiagnosed in busy clinical settings.[27]

We therefore aimed to describe the prevalence, risk factors and short- and long-term outcomes for patients admitted with a delirium to the acute medical service of two public hospitals in Cape Town, South Africa. Such knowledge would provide much needed data from a low-middle income country with a high background prevalence of HIV and NCDs.

METHODS

Study design and setting

This is a prospective cohort study of acute medical admissions from 11 November 2013 to 7 March 2014, at two university affiliated hospitals serving the Metro West area of Cape Town, South Africa. Groote Schuur Hospital has approximately 120 acute medical beds and serves as a tertiary referral centre; the majority of acute admissions are however admitted from the emergency department as "walk-ins", a minority are referred from other hospitals in the areas for more specialised care. Victoria Hospital has 80 acute medical beds and is a district level hospital. Acutely admitted patients in both hospitals are largely admitted to undifferentiated general medical wards under a single specialist consultant-run team.

Participants

Ten participants were randomly selected (using a electronic randomising sequence) from each day's acute general medical admissions (daily intake total between 15-25 patients per day). Patients younger than 18 years old, patients withholding consent, aphasic patients, and patients with GCS < 12/15 were excluded.

Delirium assessment

Within 24 hours of admission, a study physician reviewed the patient's charts and obtained data pertaining to the patient's primary diagnosis, clinical background, admission medication, level of education, and demographic characteristics. An independent study neuropsychologist then assessed the patient for delirium using the confusion assessment method (CAM) performed during a 20-30-minute interview consisting of formal cognitive testing and also assessed delirium in conjunction with the study physician according to Diagnostic and Statistical Manual Fourth Edition (DSM IV) criteria. For all testing tools the presence of language barriers was noted, or a ward-based translator was used, when possible, so that testing was performed in the patients' first language.

Demographic data, presenting complaint, primary admission diagnosis and potential associates of delirium available from routine patient assessment were recorded from the patient, relatives and referring physician. Data on pre-admission functional status (in the form of Barthel Index of Activities of Daily Living), chronic medications at the time of admission, co-morbidities and blood results were collected. Although not a formal assessment tool for frailty, we used the Barthel Index as a marker for frailty as it refers to independence, functionality, mobility and strength, many of which are utilised in frailty scores. For analysis purposes we dichotomised laboratory values to clinically valuable "normal" or abnormal" results. For serum creatinine a simple round number cut off of 100µmol/L was used, signifying renal impairment in most people. Co-morbidities were defined as any pre-existing medical or surgical condition, present prior to the current admission. Data on HIV status, pre-existing cognitive impairment, depression, visual/hearing impairment, and drug/alcohol abuse were also recorded where available. Pre-existing cognitive impairment was defined as any patient history suggesting cognitive decline prior to admission. Depression was defined as any patient history suggesting depressive symptoms present prior to the current admission. For analysis and reporting purposes, diagnoses were categorised as either communicable and non-communicable and classified into major and common groups for ease of reporting using ICD10 code grouping.

Outcomes

Length of hospital stay, in-patient mortality and 12-month mortality data were obtained from patient folders, the hospital electronic patient management system and the Western Cape Provincial death registry which links a unique patient identification number with national death certificate records and system wide electronic records. Patients in whom no death record were available were deemed "Alive".

Statistical methods

All data were analysed using in Stata 14 (Statacorp, TX, US). Categorical variables were summarized as frequencies and percentages and continuous variables as medians with inter-quartile ranges (IQR) if non-parametric. Socio-demographic, clinical characteristics and outcomes were assessed for differences between those with delirium and those without. Associations between categorical variables were analysed using the chi-square test and

Fisher's exact, as appropriate. Wilcoxon rank-sum or Kruskal-Wallis test was used to compare continuous variables between two and three groups respectively.

Univariable and multivariable logistic regression analysis were performed to identify risk factors for delirium. Risk factors that were strongly associated with delirium in the univariable analysis ($p < 0.05$) were retained in a multivariable logistic regression model. Kaplan Meier survival curves for delirious vs non-delirious patients were compared using the Log-Rank test. A $p < 0.05$ was regarded as statistically significant.

RESULTS

1027 participants from all admissions were screened for inclusion into the study of which 138 were excluded for the following reasons: 43 had a depressed level of consciousness with GCS < 12/15, 35 were not admitted directly into a general medical ward or transferred to another discipline, 47 were aphasic, 2 were deaf and could not effectively be tested, and 8 demised before testing. A further 84 patients were not included in the final analysis: 49 had missing data and 35 refused consent. 808 participants were included in the analysis.

