

**The association between length of emergency department  
boarding and hospital length of stay for patients with mental health  
and behavioural disorders**

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## **Acronyms and abbreviations**

CI	Confidence interval
EC	Emergency centre
ED	Emergency department
HECTIS	Hospital and Emergency Centre Tracking Information System
HREC	Human Research Ethics Committee
ICD-10	International Statistical Classification of Diseases and Related Health Problems 10 <sup>th</sup> revision
LOS	Length of stay
SATS	South African Triage Scale
SD	Standard deviation
UCT	University of Cape Town
WHO	World Health Organisation

## Section A: Literature Review

## Introduction

Psychiatric boarding has been described internationally by hospital and Emergency Department managers as the number one problem of their Emergency Departments.(1) Despite there being no consensus regarding the definition, psychiatric boarding commonly refers to the time spent waiting in an Emergency Department for an inpatient hospital bed or for transfer to another facility.(2) Although boarding of patients in general is a common challenge globally, patients with mental and behavioural disturbances tend to be disproportionately affected with boarding times reported up to three times longer.(2,3) This, together with the fact that they are 2.5 times as likely to require admission, results in very long Emergency Department length of stays with significant clinical consequences.(4)

### *Aim and Objectives of literature review*

The aim of the literature review is to describe the burden and epidemiology of psychiatric boarding, as well as to explore improvement strategies.

The objectives of literature review are:

- i. To define psychiatric boarding and describe the variations thereof as used in different settings.
- ii. To explore the burden of psychiatric boarding in both high-income countries and low- to middle-income countries
- iii. To describe the effects of psychiatric boarding on the mental health care user, as well as on the staff and hospital
- iv. To explore and collate contributing factors of psychiatric boarding in emergency departments
- v. To describe improvement strategies that have been implemented to decrease the burden of psychiatric boarding.

### *Literature review strategy, inclusion, and exclusion criteria*

The literature search was sourced from the following online medical and scientific databases: PubMed, Scopus, EMBASE, Google Scholar and NCBI. Search criteria depended on the limitations and options from the various databases but included combinations of the following groups: *mental health* OR *psychiatric* OR *psychiatry*; *boarding* OR *boarders* OR *length of stay*; *emergency centre* OR *emergency department*; *decentralisation* OR *decentralization*; *burden* OR *epidemiology*; *improvement* OR *intervention* OR *solution*. For PubMed, MeSH major topics and MeSH terms used included *mental health*, *psychiatry*, and *length of stay*.

Search results were further narrowed by applying the following criteria: only English articles; articles published in peer reviewed journals only and articles within 20 years since publication (i.e., Jan 2000). Article in the press (available online) at the time of the search (December 2020), but not published yet, were also included. Abstracts and titles of studies identified by the search criteria were reviewed individually and full text articles were obtained for those considered relevant. Full text articles that were not available online via the university portals, were sourced directly from University of Cape Town Library. References of included articles were also screened for potential articles that were missed by the criteria (snowballing). No formal quality assessment of articles was performed as this is not a requirement for the MPhil degree. All articles were however screened for applicability and relevance, and whether the results were internally and externally valid. Two more articles were included after December 2020 because of their significant relation to the topic (both published in 2021).

## Summary of literature reviewed

### *Definition of psychiatric boarding*

*Psychiatric boarding* has no standard definition but generally refers to the time spent waiting in an Emergency Department for an inpatient hospital bed or for transfer to another facility by patients with mental and behavioural disorders.(2) Other definitions include length of stay, for example more than four hours as described by the American College of Emergency Physicians and more than 24 hours as described by Susan Stefan, one of the most highly regarded experts on mental disability law in the United States of America.(5,6) In most settings six hours is used as the threshold for boarding status.(7,8) The current guidelines of the Western Cape Health Department as stipulated in Circular H221 of 2014 recommends that the process for patients with mental and behavioural disorders from presentation to an Emergency Department (ED) to admission to an inpatient bed should not take longer than six hours.(9) This however refers to the ED length of stay and not the boarding time - two different concepts that are often muddled in reports and guidelines. Patients with mental and behavioural disorders that present to an Emergency Department require a clinical assessment to: (i) assess whether or not the symptoms are caused or exacerbated by a general medical condition; (ii) assess and stabilise any acute medical condition and (iii) determine whether or not the patient is intoxicated.(10,11) This process is also known as *medical clearance* and various guidelines exist to ensure that special investigations are targeted and not wasteful.(10,11) It is only after this process has been completed that the decision to admit patients with mental and behavioural disorders is made.(10)

### *Burden and extent of psychiatric boarding*

Boarding of patients with mental and behavioural disorders in EDs remains a global challenge affecting hospitals across all income and resource categories. An American College of Emergency Physicians survey of 328 directors of EDs in 2008 found that 79% of patients with mental health emergencies boarded in Emergency Departments across the United States of America; 55% had psychiatric boarders on a daily basis and 62% reported that psychiatric boarders receive no psychiatric services while in the Emergency Department. (12,13) The reported boarding times ranged from 6.8 hours to 34 hours and the odds of boarding for psychiatric patients were 4.8 times higher than non-psychiatric patients.(13) This, together with the fact that they are 2.5 times more likely to require admission, results in very long Emergency Department length of stays with significant consequences.(4) A

retrospective study by Nicks et al.(3) from EDs in the United States of America demonstrated that psychiatric patients awaiting inpatient placement remain in the Emergency Department 3.2 times longer than non-psychiatric patients, preventing 2.2 bed turnovers per psychiatric patient. A recent study by Nolan et al. found that EDs in the United States of America experience high rates and durations of boarding with psychiatric patients disproportionately affected.(7) They found that 11% of all Emergency Department patients boarded (Emergency Department length of stay of more than 6 hours) in comparison to 21.5% of psychiatric Emergency Department patients.(7) Psychiatric boarding times varied depending upon local community outpatient and inpatient resources. In Maryland for instance, psychiatric boarding lasted for several days, while in California, average boarding times were as low as 10 hours.(14) To date, no comprehensive nationwide evaluation and quantification of the burden of psychiatric boarding in South Africa and in Africa, has been done.

The burden of psychiatric boarding in EDs is likely to get worse as the prevalence of mental health conditions is increasing with a subsequent increase in Emergency Department visits.(4,15) In the United States of America it has been reported that the overall utilisation of EDs has increased by 14.8% between 2006 and 2014, with mental health or substance related presentations increasing by 44.1% with 31.8% requiring admission.(16) This is as a result of a wider mental health care delivery crisis and a failure of the outpatient care system.(17) In the United States of America, the 1960's marked the beginning of an era of deinstitutionalisation of patients with mental and behavioural disorders and the number of inpatient psychiatric beds were drastically reduced. Between 1970 and 2006 it was reduced from approximately 400 000 to 50 000 and between 62% and 89% of existing beds in state and county psychiatric hospitals.(7) The Community Mental Health Act of 1963 (US) recommended that the emphasis of caring for persons with mental disorders be shifted away from state-run facilities and toward both in- and out-patient community-based treatment facilities.(13) Most countries in Africa have followed a decentralisation strategy for some time, embracing the policy of integration of mental health services into general health as the most cost-effective way to deliver services.(18) The situation on the ground however does not reflect the optimistic policies and programmes and substantial gaps in service delivery remain.(18,19) A systematic review of mental health service delivery in South Africa from 2000 to 2010 suggests that while some progress was made in delivering decentralised care for patients with mental and behavioural disorders, insufficient resources to support community-based care is hampering service delivery, resulting in the classic revolving-door phenomenon – a term used to describe frequent readmissions of a subset of mental health users.(19)

More than 80% of people with mental health disorders reside in low- and middle-income countries (LMICs) with mental illness and substance abuse disorders contributing to 8.8% and 16.6% of the total burden of disease respectively.(20) Mood- and psychotic disorders, together with alcohol abuse disorders represent nearly 20% of all disability related to health conditions in LMICs and people with a low socioeconomic status are 8 times more likely to develop schizophrenia than people with a middle or a high socioeconomic status.(20) The 12-month and lifetime prevalence of mental health disorders in South African adults is 16.5% and 30.3% respectively.(21) The Western Cape has the highest 12-month and lifetime prevalence (39.4%) of mental health disorders in South Africa with the prevalence of anxiety, mood and substance disorders being 18.9%, 13.7% and 20.6% respectively.(21) Despite the significant contribution to the burden of disease and disability in Africa, mental and behavioural disorders generally enjoy less than 1% of the already small national health budgets.(22,23) Although advances in mental health care in South Africa have been made, it is still regarded as a very low priority and consequently attains minimal resource allocation.(18,24)

### *Effects of boarding*

It is widely recognised that Emergency Department boarding leads to increased morbidity and mortality for all Emergency Department patients. (25,26) It consumes Emergency Department resources, prolongs the time patients wait for services and reduces the number of treatment beds available to accommodate surges in demand.(27) A retrospective cohort by Singer et al.(25) of 41 256 hospital admissions at a suburban academic Emergency Department in the United States of America from 2005 to 2008 found that the mortality rate (for all types of Emergency Department patients) increased from 2.5% in patients boarding less than two hours to 4.5% in patients boarding for 12 hours or more. Mean hospital length of stay increased from 5.6 days for those who boarded for less than 2 hours to 8.7 days for those who boarded for more than 24 hours (Boarding was defined as ED length of stay for 2 hours after the decision to admit).(25) Boarding of patients in the Emergency Department is also a major cause and effect of Emergency Department crowding and subsequent adverse outcomes as demonstrated by White et al.(26) in a large retrospective study of 179 840 patients. Median length of stay in the Emergency Department increased with increasing number of boarders with a Spearman correlation of 0.25.(26)

Access block in general is defined as the situation where patients admitted from the Emergency Department have no access to hospital or ward beds, and end up with an unusually long length of stay in the Emergency Department.(28) It leads to crowding which results in a multitude of adverse effects

as described above. Research has explored the relationship between access block of all patients in the Emergency Department and inpatient outcomes, and has found that those who experience access block had a longer inpatient length of stay.(26,28) Richardson et al.(28) found that inpatient length of stay was 0.8 days longer in all patients who experienced access block, which in that specific hospital resulted in over 700 bed-days extra per year. The author does admit though that this access block effect is an association and does not prove causation. The results further suggest that Emergency Department access block of eight hours seems to be the threshold for longer inpatient length of stay.(28)

Patients with mental and behavioural disorders in particular do not receive high quality care while they are boarding in the Emergency Department.(2) Sixty percent of Emergency Department directors in US hospitals report that no psychiatric services are provided during the boarding period, even though they require more nursing care than patients without mental and behavioural disorders.(5) Emergency Department nurses report that they often feel uncomfortable to care for patients with mental and behavioural disturbances because they feel unequipped to care for them with a subsequently negative impact on their job satisfaction. (29,30) Patients with mental health disturbances report that they are aware of the lack of resources and provider comfort and feel that their treatment in the Emergency Department is not a priority. (29,31) Furthermore, the chaotic and noisy Emergency Department environment is far from ideal for patients with mental and behavioural disorders and may further exacerbate their pre-existing condition.(3) Psychiatric boarders are at a greater risk of requiring chemical and physical restraints, with the risk increasing proportionally with Emergency Department length of stay.(32) Medication errors are also prevalent with around 65% of psychiatric boarders not getting medication as prescribed.(33) Physical or verbal assault by patients with mental and behavioural disorders on emergency staff is not uncommon. A study reviewing the epidemiology and effects of violence on Emergency Department staff by patients with mental and behavioural disturbances over a one-year period, found that 21% had witnessed physical threat or assault, 12% had experienced verbal abuse and 10% had been physically threatened.(34) The likelihood of violence increased with an increase in the number of patients in EDs, the presence of patients with a history of violence, the number of female staff members and the number of staff with no psychiatric training.(34)

Psychiatric boarding holds significant financial consequences for Emergency Departments due to a reduction in the bed turnover rate and by consuming Emergency Department resources.(3) Because psychiatric boarders prevent Emergency Department beds from being used for new patients, it

reduces the functional capacity significantly. There is a paucity of data about the financial impact of boarding in LMICs. In 2012, Nicks et al. calculated the average monetary costs to an Emergency Department to board a psychiatric patient to be \$2 264.(3) In an Emergency Department in a high-income setting, with approximately 62 500 annual visits, this can equate to a reduction in 3 175 patients being attended to annually with a potential loss of revenue to the amount of \$3 960 264.(3,27)

### *Factors that contribute to psychiatric boarding*

Factors that contribute to psychiatric boarding are multifactorial and vary depending on the setting with regards to availability of resources such as admission bed capacity, regional patient profile and patient flow dynamics.(13) Although the most cited cause of psychiatric boarding is inpatient bed shortages or access block to existing beds, the problem really incorporates any factor that affects increased psychiatric presentations (input), ineffective Emergency Department throughput and reduced output (access block).(13)

Input: A 2008 survey of 1400 Emergency Department directors by the American College of Emergency Physicians found that 23% of ED directors have no access to accessible community psychiatric resources and 59% had no substance or dual-diagnosis patient services available.(13) The absence of these services leads to no alternative placement options aside from admissions, thus increasing input and bed shortages.(13)

Throughput: Numerous studies assess factors associated with long Emergency Department length of stays and not only the boarding times. Factors that contribute to these time metrics are not necessarily linked – factors affecting boarding times inevitably lead to longer EC length of stays but not vice versa. The most common causes include delays with medical workup or the delays with completing legal forms.(35) Patients who are intoxicated cause pre assessment delays, ultimately leading to an increased length of stay in the Emergency Department.(35) In a prospective study of more than a thousand Emergency Department visits by patients with mental and behavioural disorders, patients with a positive toxicology screen for alcohol, boarded for more than six hours longer than patients with a negative screen.(35) The need for ancillary testing can also contribute to longer boarding times and routine diagnostic imaging or laboratory screening tests are no longer advocated for this reason.(11,36) Because patients with mental health conditions provide emergency clinicians with difficult decisions in time constricted and resource limited environments, they often get admitted unnecessarily, to avoid potential liability issues (for example if patients commit suicide after being

discharged).(37) The odds of boarding increased as age increased, because advancing age may be a proxy for increasing morbidity.(7) Other factors that may increase boarding time for patients with mental and behavioural disorders includes the need for hospitalisation, the use of restraints and the need for diagnostic imaging.(35)

Output: Output factors affecting psychiatric boarding include ambulance availability and consequent delays to provide transport for admitted patients, delays with insurance pre-authorisations and challenges with placement of the severely ill.(13) Added to this, in the public sector, the availability of inpatient beds due to funding cuts, unit closures and bed reductions are the most common contributing factor to psychiatric boarding.(13) A multicentre cohort study in the United States of America in 2010 assessed predictors of psychiatric boarding and found that unfunded patients board significantly longer than those with health insurance.(30) This also applied to those transferred to publicly funded facilities, in comparison to privately funded facilities.(30) This is despite the fact that there were no differences between insured and uninsured patients with regards to the time delay from presentation to decision to admit.(30) Nolan et al. (7) assessed data from 1992 to 2008 across the United States of America and found that uninsured patients, patients from non-metropolitan areas and an active ambulance diversion were significantly associated with psychiatric boarding.(7)

It is difficult to make inferences from data from high-income countries, where most of the existing evidence is drawn from, and to apply it to lower income settings, but considering the huge discrepancy of resource availability, one can assume that the burden and costs involved are at least similarly increased, if not worse. Comparisons between high-income countries (where the majority of research stems from) and low- and middle-income countries reveals that the global average of psychiatrists per 100 000 people is 3.96.(20) In the most densely populated and poorer countries, the number is much lower: Asia 0.301, Africa 0.185, India 0.06 and Pakistan 0.04 respectively.(20)

### *Improvement strategies and potential solutions*

A number of strategies have been proposed globally to improve the throughput of patients with mental and behavioural disturbances presenting to Emergency Departments, and to improve Emergency Department flow dynamics by minimising boarding times.(2) Each strategy or action plan is unique to the situation where it has been developed, taking into account local patient numbers, local resources and in depth situational analysis and needs assessments.(2) A seven point generic action plan was developed in the United States of America and includes the following steps: (i) quantifying the problem; (ii) improvement of Emergency Department care of patients with mental and

behavioural disorders (iii) more efficient use of existing capacity; (iv) implementation of low-cost collaboration; (v) working with law enforcement; (vi) investing into comprehensive community crisis services and (vii) investing in continuity of care.(2) A lack of data in South Africa limits the development of evidence based and locally applicable strategies to help understand and improve the burden of psychiatric boarding, as defining the problem is the first step in any improvement plan.

Patient flow interventions to reduce psychiatric boarding can be divided into factors that reduce Emergency Department input, factors that improve Emergency Department throughput and those that increase and maintain output.(38)

Input: Input can be reduced by improving access to outpatient setting like community health centres, by incentivising or funding programs that reduce first responders from bringing patients with mental and behavioural disturbances to the Emergency Department, and increasing efforts to improve drug and substance usage and access.(38)

Throughput: Interventions to improve outcomes of psychiatric patients boarding in the Emergency Department have been suggested by Nordstrom et al.(13) The interventions are: (i) rapid treatment of agitation; (ii) minimisation of restraint and seclusion use; (iii) rapid identification of medical comorbidities; (iv) active treatment of psychiatric illness; (v) implementation of observation units (vi) active treatment of substance intoxication or withdrawal and (vii) improved coordination and communication around disposition. Other strategies to improve throughput include standardised reporting of mental health data and sharing resources between hospitals.(38)

Output: Increasing output can be obtained by increasing access to inpatient treatment options and beds, incentivising timely and effective hospital bed monitoring systems and ward turnover, and incentivising hospitals to develop and implement discharge processes and outpatient management.(38) Parwani et al.(39) assessed the impact of opening a psychiatric observation unit in a tertiary hospital in the United States of America. It significantly reduced Emergency Department length of stay and boarding times, as well as hospital length of stay.(39) The 12 bedded psychiatric observation unit was designed to observe patients for a maximum of 48 hours to ensue throughput and served as an intermediary to the psychiatric ward. The study concluded that that the creation of the 12 bed capacity psychiatric observation unit improved Emergency Department and acute psychiatric service throughout.(39)

An alternative to boarding of patients in the Emergency Department is inpatient hallway boarding – a strategy where the load is shared by admitting boarders to the ward into inpatient hallways as part of a full-capacity protocol.(40) Inpatient hallway boarding is overwhelmingly preferred by patients to boarding in the Emergency Department, especially by male patients.(40–42) The preference to rather board in inpatient hallways is also correlated with the extent of Emergency Department crowding.(41) The impact of inpatient hallway boarding was investigated by Shoham et al.(43) in a large hospital in Jerusalem and they found that by enabling inpatient hallway boarding in medical wards, lower inpatient mortality was noticed, even though the 30-day readmission rate was higher. Inpatient nurses were more opposed to inpatient hallway boarding than Emergency Department nurses and felt that the lack of monitoring and patient privacy were the most important factors.(44) This strategy is yet to be described in psychiatric wards, even though its practice is widespread according to anecdotal evidence.

New interventions or improvements to psychiatric boarding should be monitored against the readmission rate to ensure that the system as a whole is assessed. The readmission rate of psychiatric patients is considered an indication of the quality of mental health care and is considered the balancing variable for improving length of stay.(45,46) The definition of readmission rate differs globally and thus makes it difficult to compare or benchmark but in general it is described as the proportion of patients that are readmitted after being discharged from a psychiatric service within 30 or 90 days, or even a year.(45–47) The Western Cape Health Department’s definition is guided by provincial policy and is calculated as: “the number of psychiatric patients who are re-admitted for any reason to any hospital within 90 days of discharge from the same hospital or other hospitals”.(48)

Factors that have an effect on readmission rates can be divided into two different groups. Pre-discharge factors relate to the care during the preceding hospital episode, whereas post-discharge factors relate to factors that occurred after discharge, including follow up and community reintegration.(45,46) A systematic review of global literature between 1990 and 2014 found that in 2011 the 30-day readmission rate was 13% for patients with schizophrenia and 11% for those with bipolar mood disorder.(45,46) In Beijing, China a study that investigated factors associated with psychiatric readmission found that the 30-day readmission rate was 17% and the 1 year-readmission rate 34%.(47) Factors that were associated with readmissions included residing in an urban area, medical comorbidities, previous psychiatric admissions, length of stay > 60 days in an index admission and being treated in a tertiary hospital.(47)

Readmissions can be disruptive for families of psychiatric patients and can increase the economic burden on the health system.(45) The most common pre-discharge factor associated with readmission was previous hospitalisation, while results of other factors like length of stay were inconsistent.(45) Another systematic review assessing global literature between 1990 and 2014 found that post-discharge factors associated with readmission can further be divided into four categories: (i) individual vulnerability; (ii) aftercare related factors; (iii) community care and service responsiveness and (iv) contextual factors and social support.(46) Interestingly, a smaller observational study reported that 30% of patients who were readmitted for a second or third time within 90 days had medical reasons for the admission.(49)

### Identification of gaps in the literature

The overwhelming finding of this literature review is the paucity of data in low- and middle-income countries, including South Africa. As Alakeson et al.(2) have summarised, the first step to sustainably improve psychiatric boarding and its contributing factors is measuring the burden and defining the problem. A descriptive study on resources available to manage patients with mental and behavioural disorders should form the basis of an in-depth situational assessment and a descriptive analysis of the burden will inform the needs assessment. Future research should investigate barriers and enablers to data management and surveillance systems and aim to set in motion evidence-based improvements. Definitions and short- and long-term goals of care should be agreed upon by overarching governance committees. Without the above as basis, sustainable cross-platform improvements in psychiatric boarding will not be obtainable. Interventions to improve psychiatric boarding should be followed by qualitative exploration of perceptions of health care staff, patients and their families to aid in understanding its impact and acceptability.

### Conclusion

Psychiatric boarding of patients in Emergency Departments remains a global challenge affecting hospitals across all income and resource categories. The burden of psychiatric boarding is likely to worsen as the prevalence of mental health conditions is increasing with a subsequent increase in Emergency Department visits. Despite the significant contribution to the burden of disease and disability in Africa, mental and behavioural disorders generally enjoy a very small proportion of the already small national health budgets and although advances in mental health care in South Africa

have been made, it is still regarded as a very low priority and consequently attains minimal resource allocation.

A lack of access to community psychiatric resources and substance or dual-diagnosis patient services leads to no alternative placement options aside for admissions, thus increasing input and bed shortages. Input can be reduced by improving access to outpatient setting like community health centres, by incentivising or funding programs that reduce first responders to bring patients with mental and behavioural disturbances to the Emergency Department and increase efforts to improve drug and substance usage and access. Delays with medical workup and completing legal forms leads to an increase in length of stay in the Emergency Department. Older patients, patients who are intoxicated and the use of restraints also affects EC throughput negatively, leading to longer boarding times. Strategies to improve throughput include standardised reporting of mental health data and sharing resources between hospitals. The availability of inpatient beds is the most common contributing factor to psychiatric boarding and leads to access block and a decreased output. Increasing output can be obtained by increasing access to inpatient treatment options and beds, incentivising timely and effective hospital bed monitoring systems and ward turnover, and incentivising hospitals to develop and implement discharge processes and outpatient management. An alternative to boarding of patients in the Emergency Department is inpatient hallway boarding – a strategy where the load is shared by admitting boarders to the ward into inpatient hallways as part of a full-capacity protocol. Attempts to improve Emergency Department boarding may not be sustainable or attainable in low- and middle-income countries without the necessary data, including a description of the burden (needs analysis), a situational assessment to understand available resources and a coordinated plan to improve. Given the wide differences between low- and middle-income vs high-income health settings, perhaps a systems wide analysis of the clinical pathway and access to care for patients with mental and behavioural disorders should be performed to determine what is most cost-effective and equitable. Alternative clinical pathways with access, other than via the Emergency Departments, should be explored, considering the overburdened and under-resourced health systems in low- and middle-income settings.

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**Section B: Manuscript in article format: Emergency Medicine Journal (EMJ)**

Title page

## **An initiative to reduce psychiatric boarding in a district level Emergency Department in Cape Town, South Africa: a cross-sectional analysis.**

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Keywords: psychiatric boarding; access block; emergency medicine; readmission rate; crowding

Funding: The study was self-funded.