Patient demographics (Table 1)

The median (IQR) age was 51 (36-65) years; only 17.7% of participants were older than 70 years. The cohort had equal gender distribution, with 52% female. The most frequent admission diagnoses were non-communicable disease of the cardiovascular (n=170), central nervous (n=86) and respiratory systems (n=76), followed by pulmonary tuberculosis (n=60) and non-tuberculous respiratory infections (n=58). The majority of patients were on chronic medication pre-admission (n=581, 72%), and 29% were using more than six chronic medications

Delirium prevalence using either the DSM-IV or CAM reference methods did not differ significantly; thus, the results are presented using the CAM reference method. The overall prevalence of delirium was 12.3%. Patients with delirium were older (median age 55 vs 51 years), were more likely to be "frail" (19% had pre-admission Barthel Score of < 50) and were more likely to have pre-existing predisposing factors for delirium such as cognitive impairment (14%), a terminal illness (9%) or a urinary catheter at home (30%). The prevalence of an infection as primary admission diagnosis was similar in the delirium and

non-delirium cohorts. Patients with delirium were more likely to have been admitted primarily because of a neurologic disease (***Table 1***).

Twenty-nine percent of our cohort were confirmed HIV-infected with a median CD4 count of 150 (IQR 66-132) cells/mm^3. The median age of HIV-infected patients was lower than HIV-uninfected patients [36 (IQR 30 – 44) vs. 52 (IQR 38 – 65) years, $p < 0.01$], there was a greater female predominance (n = 110, 60%) and a different profile of primary admission diagnoses, with a predominance of communicable diseases. In HIV-infected patients the prevalence of delirium was 13% and did not differ significantly from HIV-uninfected patients (***Supplementary Table 1 reports on patients by HIV status***).

Predictors of delirium

Table 2 shows univariable and multivariable logistic regression analysis of factors associated with delirium. After adjustment for co-variates, the multivariate predictors of delirium were presence of an indwelling urinary catheter (OR 4.37, CI 2.36-8.03), admission with a central nervous system disease (OR 4.37, CI 2.39-7.98), pre-existing cognitive impairment (OR 2.72, CI 1.11-6.64) and admission with a terminal disease (OR 3.11, CI 1.09-8.89). Neither HIV status, infection as the admission diagnosis, age, number of comorbidities, number chronic medications or any other laboratory abnormality were statistically significant in predicting delirium in this cohort.

Outcomes

Greater risk for adverse outcomes was seen with delirium (***Table 3***). The median length of hospital-stay was longer in patients with delirium (7 days vs. 5 days for patients without delirium, $p < 0.01$). In-patient mortality (29% vs 12%; $p < 0.001$) and 12-month mortality (30% vs 20%; $p < 0.014$) were greater in patients with delirium. ***Figure 1*** shows the Kaplan Meier survival curves for patients with and without delirium. Survival was significantly better without delirium (log-rank p=0.008), with the majority of difference associated with greater early mortality in patients with delirium.

DISCUSSION

Delirium was common in this young cohort, diagnosed in 1 in every 8 patients admitted acutely to general medical wards in two public sector hospitals in Cape Town, South Africa. The predisposing factors for delirium were similar to those reported from geriatric cohorts, and included: premorbid cognitive impairment, presenceof a terminal illness, presence of an indwelling urinary catheter, age older than 70 years, immobility, and renal impairment (creatinine >100umol/l); the latter 3 variables not being retained in a multivaraiable model. We choose 70 years as a cut-off as it was collected in the original study as a risk factor for delirium. This age cut-off is frequently cited in literature on delirium. The only category of admission diagnosis associated with delirium was that of a disease of the central nervous system. Despite the high prevalence of HIV, HIV status was not associated with an increased risk of delirium, and neither were HIV-associated opportunistic infections. Admission delirium was associated with increased mortality, with differences predominantly associated with increased early mortality, although the difference was still evident up to 12-months post-discharge.