STROBE Statement: Observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	B-2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	B-5
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	B-6
	3	State specific objectives, including any prespecified hypotheses	B-7
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	B-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	B-7
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	B-8
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	NA
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	B-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	B-8
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	B-8 to B-9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	B-8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	B-8 to B-9
		(b) Describe any methods used to examine subgroups and interactions	B-9
	(c) Explain how missing data were addressed		
	(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	B-9	
	(e) Describe any sensitivity analyses		

<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	B-10
		(b) Give reasons for non-participation at each stage	B-10
		(c) Consider use of a flow diagram	B-10
Descriptive data	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders	B-10
		(b) Indicate number of participants with missing data for each variable of interest	B-10
		(c) <i>Cohort study</i> —Summarise follow-up time (e.g., average and total amount)	NA
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	NA
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	NA
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	B-10 to B-11
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included	B-11 to B-13
		(b) Report category boundaries when continuous variables were categorized	B-14 to B-15
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	B-16
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	B-17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	B-18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	B-19
Generalisability	21	Discuss the generalisability (external validity) of the study results	
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	B-19

## Abstract

### *Background*

Psychiatric boarding in Emergency Departments is a global challenge. Patients with mental and behavioural disturbances are disproportionately affected with boarding times up to three times longer than other patients. This retrospective cross-sectional study investigated the impact of an initiative to reduce psychiatric boarding on length of stay and readmission rate, as well as exploring the relationship between boarding times and length of stay.

### *Methods*

All adult patients referred over a 24-month period (June 2017 – May 2019) for psychiatric admission from the Emergency Department of a Cape Town district hospital were included. This included a 9-month period prior to the initiative, after which inpatient capacity was increased, and inpatient hallway boarding was implemented. Data relating to admission processes and outcomes were extracted from electronic registries.

### *Results*

In total, 2607 patients were referred for psychiatric admission (2.7% of all Emergency Department patients). The initiative was associated with a decrease of 95% (56 vs 3 hours,  $p < 0.001$ ) in psychiatric boarding times, 13% (16 vs 14 days,  $p < 0.001$ ) in ward length of stay and 25% (20 vs 15 days,  $p < 0.001$ ) in hospital length of stay. Ward length of stays were largely independent of ED boarding times, with a clinically insignificant increase in the >24-hour boarding category (351 vs 360 hours,  $p = 0.047$ ). The readmission rate increased from 12% to 18% post intervention.

### *Conclusion*

A significant improvement in hospital length of stay and psychiatric boarding times occurred after the initiative was implemented. The benefits should be weighed up against a subsequent higher readmission rate. From a lean- and economical perspective, the results of this study suggest that psychiatric boarding equates to waste as it is independent of ward length of stay. The observational nature of this study precludes concrete conclusions and further investigations into psychiatric inpatient hallway boarding are recommended.

## Background

Psychiatric boarding has been described by hospital and Emergency Department (ED) managers around the globe as the number one problem of their EDs.(1) Despite there being no consensus regarding the definition, psychiatric boarding commonly refers to the time that mental and behaviourally disturbed patients spend waiting in an ED for an inpatient hospital bed or for transfer to another facility.(2) Although boarding in general is a common challenge globally, patients with mental and behavioural disturbances tend to be disproportionately affected with boarding times reported up to three times higher.(2,3) This, together with the fact that they are 2.5 times as likely to require admission, results in very long ED length of stays with significant consequences.(4)

Patients with mental and behavioural disorders do not receive high quality care while they are boarding in EDs and even though they are aware of the lack of resources, they perceive their treatment in the ED to not be a priority.(2,5,6) Sixty percent of ED directors in American hospitals report that no psychiatric services are provided during the boarding period, even though they require more nursing care than patients with no mental and behavioural disorders.(7) Psychiatric boarding contributes to ED crowding which leads to increased morbidity and mortality for all ED patients.(8,9) It consumes scarce ED resources, prolongs the time patients wait for potentially life-saving interventions and reduces the number of treatment beds available to accommodate surges in demand.(10)

The burden of psychiatric boarding in EDs is likely to worsen as the prevalence of mental health conditions is increasing with a consequent increase in ED presentations.(4,11) This is as a result of a wider mental health care delivery crisis and a failure of the outpatient care system.(12) Most countries in Africa, and in fact globally, have followed a decentralisation strategy for some time, integrating mental health care into general health as the most cost-effective way to provide services.(13) The situation on the ground however does not reflect the optimistic policies and programmes such that substantial gaps in service delivery remain in Africa.(13,14)

More than 80% of people with mental health disorders reside in low- and middle-income countries (LMICs) with mental illness and substance abuse disorders contributing to 8.8% and 16.6% of the total burden of disease respectively.(15) Mood and psychotic disorders, together with alcohol abuse disorders represent nearly 20% of all disability related to health conditions in LMICs and people with a low socioeconomic status are 8 times as likely to develop schizophrenia.(15) The Western Cape Province has the highest lifetime prevalence (39.4%) of mental health disorders in South Africa with the prevalence of anxiety, mood and substance disorders being 18.9%, 13.7% and 20.6% respectively.(16) Despite the significant contribution to the burden of disease and disability in Africa, mental and behavioural disorders generally enjoy less than 1% of already small national health budgets.(17,18) Although advances in mental health care in South Africa have been made, it is still regarded as a very low priority and consequently attains minimal resource allocation.(13,19)

Mitchells Plain Hospital, a public sector district-level hospital in Cape Town, South Africa, treats 55 000 patients per annum in the 25 bed ED and serves a community of approximately 600 000 predominantly low- to middle-income residents. On Monday the 19<sup>th</sup> of February 2018, the hospital embarked on an initiative to reduce psychiatric boarding in the ED by implementing two changes: (i) increasing the psychiatric inpatient capacity by nearly 50% and (ii) admitting all psychiatric boarders to the psychiatric ward until a bed becomes available – so-called inpatient hallway boarding. The aim of this study was to investigate the impact of this initiative on hospital and ward length of stay (LOS). The first objective was to describe the burden and demographics of psychiatric boarders and the second objective was to explore the relationship between boarding times and length of stay.

## Methods

### *Study design*

An analytical cross-sectional study was performed, and data was collected retrospectively from electronic patient registries.

### *Study population and sampling*

All adult patients (>18 years) that were referred to the psychiatric department from the ED between the 1<sup>st</sup> of June 2017 and the 31<sup>st</sup> of May 2019 (24 months) were eligible for inclusion. This convenience sample included 38 weeks (9 months) prior to the start of the initiative (19 February 2018). Only patients that were admitted to the psychiatric ward were included. Patients with incomplete clinical documentation, those who left before completion of hospital treatment, as well as those whose final diagnosis suggested a general medical condition as a cause for their symptoms were excluded from the study.

### *Data collection and management*

Data were extracted from two electronic registries that collect routine administrative and clinical data. Process times, demographic details and diagnosis codes according to the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) were sourced from the Hospital and ED Tracking and Information system (HECTIS), while ward discharge times were sourced from the hospital's electronic patient management system, Clinicom. Both these registries are official Western Cape Department of Health applications that prospectively collect routine data on all patients. HECTIS also tracks patient movement through the ED and hospital and is updated in real time. Data were de-identified once the data collection process was completed.

Process times were calculated in minutes and rounded to days or hours where appropriate. The definition of boarding for the purpose of this project was defined as waiting in the ED >6 hours for an inpatient bed after being referred to the psychiatric department.(20,21) Boarding categories were adopted from Singer et al.(8): 6-12 hours; 12-24 hours, 24-72 hours and >72 hours. The readmission rate was defined by provincial policy as the number of patients with mental and behavioural disturbances who are re-admitted for any reason within 90 days of discharge from hospital.(22)

### *Data analysis*

Categorical data were described with descriptive statistics and presented as frequency or percentages and non-random associations were assessed with the Chi<sup>2</sup> test. The Kolmogorov-Smirnov was used to test the distribution of

continuous variables and non-normal variables were described using median and percentiles (25% to 75%) and compared with the Mann-Whitney U test. The Spearman's correlation coefficient was used to determine the strength and direction of the association between boarding time and length of stay; no outliers were removed. A post-hoc power calculation for the primary outcome (hospital length of stay) comparing the means and standard deviation (SD) before and after the initiative, with an alpha=0.05 resulted in a power of 100%. Statistical significance was defined as  $p < 0.05$  and a clinically significant difference in ward- or hospital length of stay was defined as 1 day (24 hours).

### Patient and public involvement

This project was conducted without any patient involvement. Patients were not invited to contribute to the writing or editing of this manuscript and no patient was consulted during the study design phase to comment on study design or relevant outcomes.

## Results

Overall, 97 357 patients presented to the ED during the study period of which 74 459 (76%) were adults. A total of 2 965 (3%) patients were referred to the psychiatric department and were therefore eligible for inclusion. After applying exclusions, 2 607 (88%) of patients were included in the final analysis (Figure 1).

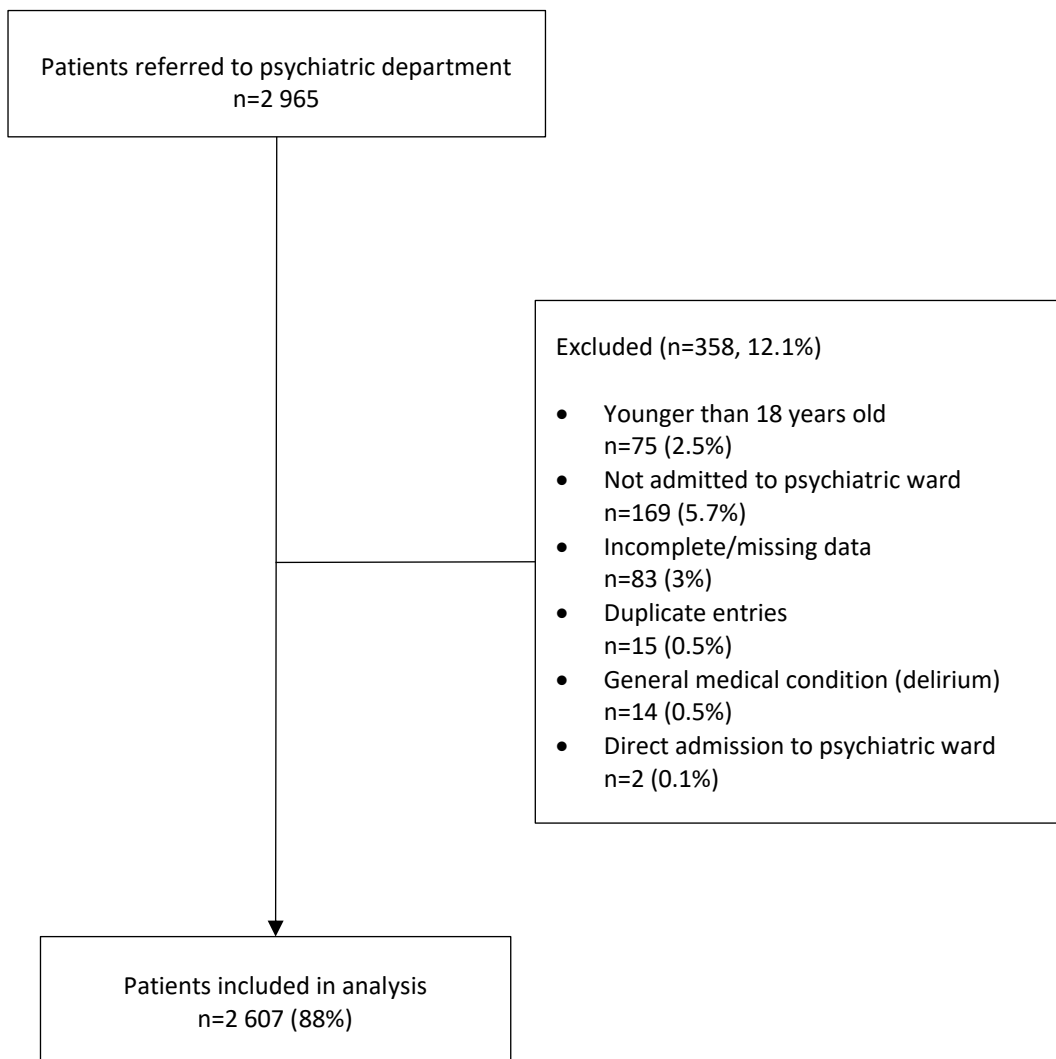


Figure 1: Flowchart of study population

The median age for male and female patients were 30 years (26 to 44) and 35 years (18 to 52) respectively. The demographical and clinical differences of the sample before and after the start of the initiative are presented in Table 1. Age ( $p=0.337$ ), gender ( $p=0.214$ ), triage category ( $p=0.968$ ) and day of arrival to the hospital ( $p=0.184$ ) were similarly distributed between the two groups. More patients arrived between 08:00 and 16:00 after the start of the initiative ( $p=0.009$ ) but less patients had their decision to admit made between 08:00 and 16:00 ( $p<0.001$ ). Patients with behavioural disturbances due to substance use were more prevalent after the initiative (5% vs 9%), while patients with schizophrenia and other delusional disorders were more prevalent before (76% vs 71%,  $p<0.001$ ).

Table 1: Patient demographic and clinical characteristics of psychiatric admissions before and after the start of the initiative (n=2 607)

n (column%)		TOTAL (n=2 607)	Before (n=809, 31%)	After (n=1 798, 69%)	P
Gender	Male	1 829 (70%)	581 (72%)	1 248 (69%)	0.214
	Female	778 (30%)	228 (28%)	550 (31%)	
Age (years)	18 – 25	591 (23%)	170 (21%)	421 (23%)	0.337
	26 – 35	1 031 (40%)	310 (38%)	721 (40%)	
	36 – 45	524 (20%)	178 (22%)	346 (19%)	
	46 – 55	255 (10%)	83 (10%)	172 (10%)	
	56 – 65	161 (6%)	53 (7%)	108 (6%)	
	66 – 75	38 (2%)	11 (1%)	27 (2%)	
	>75	7 (0.3%)	4 (0.5%)	3 (0.2%)	
ICD-10 category					
F00-F09: Organic, including symptomatic mental disorders		23 (1%)	9 (1%)	14 (1%)	
F10-F19: Mental and behavioural disorders due to substance use		201 (8%)	37 (5%)	164 (9%)	
F20-F29: Schizophrenia, schizotypal and delusional disorders		1 888 (72%)	616 (76%)	1 272 (71%)	
F30-F39: Mood disorders		346 (13%)	98 (12%)	248 (14%)	<0.001
F40-F49: Neurotic, stress-related and somatoform disorders		20 (1%)	2 (0.2%)	18 (1%)	
F60-F69: Disorders of adult personality and behaviour		3 (0.1%)	3 (0.4%)	0	
F70-F79: Mental retardation		8 (0.3%)	1 (0.1%)	7 (0.4%)	
Other		118 (4.5%)	43 (5%)	75 (4%)	
Day of arrival					
Monday		351 (14%)	101 (13%)	250 (14%)	0.184
Tuesday		431 (17%)	155 (19%)	276 (15%)	
Wednesday		419 (16%)	117 (15%)	302 (17%)	
Thursday		457 (18%)	149 (18%)	308 (17%)	
Friday		364 (14%)	113 (14%)	251 (14%)	
Saturday		308 (12%)	89 (11%)	219 (12%)	
Sunday		277 (11%)	85 (11%)	192 (11%)	

Time of arrival	Weekday	2 022 (78%)	635 (79%)	1 387 (77%)	0.444
	Weekend	585 (22%)	174 (22%)	411 (23%)	
Time of disposition decision	08:00 – 16:00	999 (38%)	280 (35%)	719 (40%)	0.009
	16:00 – 08:00	1 608 (62%)	529 (65%)	1 097 (60%)	
Readmitted*	08:00 – 16:00	1 101 (42%)	420 (52%)	681 (38%)	<0.001
	16:00 – 08:00	1 506 (58%)	389 (48%)	1 117 (62%)	
Boarding category (hours)**	Yes	409 (16%)	94 (12%)	315 (18%)	<0.001
	No	2 198 (84%)	715 (88%)	1 483 (83%)	
Boarded in ED	None	1 298 (50%)	85 (11%)	1 213 (67%)	<0.001
	6 – 12	340 (13%)	36 (4%)	304 (17%)	
	12 – 24	296 (11%)	81 (10%)	215 (12%)	
	24 – 72	339 (13%)	274 (34%)	65 (4%)	
	>72	334 (13%)	333 (41%)	1 (0.1%)	
Process times (median, Q <sub>1</sub> – Q <sub>3</sub> ***)	Yes	1 309 (50%)	724 (90%)	585 (33%)	<0.001
	No	1 298 (50%)	85 (11%)	1 213 (67%)	
	ED boarding time (hours)	6 (1-26)	56 (24-104)	3 (1-8)	<0.001
	ED length of stay (hours)	19 (9-47)	81 (46-128)	13 (7-23)	<0.001
	Ward length of stay (days)	15 (7-25)	16 (8-27)	14 (7-24)	0.001
	Hospital length of stay (days)	16 (9-27)	20 (13-31)	15 (8-25)	<0.001
Admissions per week (mean, SD)		25 (7.1)	21 (4.8)	28 (7.2)	

Column percentages may not add to 100% because of rounding; Statistically different proportions highlighted ( $p < 0.05$ );

\*Readmitted within 90 days of discharge; \*\* Boarding is defined as waiting in the ED >6 hours for an inpatient bed after being referred to the psychiatric department; \*\*\* 25<sup>th</sup> and 75<sup>th</sup> percentile

A significantly higher proportion of patients boarded in the ED prior to the start of the initiative (90% vs 33%,  $p < 0.001$ ), especially those who waited for more than 24 hours (34% vs 4%,  $p < 0.001$ ). The initiative was associated with a decrease of 95% (56 vs 3 hours,  $p < 0.001$ ) in psychiatric boarding times, 13% (16 vs 14 days,  $p < 0.001$ ) in ward length of stay and 25% (20 vs 15 days,  $p < 0.001$ ) in hospital length of stay. There was a statistically significant increase in the readmission rate of 6% ( $p < 0.001$ ).

Figure 2 displays the median ED boarding time per week before and after the initiative was implemented. A significant and sustained reduction in ED boarding times after the initiative (study week 39) occurred.

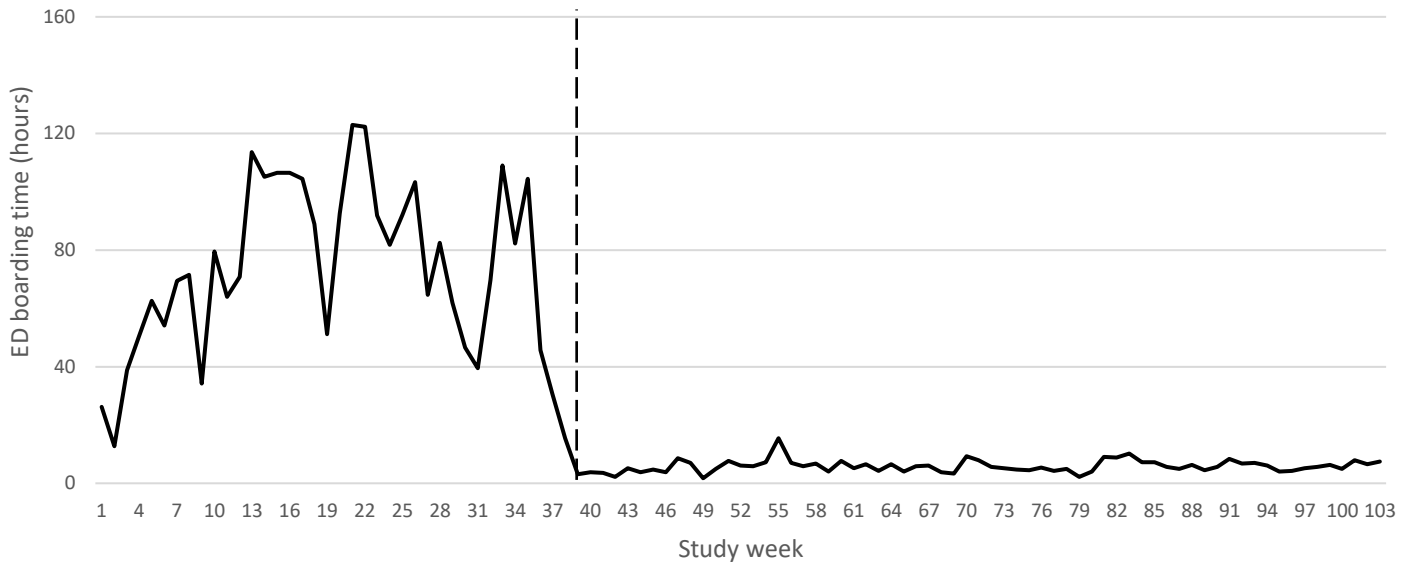


Figure 2: Median Emergency Department psychiatric boarding time per study week before and after the start of the initiative (week 39).

Figure 3 depicts ward- and hospital length of stay for boarding vs no boarding, before and after the initiative. The median ward- and hospital length of stay were universally shorter after the start of the initiative, whether boarding was present or not. After the start of the initiative, the median ward- and hospital length of stay were statistically similar (336 vs 351 hours,  $p=0.077$  and 357 vs 361 hours,  $p=0.476$  respectively). Figure 4 depicts ward- and hospital length of stay for each boarding category, before and after the initiative. The median ward- and hospital length of stay was shorter for all categories of boarding after the start of the initiative, with the biggest difference in the 12-24-hour boarding category. The median hospital length of stay for the >72-hour-category was the longest, and disproportionately longer than the corresponding ward length of stay.

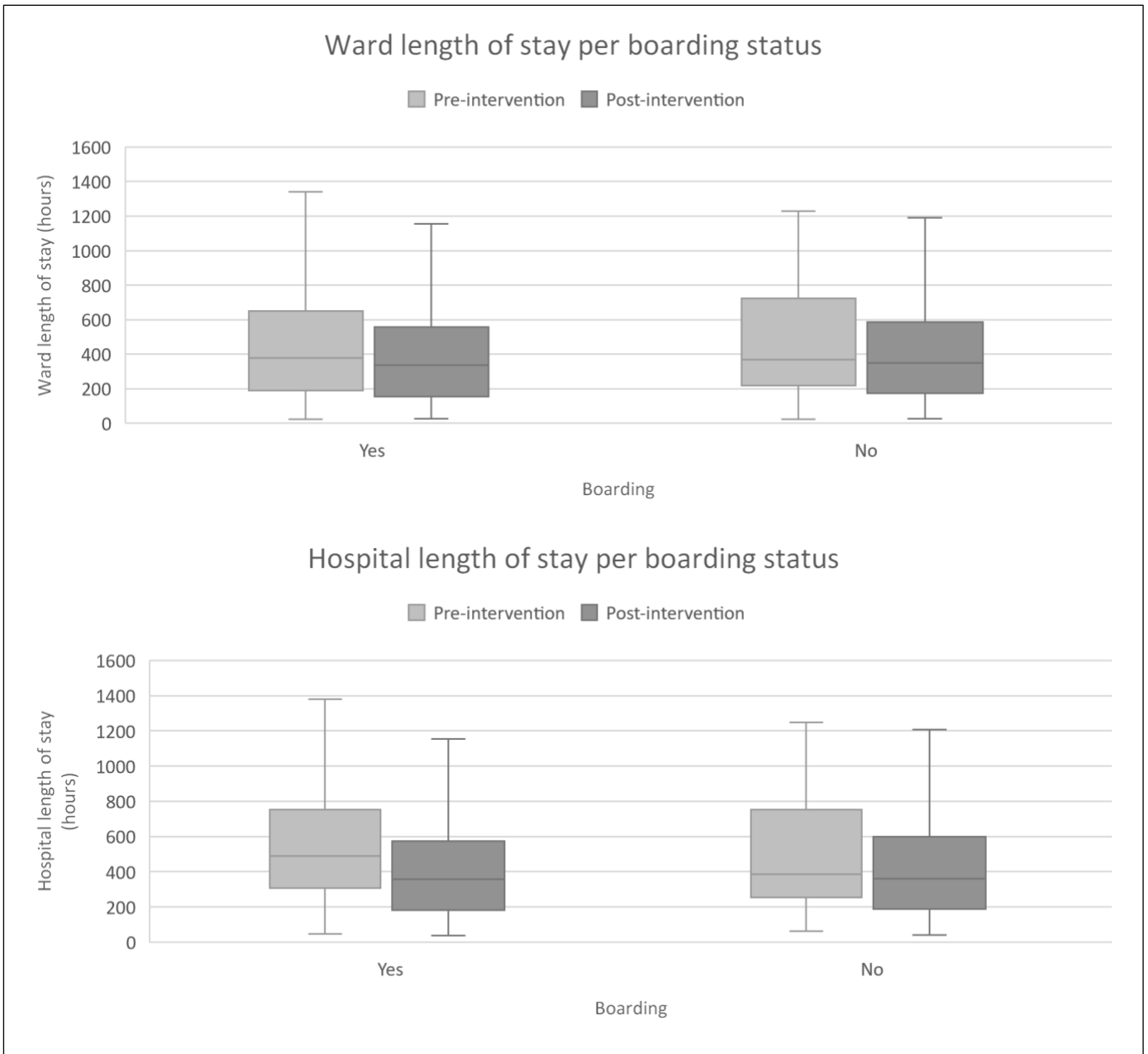


Figure 3: Clustered boxplots of ward- and hospital length of stay per boarding status pre- and post-intervention, N=2 706. (Whiskers = minimum and maximum)