The overall rate of delirium in this study was 12.3%, falling within the range reported in international literature. [3,7-9] Importantly though, the composition of this cohort is distinct from the majority of published reports, and more generalisable to other low-middle income countries (LMIC). A 2006 systematic review by *Siddiqi et al.* looked at the occurrence and outcome of delirium in medical in-patients. In this review the mean age was older than 70 years in 31 of the 33 cohorts in which age was reported, and HIV infection rates were not reported in any of the included cohorts.[8] In contrast, our median age was 50 years. Our study population is also unique by virtue of the higher incidence of HIV and HIV-related illnesses. [28,29] In spite of this, in our cohort HIV-status was not associated with increased risk for delirium. This is in contrast to a systemic review by *Paddick et al.* who consistently found HIV positivity to have a higher association with delirium.[30]

The study has several strengths. It is the largest prospective study amongst acute general medical admissions in a low middle-income country. South Africa's dual burdens of communicable and non-communicable diseases make it an important setting to consider delirium prevalence, risk factors and outcomes.[31] Reference testing was robust using well validated tools and performed by experienced neuropsychologists. Limitations included that national death certification records were not accessed – patients that moved province and

died would thus have not been identified as such. We lacked a very detailed assessment of comorbidities, such as Charlson Index or comorbidity–polypharmacy score. This may have allowed a better understanding of the interplay between premorbid functioning, predisposing factors, precipitants and the development of delirium. We also did not capture data on readmission rates and functional status post-discharge. Such information might have further demonstrated that range of long-term sequelae in patients with delirium. Furthermore, different data are represented in different cohorts. This, together with the paucity of data for Sub-Saharan Africa makes it difficult to draw a direct correlation between our cohort and other cohorts. Unfortunately, this distracts from the generalisability of our results.

In conclusion, our study informs acute general medical practice in LMICs. Delirium is common in this setting, an important predictor of morbidity and mortality. Like heart failure, respiratory failure and renal failure, “brain failure” should be awarded similar status. Delirium is underrecognized. There should be greater emphasis in the clinical training of doctors, nurses and carers, and members of allied health services to effectively screen for delirium and to ameliorate risk factors. As an important quality indicator, efforts should be made to ensure early detection and management. Research into why patients who develop delirium have worse outcomes should be explored.

TABLES

Table 1: Characteristics for the overall cohort, stratified by presence/absence of delirium

	Overall n = 808	**No delirium n = 709**	**With delirium n = 99**	**p-value**
Age: median(IQR)	51 (36-65)	50.52 (35-65)	54.93 (40-70)	0.03
Female: (%)	418 (52)	372 (52)	46 (46)	0.26
Education: (n=765)				
Education in years, median(IQR)	9 (7-11)	9 (7-11)	9 (7-11)	0.39
< 7 years (%)	167 (22.00)	150 (22)	17 (23)	0.80
Communication barriers present[1](%)				
Deafness	12 (1)	8 (1)	4 (4)	0.05
Dysphonia	6 (1)	6 (1)	0 (0)	0.46
Language barrier	51 (6)	41(6)	10 (10)	0.10
Visual impairment	18 (2)	12 (2)	6 (6)	0.02
Dysarthria	36 (4)	27 (4)	9 (9)	0.02
Risk factors for delirium: (%)				
Age > 70 years	143 (18)	118 (17)	25 (25)	0.04
Presence of cognitive impairment	39 (5)	26 (4)	13 (14)*	< 0.01
Terminal illness	23 (3)	14 (2)	9 (9)*	< 0.01
Depression	60 (7)	53 (7)	7 (7)	0.57
Indwelling urinary catheter	79 (10)	50 (7)	29 (30)*	< 0.01
Immobility	108 (14)	83 (12)	25 (27)*	< 0.01
Number of comorbidities	2 (1-3)	2 (1-3)	3 (2-4)*	< 0.01
More than 3 comorbidities	355 (44)	300 (42)	55 (56)	0.01
Barthel Index < 50	36 (5)	18 (3)	18 (19)*	< 0.01
Diagnostic category – 4 most frequent categories: (%)				
Communicable diseases:				
Pulmonary TB	60 (7)	53 (8)	7 (7)	0.54
Respiratory infections	58 (7)	48 (7)	10 (10)	0,.6
HIV-related infections	24 (3)	20 (3)	4 (4)	0.34
GIT infections	23 (3)	20 (3)	3 (3)	0.55
Non-communicable diseases:				
Cardiovascular disease	170 (21)	160 (23)	10 (10)*	< 0.01
CNS diseases	86 (11)	63 (9)	23 (23)*	< 0.01
Respiratory diseases	76 (9)	75 (11)	1 (1)*	< 0.01
Renal diseases	48 (6)	41 (6)	7 (7)	0.61
HIV status:				
HIV positive (%)	183 (29)	159 (29)	24 (32)	0.51
CD_4 (cells/µL) median(IQR)	150 (66-312)	155 (66-313)	113 (60-282)	0.73