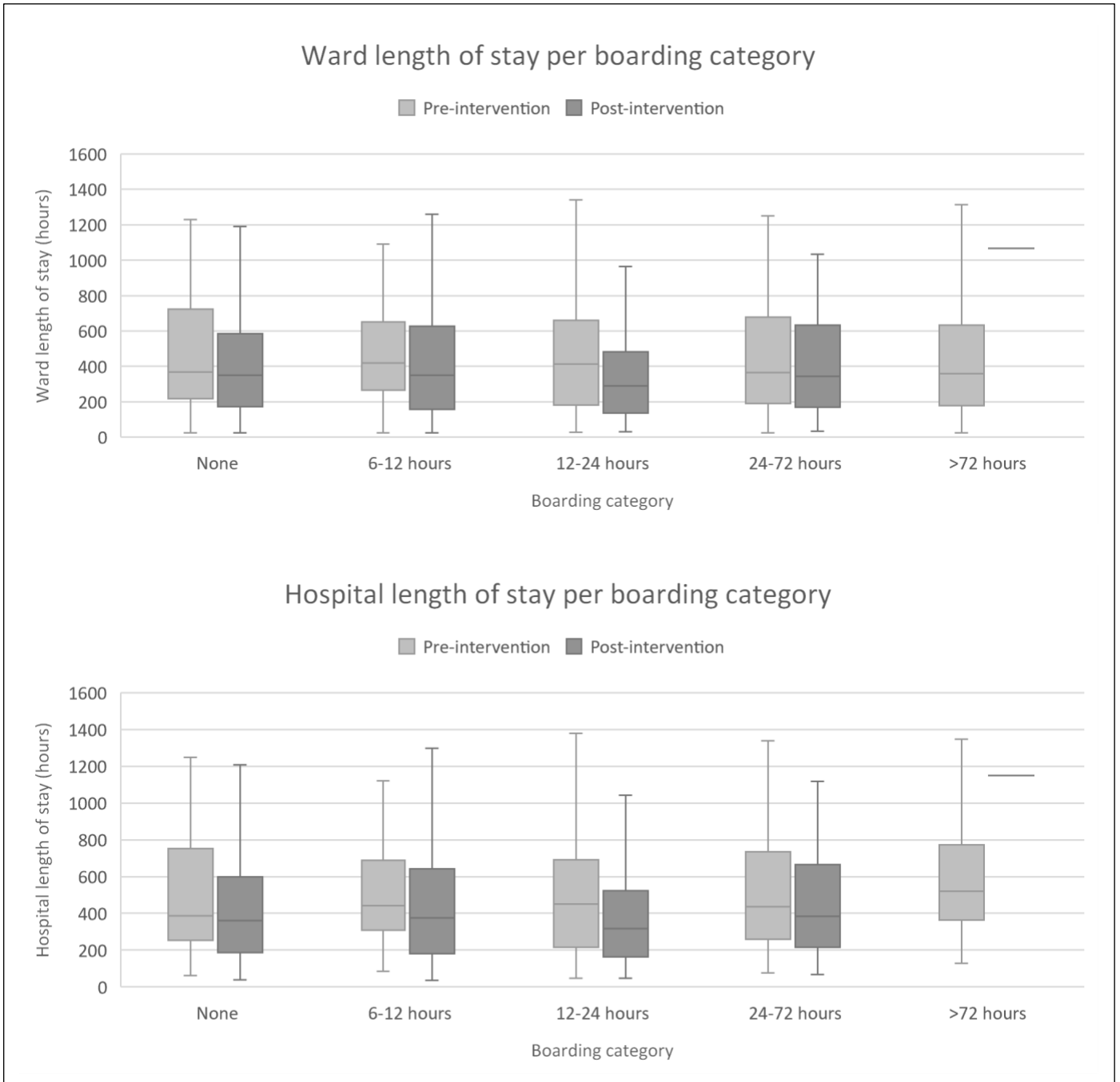


Figure 4: Clustered boxplots of ward- and hospital length of stay per boarding category pre- and post-intervention, N=2 706. (Whiskers = minimum and maximum; post-intervention >72-hour boarding category N=1)

The correlation between ED boarding time and ward length of stay was non-linear ( $r_s = 0.022$  ( $p=0.27$ )). The association between ED boarding time and length of stay (ward and hospital) is presented in Supplementary table 1. The combined data showed that patients who experienced ED boarding vs no ED boarding had a similar median ward length of stay (352 vs 353 hours,  $p=0.919$ ). Boarding for >24 hours however was associated with a statistically significantly longer ward stay (351 vs 360 hours,  $p=0.047$ ). Hospital length of stay was significantly longer for all boarding thresholds.

Post-hoc subgroup analysis shows that male patients had a significantly longer median hospital length of stay (18 vs 15 days,  $p<0.001$ ) and median ward length of stay (16 vs 13 days,  $p<0.001$ ) while females had longer median ED boarding times (10 vs 4 hours,  $p<0.001$ ) (Supplementary table 2).

## Discussion

The increase in inpatient capacity along with the implementation of inpatient hallway boarding was associated with a decrease in psychiatric boarding in the ED and a decrease in the number of patients with mental and behavioural disorders boarding for longer than 6 hours in the ED by 57%. The median ED boarding time subsequently decreased by 53 hours, the median ward length of stay decreased by 2 days and the median hospital length of stay by 5 days. This reduction was sustained over time, but a 6% increase in the readmission rate was noted.

Nine in ten patients with mental and behavioural disorders boarded in the ED before the start of the initiative. This is substantially higher than the prevalence reported in high-income countries, although it varies considerably. In 2008, a survey of 328 US EDs indicated that 79% of patients with mental health emergencies boarded in the ED.(23) In the same year, Nolan et al.(20) assessed a cohort of nearly 35 000 ED patients across the United States of America and found that 22% of patients with mental and behavioural disorders board in EDs. An ED in Florida reported the prevalence to be 40% between 2010 and 2013, which increased to 70% in patients who were transferred to a different health facility for admission.(21) Data from our study showed that female mental health users boarded for 6 hours longer than their male counterparts, most likely due to the fact that they required transport to a different facility for admission. The paucity of data in low- and middle-income countries precludes any concrete comparisons and a comprehensive nationwide evaluation of the burden of psychiatric boarding in South Africa and Africa is needed.

Ward length of stay was similar for all categories of boarding, both before and after the initiative, as well as when data were combined. The isolated statistically significant reduction of 9 hours in ward length of stay for patients who boarded in the ED for >24 hours, is not clinically significant, considering the fact that any reduction less than a day has minimal impact on hospital throughput metrics. This access block-effect refers to a paradox where an increase in the duration of ED boarding times is associated with longer inpatient length of stays.(24) Logically, the opposite is expected

as one would assume that the *healing process* initiates in the ED with continuation of care in the ward – therefore expecting shorter ward stays for those with longer ED stays. This association however does not necessarily equal causation, as the opposite could also be plausible – a decrease in ward length of stay leading to a decrease in ED boarding times. The data however indicate that the ward length of stay of patients with mental and behavioural disturbances is independent of their ED boarding times. From a lean- and economical perspective, the results of this study suggest that psychiatric boarding equates to waste. This study is however an observational study and further inferences would be imprecise.

Hospital length of stays were universally and significantly shorter for all categories of boarding, both before and after the initiative, as well as when data were combined. This contradicts the findings of a recent study investigating more than 19 000 psychiatric admissions in Canadian EDs where psychiatric boarding was associated with a minimal increase in hospital length of stay (14 minutes more in the hospital for a patient who boarded for  $\geq 24$  hours, or 29 minutes more days in the hospital for a patient who boarded for  $\geq 72$  hours).(25) This is unexpected considering that the reported median boarding time of 6.5 hours is similar to the 6 hours in this study. Patients in this study who boarded for  $\geq 24$  hours had a 121-hour increased hospital stay, while those who boarded for  $\geq 72$  hours had a 147-hour increase. This could be explained by the fact that both the ward and ED length of stays were much longer.

The reduction in length of stay came at a cost in the form of a higher readmission rate. The 6% increase in readmission rate may be as a result of premature discharges to accommodate the burden of admissions (perhaps now more visible and acutely felt by psychiatrists as opposed to when boarded in the ED). The increase should however be interpreted along with the increase in admissions per week from 21 prior to the initiative to 28 thereafter (Table 1). The readmission rate as a standalone quality marker does not necessarily refute the significant improvement in hospital and ED length of stays as a result of this initiative. Pre- and post-discharge factors associated with readmission, including: (i) individual vulnerability; (ii) aftercare related factors; (iii) community care and service responsiveness and (iv) contextual factors and social support, should be assessed to understand the true impact. (26,27)

Even though the initiative resulted in a significant decrease in overall length of stay, a comprehensive impact assessment was not performed and aspects like patient and staff perceptions about inpatient hallway boarding was not explored. Inpatient hallway boarding, as an alternative to boarding in the ED, is a strategy that has been used as a full-capacity protocol to distribute admitted patients to inpatient wards, to reduce ED crowding and improve overall patient flow.(28) Surveys elsewhere that explored patients perceptions and experiences suggests that they overwhelmingly prefer inpatient hallway boarding to ED boarding.(28–30) Shoham et al.(31) found that inpatient hallway boarding in a hospital in Jerusalem lowered inpatient mortality (OR 0.76, [CI, 0.65 to 0.90]) but increased the 30-day readmission rate (OR, 1.18 [CI, 1.00 to 1.40]). Nursing perceptions differed depending on where they work, with unsurprisingly ward nurses being opposed to inpatient hallway boarding and ED or ex-ED nurses supporting it.(32)

## Strengths and limitations

This study investigated a large sample of nearly 3 000 patients and therefore minimised the likelihood that random error could have impacted the results. The robust electronic patient registries ensured accurate data. A few potential confounders were not analysed including the time delay to the first consultation by a psychiatrist, the type of admission (index presentation vs known mental health user or voluntary vs assisted admission) and final (discharge) diagnosis. Readmissions to other facilities were not actively sought and a few cases could have been missed both prior and after the start of the initiative. An increase in readmissions in our hospital, with a concurrent decrease in readmissions elsewhere, may also indicate increased patient satisfaction by choosing to re-present at this hospital – this was however not explored. Operational practices within the psychiatric ward could have changed to adopt to the increased patient load – this was not explored in this study but does require further investigation.

## Suggestions for future research

A follow up study should determine whether the initiative and outcomes are sustainable. Future research should aim to perform a multicentre analysis and include potential confounders. Perceptions of patients and their families, as well as the nursing staff should be explored qualitatively with regards to inpatient hallway boarding. The impact of strategies that the psychiatric department utilised to manage the increased patient burden, as well as the effect of inpatient hallway boarding on the length of stay of non-psychiatric patients should be investigated.

## Conclusion

This study demonstrated a significant improvement in hospital length of stay and ED boarding times after psychiatric inpatient capacity was increased and inpatient hallway boarding for patients with mental and behavioural disturbances was implemented. This initiative halved the prevalence of psychiatric boarders and significantly decreased hospital length of stay. From a lean- and economical perspective, the results of this study suggest that psychiatric boarding equates to waste as it is independent of ward length of stay. The benefits of this initiative should be weighed up against the subsequent higher readmission rate. The observational nature of this study precludes concrete conclusions and further investigations into psychiatric inpatient hallway boarding are recommended.

## Ethics statement

Ethical approval was obtained from the University of Cape Town Human Research Ethics Committee (HREC): HREC REF 539/2019 and facility approval was granted via the National Health Research Database: WC\_201908\_037. There was no patient participation, and a waiver of consent was approved.

## Acknowledgements

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The study was self-funded.

## Contributions

CH and DJvH developed the concept. The proposal was developed by CH and edited by DJvH and PH. CH performed the data collection and statistical analysis. The manuscript was drafted by CH and edited by DJvH and PH. CH is the guarantor.

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Supplementary table 1: Comparison of ward and hospital length of stay (LOS) for various ED boarding thresholds (Hours)

ED boarding threshold	N (column %)	Ward LOS		Hospital LOS	
		Median (Q <sub>1</sub> -Q <sub>3</sub> )	P*	Median (Q <sub>1</sub> -Q <sub>3</sub> )	P*
6 hours	<6 hours	1 298 (50%)	352 (174-597)	0.919	364 (189-605)
	>6 hours	1 309 (50%)	353 (170-616)		429 (233-672)
12 hours	<12 hours	1 638 (63%)	354 (172-598)	0.778	367 (188-613)
	>12 hours	969 (37%)	349 (171-608)		450 (263-691)
24 hours	< 24 hours	1 934 (74%)	351 (170-586)	0.047	365 (188-602)
	>24 hours	673 (26%)	360 (186-649)		486 (305-751)
72 hours	<72 hours	2 273 (87%)	351 (170-598)	0.159	374 (193-624)
	>72 hours	334 (13%)	359 (182-636)		521 (363-776)

\*Mann-Whitney U; Q<sub>1</sub>-Q<sub>3</sub>: 25<sup>th</sup> -75<sup>th</sup> percentile

Supplementary table 2: Overall length of stays (LOS) per gender and ICD-10 diagnosis categories (median, IQR)

	N (column %)	ED boarding time (hours)	Ward LOS (days)	Hospital LOS (days)
Overall	2 607	6 (1-26)	15 (7-25)	16 (9-27)
Gender				
Male	1 829 (70%)	4 (1-24)	16 (8-27)	18 (9-29)
Female	778 (30%)	10 (3-29)	13 (6-19)	15 (8-22)
*P-value		<0.001	<0.001	<0.001
ICD-10 diagnosis category				
F00-F09: Organic, including symptomatic mental disorders	23 (1%)	7 (1-49)	19 (10-37)	22 (11-43)
F10-F19: Mental and behavioural disorders due to substance use	201 (8%)	4 (1-13)	15 (6-23)	16 (8-24)
F20-F29: Schizophrenia, schizotypal and delusional disorders	1 888 (73%)	6 (1-27)	16 (8-26)	18 (10-28)
F30-F39: Mood disorders	346 (13%)	8 (2-29)	13 (7-21)	15 (8-23)
F40-F49: Neurotic, stress-related and somatoform disorders	20 (1%)	13 (4-23)	6 (3-13)	8 (5-14)
F60-F69: Disorders of adult personality and behaviour	3 (0.1%)	26 (16-26)	15 (4-19)	17 (5-20)
F70-F79: Mental retardation	8 (0.3%)	1 (0-20)	14 (8-24)	14 (11-24)
Other	118 (5%)	7 (2-21)	7 (4-15)	10 (5-17)

Column percentages may not add to 100% because of rounding

\*Mann-Whitney U

## Section C: Addenda

## Addendum 1: Author guidelines

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## Addendum 2: Research proposal

# The association between length of emergency centre boarding and hospital length of stay for patients with mental health and behavioural disorders

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## Acronyms and abbreviations

ACEP	American College of Emergency Physicians
CDC	Centres for Disease Control and Prevention
CI	Confidence interval
EC	Emergency centre
ECM	Enterprise Content Management
ED	Emergency department
GDP	Gross Domestic Product
HECTIS	Hospital and Emergency Centre Tracking Information System
HREC	Human Research Ethics Committee
ICD-10	International Statistical Classification of Diseases and Related Health Problems 10 <sup>th</sup> revision
LOS	Length of stay
MHC	Mental health condition
POU	Psychiatric observation unit
SATS	South African Triage Scale
SD	Standard deviation
UCT	University of Cape Town
US	United States
USA	United States of America
WHO	World Health Organisation

## Abstract

### Introduction

*Psychiatric boarding* refers to the time spent waiting in an emergency centre for an inpatient hospital bed or for transfer to another facility by patients with mental health conditions. It is widely recognised that emergency centre boarding leads to increased morbidity and mortality for all emergency centre patients, and in general also longer hospital length of stays. Quantifying the extent of psychiatric boarding is the first step to developing strategies to improve the plight of patients with mental health conditions presenting to the emergency centre. The aim of this study is to explore the association between length of psychiatric boarding and hospital length of stay.

### Methodology

A retrospective analysis of the process times of all patients that presented to the EC and admitted by the psychiatric team, will be performed. All patients presenting to Mitchell's Plain Hospital EC from the 1st of June 2017 till the 31st of May 2019 (24 months) will be eligible for inclusion. Descriptive statistics will be used to describe the burden of mental health and behavioural disorders, as well as the demographics of patients. Spearman's correlation coefficient will be calculated to measure the strength and direction of the association between the length of boarding time and hospital length of stay. Statistical significance will be defined as  $p < 0.05$  and 95% confidence intervals will be provided if applicable.

### Ethical considerations

Patients with MHCs are considered vulnerable with regards to participation in research projects. This research project, however, involves no more than minimal risk to the participants and we therefore request a waiver of informed consent. As this will be a retrospective analysis of routinely collected data, taking individual consent will be impractical. There is no interest in individual patients, nor individual healthcare personnel. Ethical approval will be applied for from University of Cape Town Human Research Ethics Committee.

### Conclusions

A lack of data in South Africa limits the development of evidence based and locally applicable strategies to help improve the burden of psychiatric boarding. This study, taking into consideration the sample size and the methodological vigour, will be the first of its kind in this setting. This will form the knowledge base for future studies and policy decisions.

## Introduction

### Background

Psychiatric boarding has been described by hospital and emergency centre (EC) managers as: *“the number one problem of my Emergency Department”*.<sup>(1)</sup> It is a universal challenge that negatively impacts service delivery in general with significant implications on EC productivity. Despite the fact that mental health conditions (MHCs) contribute hugely to the burden of disease and disability in Africa, it generally enjoys less than 1% of the already small national health budget.<sup>(22)</sup> Although advances in mental health care in South Africa have been made, it is still regarded as a very low priority and consequently attains minimal resource allocation.<sup>(18,24)</sup>

*Psychiatric boarding* has no standard definition but generally refers to the time spent waiting in an EC for an inpatient hospital bed or for transfer to another facility by patients with MHCs.<sup>(2)</sup> Other definitions include length of stay, for example *“four or more hours”* as described by The American College of Emergency Physicians (ACEP) and *“exceeding twenty-four hours”* as described by *Stefan*.<sup>(5,6)</sup> The current guidelines of the Western Cape Health Department as stipulated in Circular H221 of 2014 recommends that the process (*including the exclusion of general medical conditions (GMCs) and completion of legal documents*) from presentation to admission should not take longer than six hours.<sup>(9)</sup>

Despite there being no consensus regarding the definition, boarding of patients in ECs remains a global problem affecting hospitals across all income and resource categories. An analysis of EC visits in the United States of America found that 32% of all patients boarded from 2007 to 2010.<sup>(52)</sup> Psychiatric boarding times varies depending upon local community outpatient and inpatient resources. In Maryland for instance, psychiatric boarding may last for several days, while in California, average boarding times are as low as 10 hours.<sup>(14)</sup> To date, no comprehensive nationwide evaluation and quantification of the burden of psychiatric boarding exists in South Africa.

It is widely recognised that EC boarding leads to increased morbidity and mortality for all EC patients. <sup>(25,26)</sup> It consumes EC resources, prolongs the time patients wait for services and reduces the number of treatment beds available to accommodate surges in demand.<sup>(27)</sup> A retrospective cohort by Singer et al. of 41 256 hospital admissions at a suburban academic EC from 2005 to 2008 found that the mortality rate increased from 2.5% in patients boarded less than 2 hours to 4.5% in patients boarding 12 hours or more. Mean hospital length of stay increased from 5.6 days for those who boarded for less than 2 hours to 8.7 days for those who boarded for more than 24 hours.<sup>(25)</sup> Boarding of patients in the EC is also a major cause and effect of EC overcrowding

and subsequent adverse outcomes as demonstrated by White et al. in a large retrospective study of 179 840 patients.(26,53) Patients with MHCs tend to board for longer periods than those without. A retrospective study by Nicks et al. demonstrated that psychiatric patients awaiting inpatient placement remain in the EC 3.2 times longer than non-psychiatric patients, preventing 2.2 bed turnovers per psychiatric patient.(3) A recent study by Nolan et al. found that US ECs experience high proportions and durations of boarding with psychiatric patients disproportionately affected. They found that 11% of all EC patients boarded (EC length of stay of more than 6 hours) in comparison to 21.5% of psychiatric EC patients.(7)

Patients with MHCs do not receive high quality care while they are boarding.(2) Sixty percent of EC directors in US hospitals reports that no psychiatric services are provided during the boarding period, even though they require more nursing care than patients with non-MHCs.(5) In a pilot study examining undesirable events among EC boarded patients, 18% of boarded patients missed a relevant home medication and 3% had a preventable adverse event.(54) The chaotic and noisy EC environment is far from ideal for patients with MHCs and may further exacerbate their pre-existing condition.(3)

Psychiatric boarding holds significant financial consequences for ECs due to a reduction in the bed turnover rate and by consuming EC resources.(3) Because patients with MHC prevent EC beds from being used for new patients, it reduces the functional capacity significantly. There is a paucity of data about the financial impact of boarding in low- and middle-income countries (LMIC). However, in an EC in a high-income country (HIC), with approximately 62 500 annual visits, this can equate to a reduction in 3 175 patients being attended to annually with a potential loss of revenue to the amount of \$3 960 264.(3,27)

The increasing number of EC visits by patients with MHCs is as a result of a wider mental health care delivery crisis and a failure of the outpatient care system.(17) Because of limited access to community mental health services, patients default back to ECs for help – services which can be delivered at a lower cost in the community. In the US, the 1960's marked the beginning of an era of deinstitutionalisation of patients with MHCs and inpatient psychiatric beds fell dramatically. Between 1970 and 2006 it was reduced from approximately 400 000 to 50 000.(55) The community mental health centres act of 1963 (US) recommended that mental health care centres take over management and rehabilitation of those discharged from mental health institutions. This vision has however not been adequately funded, hampering its realisation. State spending on mental services has actually declined by 30% from 1955 to 1997 when adjusted for population growth.