Chronic medications: (%)				0.93
None	227 (28)	198 (28)	29 (29)	
1-5 drugs	349 (43)	307 (43)	42 (42)	
> 6 drugs	232 (29)	204 (29)	28 (28)	
Admission investigations - median (IQR):				
Sodium (mmol/L)	139 (136-142)	139 (136-142)	140 (136-144)	0.08
Potassium (mmol/L)	4.63 (4.16-5.20)	4.63 (4.20-5.18)	4.59 (4.03-5.21)	0.47
Urea (mmol/L)	7.3 (4.9-9.3)	7.2 (4.8-9.1)	8.3 (6.0-15.5)*	< 0.01
Creatinine (µmol/L)	85.5 (68.0-99.0)	85.0 (67.0-98.0)	91.0 (74.0-195.0)*	< 0.01
Haemoglobin (g/dL)	11.90 (9.70-14.1)	11.90 (9.60-14.20)	11.20 (9.70-13.70)	0.33
White cell count (cells/ µL)	9.13 (7.40-10.07)	9.18 (7.44-9.98)	9.03 (7.15-11.70)	0.99

- *Data are presented as n (%, rounded to nearest %) or median (IQR)*

** P < 0.01. P values for differences between those with and without delirium, calculated from Fisher's exact, Pearson chi^2, or Wilcoxon test as appropriate*

Table 2: Univariable and Multivariable analysis of predictors of delirium

Variable	Univariate OR (95% CI)	p-value	Multivariate OR (95% CI)	p-value
Male gender:	1.27 (0.83-1.94)	0.264		
Risk factors:				
Age > 70 years	1.69 (1.03-2.77)	0.037*	1.23 (0.66-2/31)	0.520
HIV-infected	1.19 (0,71-2.00)	0.514		
Visual Impairment	2.3 (0.73 – 7.21)	0.18		
Depression	0.97 (0.42-2.2)	0.94		
Pre-existing Cognitive impairment	4.16 (2.06-8.41)	<0.01*	2.72 (1.11-6.64)	0.029*
Immobility	2.80 (1.67-2.68)	<0.01*	1.86 (1.00-3.48)	0.051
Terminal illness	5.07 (2.13-12.06)	<0.01*	3.1 (1.09-8.89)	0.034*
Indwelling catheter	4.54 (2.61-7.93)	< 0.01*	4.37 (2.39-7.98)	<0.001*
Admission diagnosis – 4 most frequent categories:				
Communicable diseases:				
Pulmonary tuberculosis	0.94 (0.42-2.13)	0.886		
Respiratory infections	1.55 (0.76-3.17)	0.232		
HIV-related infections	1.45 (0.49-4.33)	0.505		
Gastrointestinal infections	1.08 (0.31-3.69)	0.907		
Non-communicable diseases:				
Cardiovascular disease	0.39 (0.20-0.76)	<0.01		
Central nervous system diseases	3.10 (1.82-5.29)	<0.01*	4.36 (2.39-7.98)	<0.001*
Respiratory diseases	0.09 (0.12-0.63)	0.016		
Renal diseases	1.24 (0.54-2.84)	0.612		
Admission investigations:				
Sodium (ref: 136-144 mmol/L)				
Serum sodium < 135 mmol/L	1.05 (0.60-1.86)	0.863		
Serum sodium > 145 mmol/L	2.54 (1.29-5.00)	<0.01*	1.68 (0.75-3.78)	0.209
Potassium (ref: 3.6-5.2 mmol/L)				
Serum potassium < 3.5 mmol/L	0.86 (0.33-2.26)	0.765		
Serum potassium > 5.3 mmol/L	0.79 (0.44-1.43)	0.441		
Serum creatinine > 100 µmol/l	2.10 (1.33-3.32)	<0.01*	1.67 (0.96-2.88)	0.067
Serum urea > 7 mmol/L	1.45 (0.942.25)	0.095		
Haemoglobin < 12.5 g/dL	1.44 (0.93-2.23)	0.103		
White cell count (ref: 4000-11999 mmol/L)				
White cell count > 12 000 cells/µL	1.28 (0.77-0.12)	0.336		
White cell count < 4 000 cells/µL	0.66 (0.08-5.17)	0.691		
> 6 admission drugs	0.98 (0.61-1.56)	0.92		