Most countries in Africa have followed a decentralisation strategy for some time, embracing the policy of integration of mental health services into general health as the most cost-effective way to deliver services.(18)

The situation on the ground however does not reflect the optimistic policies and programmes and substantial gaps in service delivery remains.(18,19) A systematic review of mental health service delivery in South Africa from 2000 to 2010 suggests that while some progress was made in delivering decentralised care for patients with MHCs, insufficient resources to support community-based care is hampering service delivery, resulting in the classic revolving-door phenomenon.(19)

## **Motivation**

The burden of psychiatric boarding in ECs is likely to get worse as the prevalence of MHCs is increasing with a subsequent increase in EC visits.(4,15) In US hospitals, mental health related EC visits increased from 5.4% in 2000 to 12.5% in 2007.(4) This, together with the fact that patients with MHC are more than twice likely to be admitted than patients without MHC, could result in serious disruption of service delivery and widespread consequences, if not addressed urgently.(4,15)

A number of strategies have been proposed globally to improve the plight of patients with MHCs presenting to ECs and to improve EC flow dynamics by minimising boarding times.(2) Each strategy or action plan is unique to the situation where it has been developed in, taking into account local patient numbers, local resources and an extensive literature review of local data.(2) A seven point action plan by Alakeson et al. include e.g.: (i) quantifying the problem; (ii) improvement of EC care of patients with MHC; (iii) more efficient use of existing capacity; (iv) implementation of low-cost collaboration; (v) working with law enforcement; (vi) investing into comprehensive community crisis services and (vii) investing in continuity of care.(2) A lack of data in South Africa limits the development of evidence based and locally applicable strategies to help improve the burden of psychiatric boarding. Quantifying the extent of psychiatric boarding is the first step to developing strategies to help improve the plight of patients with MHCs presenting to our ECs.

## **Research question**

In patients with mental or behavioural disorders, presenting to the emergency centre and admitted to the psychiatric inpatient service, does psychiatric boarding, in comparison to no boarding, lead to longer hospital length of stays?

## **Aim**

The aim of this study is to investigate the relationship between psychiatric boarding and hospital length of stay of patients with mental and behavioural disorders that were admitted from the emergency centre to the inpatient psychiatric team.

## Primary objectives

1. To describe the burden and demographics of patients with mental health and behavioural disorders, that presented to the EC and were admitted to the inpatient mental health team.
2. To compare average hospital length of stay of patients admitted with mental health and behavioural disorders between those who boarded in the EC and those who did not board in the EC.

## Secondary objectives

1. To assess the direction and the strength of the correlation between length of psychiatric boarding with hospital length of stay.
2. To compare hospital length of stay with pre-defined categories of psychiatric boarding. [0-6 hours; 6-12 hours; 12-24 hours; 24-72 hours; >72 hours]
3. To describe the seasonal and day-to-day variance in length of psychiatric boarding over time.
4. To perform subgroup analysis to assess the effect of the following variables on hospital length of stay and psychiatric boarding:
  - a. Disease category (mental health disorder)
  - b. Time delay to psychiatric consultation
5. To compare the average hospital length of stay between patients who were re-admitted within 90 days (balancing variable) and those who were not.
6. To perform regression analysis to predict hospital length of stay from length of psychiatric boarding.

## Methodology

### Study design

An analytical cross-sectional study will be performed to achieve the primary objectives. Data collection will follow a retrospective review of routinely collected data.

### Study setting

This study will take place in the City of Cape Town, a metropolitan municipality of South Africa, covering an area of 2 461 km<sup>2</sup>. It governs a population of 3 740 025 people in 1 068 572 households, including 129 918 informal structures in informal settlements.<sup>(56)</sup> The population is predominantly Coloured (42.4%), Black African (38.6%) and White (15.7%) while languages mostly spoken are Afrikaans (34.9%), Xhosa (29.2%), and English (27.8%).<sup>(56)</sup> As the Western Cape's economic hub, the City of Cape Town accounts for 71.1% of the

Western Cape's economy and produces 10.6% of South Africa's GDP even though 35.7% of households live below the poverty line of R3 500 income per month.(56)

Mitchell's Plain Hospital, a district level hospital in Mitchell's Plain Health District of the Metro Region, treats 54 000 patients per annum. The hospital serves a population of approximately 750 000 - 800 000, which includes the population of Mitchells Plain and the greater part of Philippi, a large nearby township. The demographics of Mitchells Plain comprises of low- to middle-income families of which 90% are coloured, and Philippi which is a low-income community that comprises of 90% black residents.(56)

## Study population

A fire affecting the EC of Mitchells Plain Hospital resulted in the EC being temporarily relocated to an area in the out-patient department. Because of the extensive repair and rebuilding process, emergency care has since been provided from a much smaller space with less room to manage psychiatric boarders. In an attempt to improve patient throughput and decrease EC crowding, inpatient capacity was increased to accommodate more admissions from the EC and to minimise psychiatric boarding. This is in contrast to the situation prior to the fire where patients with mental health disorders boarded for long periods in the EC with limited ward capacity to accommodate them. This study incorporates patients from two situations (i) limited ward space with significant EC psychiatric boarding and (ii) increased ward capacity to accommodate more admissions with minimal EC psychiatric boarding.

All patients presenting to Mitchell's Plain Hospital between the 1<sup>st</sup> of June 2017 and the 31<sup>st</sup> of May 2019 (24 months) will be eligible for inclusion. These dates are chosen around the date of the EC fire (10 February 2018) and allows for a sample of patients both prior and thereafter to be included. An average of 130 patients with mental and behavioural disorders are admitted every month – which equates to an estimated sample of more than 2000 patients. It is estimated that the number of patients included after the fire will be approximately double the amount preceding the fire. This does not however, affect the validity of the study as the statistical methods used only compares boarders with non-boarders, despite the setting. No direct comparisons will be made between the pre-and post-fire time period.

## Subject selection and sampling

The World Health Organisation's (WHO) definition and classification of mental and behavioural disorders will be used – it is summarised by the International Statistical Classification of Diseases and Related Health Problems 10<sup>th</sup> revision, chapter V (ICD-10).(57) It includes the following ICD-10 codes:

- a. Chapter V: from F00. to F99. [mental and behavioural disorders];

- b. Chapter XX: from X60. to X84. [intentional self-harm] and
- c. Chapter XVIII: R45. [symptoms and signs involving emotional state]

*Inclusion criteria*

All adult patients that presented to the EC within the study period with the above-mentioned diagnostic codes, and admitted to the inpatient psychiatric team, will be eligible for inclusion.

*Exclusion criteria*

Patients with incomplete clinical documentation, where the necessary variables are not available or not documented, and those who have left before completion of treatment will be excluded from the study sample. Patients younger than 18 years old will also be excluded.

## Data collection procedures

Variables describing the burden and demographics will be sourced from the electronic patient registry (Table 1).

**Table 2: Burden and Demographics – measured variables**

Folder number*	Triage category	ICD-10 group	Diagnosis group	Admission type	Age	Gender	Referral type
<i>Numerical discreet</i>	<i>Categorical ordinal</i>	<i>Categorical nominal</i>	<i>Categorical nominal</i>	<i>Categorical nominal</i>	<i>Numerical discreet</i>	<i>Dichotomous [M/F]</i>	<i>Categorical nominal</i>

*\*folder number will be replaced by a study number after data has been collected*

Variables describing the process times will be sourced from electronic patient registry and an electronic content manager (Table 2). Additional variables will be calculated (Table 3). Addendum 1 summarises the process times with definitions.

**Table 3: Process Times – measured variables**

Folder number*	Time of registration	Time to triage	Time to consultation	Time to disposition	Time to EC exit (boarding time)	Time of psychiatric consultation	Time of ward discharge	Readmitted in 90 days
<i>Numerical discreet</i>	<i>Numerical continuous</i>	<i>Numerical continuous</i>	<i>Numerical continuous</i>	<i>Numerical continuous</i>	<i>Numerical continuous</i>	<i>Numerical continuous</i>	<i>Numerical discreet (days)</i>	<i>Dichotomous [yes/no]</i>

*\*folder number will be replaced by a study number after data has been collected*

**Table 4: Process Times – calculated variables**

Time to psychiatric consultation	EC length of stay	Hospital length of stay	Boarding time
<i>Numerical continuous</i>	<i>Numerical continuous</i>	<i>Numerical continuous</i>	<i>Categorical ordinal**</i>

*\*\*[0-6 hours; 6-12 hours; 12-24 hours; 24-72 hours; >72 hours]*

Clinicom is a national patient management software application that has been used for many years by all health facilities from district level upwards. ECM is a content manager that is used by many hospitals to share and store patients' clinical records and contains electronic copies of clinical documentation. Hectis is a reasonably new registry that is in use in a few emergency centres across the Western Cape. Routine clinical data are collected for each patient that enters the EC and Hectis aims to replace the old paper-based patient register that most ECs use. A patient gets registered on the database as soon as the patient registers an emergency centre visit. Patient details are pulled from the Clinicom database to minimise duplication of information. Thereafter, the triage process (done by nurses) is documented on Hectis, including all the patient tracking information (which room or treatment area patient is in or moved to). Hectis also allows doctors to add the diagnosis with the help of ICD-10 codes, as well as the disposition (admitted, discharged or referred etc.). All process times are also documented automatically. Required data will be imported from Hectis after ethical and institutional approval has been obtained.

Categorisation of boarding times (6 – 12 hours; 12 – 24 hours; 24 – 72 hours; > 72 hours) will be adopted from Singer et al. and amended to suit current expected trends.(25) No boarding will be defined as 0 – 6 hours. Hospital length of stay is reported in days (the number of midnights the patient spends in the hospital) on Clinicom. Patients' clinical notes on the ECM database will be scrutinised for the exact time when patients were discharged.

### **Data safety and monitoring**

All files containing data will be stored on the lead investigator's personal password protected laptop. The file will also be password protected for added security. This file will also be stored on UCT's One Drive account, a secure cloud service that requires a password to access. Supervisors will have access to the files from the One Drive account. A backup of all data files will be performed on a cloud service and on an external hard drive, after the data collection is completed. The external hard drive will be kept in a locked cabinet in the access-controlled offices of the Division of Emergency Medicine at UCT.

Data will be de-identified and saved without personal or identifying information once the data collection phase is completed. A separate file linking the patient's name to the folder number will be created and saved – this file will be password protected and only available to the lead investigator. It will be saved on a password protected computer in the offices of the division of Emergency Medicine (different location).

## Data Analysis

To describe the burden and demographics of patients, descriptive statistics will be used to describe the burden of mental health and behavioural disorders, as well as the demographics of patients. Categorical data will be presented as frequency and proportions (%). Categorical data will be compared with the use of the Fisher's exact test or the Chi<sup>2</sup> test, depending on the characteristics of the variables.

To compare hospital length of stay between those who boarded and those who did not board, Spearman's correlation coefficient will be calculated to measure the strength and direction of the association between the length of boarding time and hospital length of stay (non-normally distributed data). This correlation will also be graphically depicted with the use of scatter plots. Length of boarding time will also be categorised and compared with hospital length of stay with the help of the Chi<sup>2</sup> test. Odds Ratio will also be calculated for each category of boarding. This calculation should be able to depict where the critical point(s) of correlation lies. And lastly, regression analysis will be performed to try and predict length of stay (LOS) from boarding times - linear regression for continuous outcomes.

An unpublished clinical audit suggests that approximately 2000 patients with mental and behavioural disorders were referred during the study period (2 years) to the psychiatric team from the EC. We estimated a total sample size of n= 1274 for the primary outcome, to detect a minimum clinically significant difference (two-sided) of 1 day between boarders and non-boarders, assuming a baseline non-boarder LOS of 16 days, with a common SD of 6 days. Exposed and unexposed ratio was set at 1:2 as we expect twice as many boarders and non-boarders, with test power at 80%. Stratification will be used to screen and control for potential confounders during the analysis phase. Subgroup analysis will be performed on certain variables to assess the individual effect on hospital length of stay, including diagnosis group and delay to psychiatric consultation. Readmission rate will be measured as it is an important balancing variable that is directly affected by length of stay. The readmission rate will be calculated as defined in Circular H09 of 2018: *"the number of psychiatric patients who are re-admitted to any hospital within 90 days of discharge from the same hospital or other hospitals"*.(48)

The characteristics of incomplete (excluded) data will be described if it includes a significant number of patients (>5% of study sample). Data entry into the electronic patient registry comprises of mandatory fields and very few incomplete entries are expected (<2.5%).

Statistical significance will be defined as p<0.05 and 95% confidence intervals (CI) will be provided if applicable. Data will be analysed by Stellenbosch University Division of Epidemiology and Biostatistics using IBM SPSS Statistics version 25 or STATA.