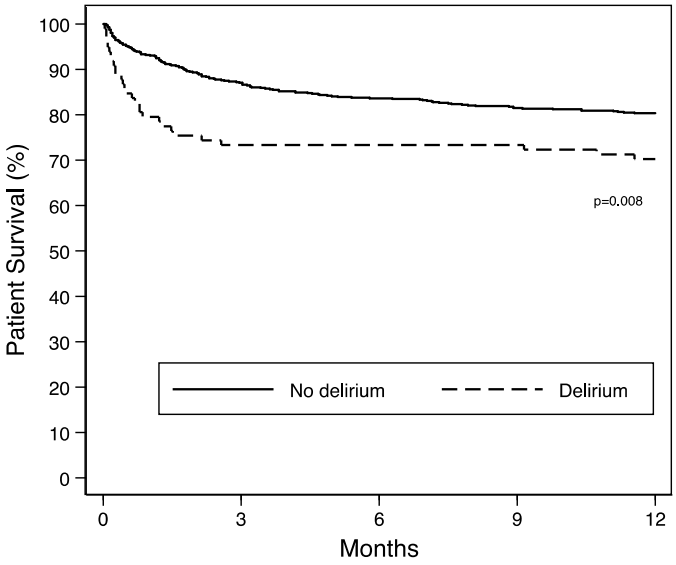
Table 3: Outcomes of patients with and without delirium

Variable	Total	No delirium n (%)	With delirium (n)	p-value*
Length of stay – median (IQR):	5 (3-9)	5 (3-9)	7 (4-12)	0.001
In-patient mortality (%):	41 (5)	29 (4)	12 (12)	0.001
3-month mortality (%):	135 (17)	105 (15)	30 (30)	<0.001
12-month mortality (%):	169 (21)	139 (20)	30 (30)	0.014

** Wilcoxon rank-sum test*

*** Pearson chi^2 test*

Figure 1: Kaplan Meier Survival curves for delirious vs non-delirious patients



SUPPLEMENTARY TABLES

Supplementary Table 1: Patient characteristics by HIV status

Characteristics:	**Total (n = 786)***	**HIV negative (n = 444)**	**HIV not tested (n = 159)**	**HIV positive (n = 183)**
Age median(IQR)	51.42 (35.66-65.34)	51.42 (35.66-65.34)	65.95 (55.41-75.25)	35.74 (30.39-44.17)
Female n(%)	315 (50.24)	205 (46.17)	94 (59.12)	110 (60.11)
< 7 years school n(%)	124 (20.84)	91 (21.51)	91 (25.33)	33 (19.19)
Communication barriers: n(%)				
Deafness	4 (0.64)	3 (0.68)	8 (5.03)	1 (0.55)
Dysphonia	5 (0.80)	4 (0.90)	1 (0.63)	1 (0.55)
Language barrier	45 (7.18)	19 (4.28)	5 (3.14)	26 (14.21)
Visual impairment	12 (1.91)	11 (2.48)	5 (3.14)	1 (0.55)
Dysarthria	23 (3.67)	19 (4.28)	11 (6.92)	4 (2.19)
Risk factors: n(%)				
Cognitive impairment	23 (3.69)	17 (3.85)	15 (9.49)	6 (3.30)
Age > 70 years	71 (11.32)	66 (14.86)	67 (42.14)	5 (2.73)
Terminal illness	22 (3.53)	13 (2.93)	0 (0.00)	9 (4.97)
Depression	47 (7.54)	36 (8.16)	10 (6.29)	11 (6.04)
Visual impairment	14 (2.24)	10 (2.26)	3 (1.89)	4 (2.20)
Indwelling catheter	53 (8.48)	38 (8.58)	21 (13.21)	15 (8.24)
Immobility	70 (11.27)	57 (12.90)	33 (21.29)	13 (7.26)
3+ comorbidities	238 (37.96)	171 (38.51)	105 (66.04)	67 (36.61)
Barthel index < 50	24 (3.86)	20 (4.52)	10 (6.45)	4 (2.22)
NCD's: n(%)	395 (63.00)	330 (74.32)	125 (78.62)	65 (35.52)
Central nervous system	62 (9.89)	55 (12.39)	20 (12.58)	7 (3.83)
Cardiovascular system	108 (17.22)	91 (20.50)	55 (34.59)	17 (9.29)
Respiratory system	65 (10.37)	55 (12.39)	11 (6.92)	10 (5.46)
Gastrointestinal system	12 (1.91)	11 (2.48)	2 (1.26)	1 (0.55)
Psychiatric illness	4 (0.64)	4 (0.90)	0 (0.00)	0 (0.00)
Fluid and electrolyte abnormalities	15 (2.39)	14 (3.15)	4 (2.52)	1 (0.55)
Drug and alcohol related conditions	13 (2.07)	9 (2.03)	1 (0.63)	4 (2.19)
Cancer	17 (2.71)	13 (2.93)	6 (3.77)	4 (2.19)
Renal system	40 (6.38)	36 (8.11)	7 (4.40)	4 (2.19)
CD's:	213 (33.97)	100 (22.52)	24 (15.09)	113 (61.75)
Central nervous system infections	17 (2.71)	5 (1.13)	1 (0.63)	12 (6.56)
Extrapulmonary TB	15 (2.39)	4 (0.90)	0 (0.00)	11 (6.01)
Pulmonary TB	58 (9.25)	33 (7.43)	2 (1.26)	25 (13.66)
TB meningitis	9 (1.44)	0 (0.00)	0 (0.00)	9 (4.92)
HIV-related illnesses	24 (3.83)	1 (0.23)	0 (0.00)	23 (12.57)
Urogenital infections	6 (0.96)	6 (1.35)	3 (1.89)	0 (0.00)
Gastrointestinal infections	18 (2.87)	12 (2.70)	5 (3.14)	6 (3.28)
Respiratory infections	41 (6.54)	27 (6.08)	12 (7.55)	14 (7.65)
Drugs:				
No drugs	201 (32.06)	140 (31.53)	0 (0.00)	61 (33.33)
1-5 drugs	269 (42.90)	176 (39.64)	0 (0.00)	93 (50.82)
> 6 drugs	157 (25.04)	128 (28.83)	64 (40.25)	29 (15.85)
Admission bloods:				
Sodium (mmol/L)	139 (136-142)	139 (136-142)	140 (138-143)	137 (132-140)

135-145	430 (72.51)	332 (78.30)	122 (83.56)	98 (57.99)
<135	128 (21.59)	65 (15.33)	10 (6.85)	63 (37.28)
>145	35 (5.90)	27 (6.37)	14 (9.59)	8 (4.73)
Potassium (mmol/L)	4.63 (4.16-5.20)	4.63 (4.16-5.20)	4.75 (4.34-5.23)	4.48 (4.02-5.05)
3,5-5,3	460 (76.54)	327 (76.22)	113 (75.33)	133 (77.33)
<3,5	36 (5.99)	24 (5.59)	6 (4.00)	12 (6.98)
>5,3	105 (17.47)	78 (18.18)	31 (20.67)	27 (15.70)
Urea (mmol/L)	7.30 (4.90-9.30)	7.30 (4.90-9.30)	8.50 (6.60-9.80)	5.90 (4.10-8.30)
<7	300 (50.34)	196 (46.23)	43 (29.25)	104 (60.47)
>7	296 (49.66)	228 (53.77)	104 (70.75)	68 (39.53)
Creatinine (µmol/L)	85.5 (68-99)	85.50 (68-99)	94.5 (76-149)	80 (60-94)
>100	113 (18.62)	96 (22.22)	53 (35.33)	17 (9.71)
Haemoglobin (g/dL)	11.90 (9.70-14.10)	11.9 (9.7-14.1)	12.7 (9.8-14.4)	9.90 (9.30-12.25)
<12,5	348 (58.00)	213 (50.24)	69 (46.31)	135 (76.70)
White cell count ($x10^9$/L)	9.13 (7.40-10.07)	9.13 (7.40-10.07)	9.63 (8.46-12.39)	8.03 (6.10-9.39)
Normal	485 (80.17)	327 (76.40)	110 (73.83)	158 (89.27)
Leukopenia	12 (1.98)	8 (1.87)	0 (0.00)	4 (2.26)
Leukocytosis	108 (17.85)	93 (21.73)	39 (26.17)	15 (8.47)
Diagnosis of delirium:				
CAM	99 (12.3)	50 (11.23)	18 (11.46)	24 (13.12)
DSM-IV	108 (13.5)	55 (12.47)	19 (12.10)	27 (14.84)

**22 participants refused HIV testing*

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