## Ethical considerations

### Autonomy:

- Patients with MHCs and patients receiving acute care are considered vulnerable with regards to participation in research projects and studies. Their capacity to understand and comprehend the implications of involvement is limited and informed consent will usually be invalid. This project however is a retrospective analysis of previously recorded data with the end goal to improve service delivery to the involved community. The investigators believe that the information that could potentially be gained from this research project will benefit the involved community and results may be applied to shorten their length of stay in hospitals, expedite the time to definitive care and to improve the overall management of patients with MHCs presenting to emergency centres.
- The research involves no more than minimal risk to the participants and we therefore request a waiver of informed consent. As this will be a retrospective analysis of routinely collected data, taking individual consent will be impractical. There is no interest in individual patients, nor individual healthcare personnel.
- Various safeguards are in place to protect the identity of the patients included in this study. Please refer to the data safety section above.

### Justice:

- This research project will not discriminate against any racial or ethnic group, nor will it discriminate against the mental health patients as the retrospective analysis will be performed on existing data (chart review) – there will be no patient contact or intervention; Data will be de-identified at point of entry.

### Beneficence and Non-Maleficence:

- This study will be implemented as an observational study with no intervention and it will have no impact on patient care

**Risk to patients:** No personal or identifying information will be reported on. Folder numbers will initially be used to source information from databases but will be replaced with a unique study number. The study numbers and folder numbers will be stored securely in a separate file as described above. As this is a retrospective study, there will be no influence on patient care.

**Risk to clinicians:** No data regarding clinicians will be collected.

**Risk to hospital:** The hospital's reputation is not threatened in any way by the results, no matter what the outcome of the project may be. The information gained will be used to improve the care that patients with mental and behavioural disorders receive at the hospital involved, as well as at hospitals in similar settings.

Hospital and Provincial Health Department approval will be applied for after UCT HREC approval and prior to the start of data collection.

**Risk to community:** There is no risk to the community. Changes brought about as a result of the study may however benefit the community.

## **Strengths and limitations**

A paucity of data is available that describes the burden of mental and behavioural patients presenting to an EC. This study, taking into consideration the estimated sample size and the methodological vigour, will be the first of its kind in this setting in South Africa. Up to now, management decisions had been based on results from small scale audits with little success. Process times describing the clinical course of a patient with mental or behavioural disorders presenting to an EC, have to date not yet been described. This will form the knowledge base for future studies and policy decisions.

All data collected is sourced from electronic databases and the quality of the data is dependent on the input from the end users. It is reasonable to assume that mistakes could have been made during data capturing and it is impractical to scrutinise every data entry individually. This can be defended by the fact that mistakes will likely both under report and over report appropriate cases and that this non-differential misclassification will likely shift the effect closer to the null value.

Process times from Hectis are accurate as it is entered in real time. It is common knowledge that discharge times (from the psychiatric ward) are often not accurately entered into Clinicom – it is often delayed. This may affect both groups once again and shift the effect towards the null value. This will be mitigated by cross-checking the discharge times on the nursing notes on ECM. This is also done in real time and is much more accurate.

## **Data dissemination**

We hope to present the data in a peer reviewed journal and at a local or international conference. The data will also be presented to the management team at Mitchells Plain Hospital, as well as the provincial service working groups for Emergency Care and Psychiatry. This research project will also form part of the research component of an MPhil degree at UCT.

## Project timeline

This study should be completed within eight months from ethics approval.

Table 5: Time Schedule

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
<b>Ethics Submission</b>	x	x										
<b>Provincial Approval</b>			x	x	x							
<b>Data collection</b>						x	x					
<b>Data management</b>							x					
<b>Statistical analysis</b>								x				
<b>Reporting of results</b>								x	x			
<b>Writing up</b>						x	x	x	x	x		
<b>Preparation for submission and publication</b>									x	x		

## Budget and resources

### Budget

The research project will be self-funded.

Table 6: Budget

Item	Description	Unit cost	Number of units	Total cost
<b>*Travel Expenses</b>				<b>R406.86</b>
• <i>Data collection</i>	**Trips to study hospital from UCT: 46km x 5 trips	R1.3/km	230 km	R300.00
• <i>Research team meetings</i>	**Monthly trips to central meeting point (Tygerberg Hospital): 27.4 km x 3 trips	R1.3/km	82.2 km	R106.86
<b>Personnel</b>				<b>R1200.00</b>
• <i>Statistician</i>	Statistical sciences SUN	R600/hour	2 hours	R1 200.00
<b>Total</b>				<b>R1 606.86</b>

\*SARS rates per kilometre (2019): <https://www.sars.gov.za/Tax-Rates/Employers/Pages/Rates-per-kilometer.aspx>

\*\*Google Maps as on 23 December 2021: <https://www.google.co.za/maps/>

### Available resources

Hardware: Laptop and printer

Word Processing and spreadsheet software: UCT subscription to Office 365

Statistical software: UCT subscription to SPSS Statistics 25

Transport: Motor vehicle

Geospatial mapping software: ArcGIS, the mapping and analytics platform (Free Version)

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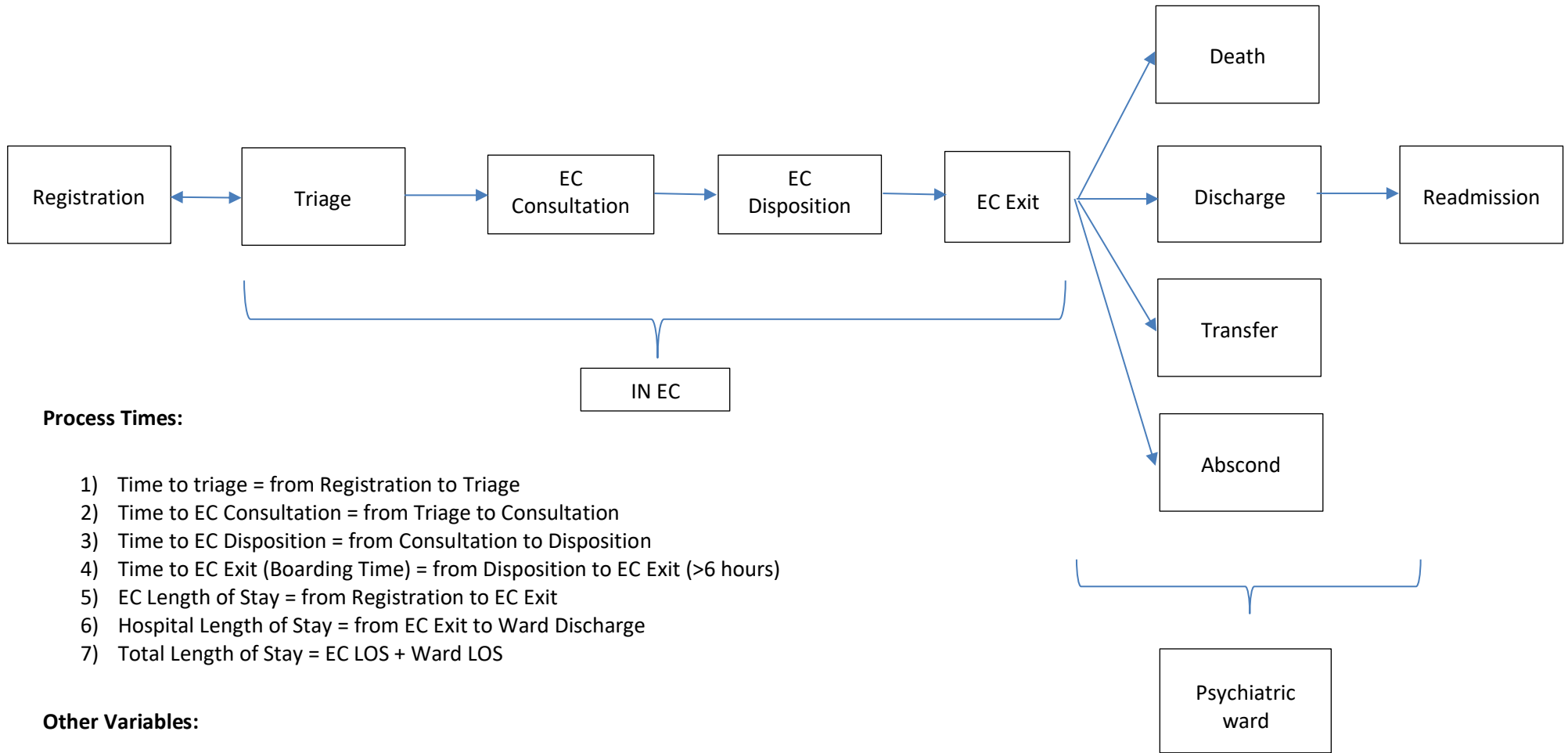
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## Addendum 1: Process Flow Chart (time stamps)

### Process Flow Chart (time stamps) (for patients admitted to the inpatient psychiatric team)



#### Process Times:

- 1) Time to triage = from Registration to Triage
- 2) Time to EC Consultation = from Triage to Consultation
- 3) Time to EC Disposition = from Consultation to Disposition
- 4) Time to EC Exit (Boarding Time) = from Disposition to EC Exit (>6 hours)
- 5) EC Length of Stay = from Registration to EC Exit
- 6) Hospital Length of Stay = from EC Exit to Ward Discharge
- 7) Total Length of Stay = EC LOS + Ward LOS

#### Other Variables:

- 1) Time to Psychiatric Consultation = from EC Disposition to Psychiatric Consultation

### Addendum 3: Differences between the proposal and study

Two of the aims and objectives of the proposal were not met in study:

1. Secondary objective 4b: *To perform subgroup analysis to assess the effect of the following variables on hospital length of stay and psychiatric boarding: Time delay to psychiatric consultation.* This objective was not met because the time of psychiatrist consultation was not routinely documented, and the quality of the data was not adequate.
2. Secondary objective 6: *To perform regression analysis to predict hospital length of stay from length of psychiatric boarding.* Regression analysis was not performed as there was no significant correlation between boarding times and ward length of stay.

Assessing the relationship between boarding times and ward length of stays without considering the effect of the confounding initiative would be imprecise and therefore all results were divided before- and after the start of the initiative.

## Addendum 4: HREC Approval



UNIVERSITY OF CAPE TOWN  
Faculty of Health Sciences  
Human Research Ethics Committee



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23 August 2019

**HREC REF: 539/2019**

**A/Prof P Hodgkinson**  
Division of Emergency Medicine  
F51, OMB

Dear A/Prof Hodgkinson

**PROJECT TITLE: THE ASSOCIATION BETWEEN LENGTH OF EMERGENCY CENTRE BOARDING AND HOSPITAL LENGTH OF STAY FOR PATIENTS WITH MENTAL HEALTH AND BEHAVIOURAL DISORDERS (MPhil - DR CLINT HENDRIKSE)**

Thank you for your response letter dated 19 August 2019, addressing the issues raised by the Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

**Approval is granted for one year until the 30 August 2020.**

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: [www.health.uct.ac.za/fhs/research/humanethics/forms](http://www.health.uct.ac.za/fhs/research/humanethics/forms))

***The HREC acknowledge that the student: Dr Clint Hendrickse will also be involved in this study.***

**Please quote the HREC REF in all your correspondence.**

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate Institutional approval, where necessary, before the research may occur.

Yours sincerely

  
**PROFESSOR M BLOCKMAN**  
**CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE**

Federal Wide Assurance Number: FWA00001637.  
Institutional Review Board (IRB) number: IRB00001938

NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

## Addendum 5: NHRD approval



REFERENCE: WC\_201908\_037  
ENQUIRIES: Dr Sabela Petros

University of Cape Town  
Anzio Road  
Observatory  
Cape Town  
7925

For attention: **DR Clint Hendrikse, PROF Peter Hodgkinson, DR Daniel Van Hoving**

Re: **The association between length of emergency centre boarding and hospital length of stay for patients with mental health and behavioural disorders**

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research. Please contact the following person to assist you with any further enquiries in accessing the following sites:

**Mitchells Plain Hospital**

**Mr Hans Human**

**021 377 4305**

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.
2. By being granted access to provincial health facilities, you are expressing consent to provide the department with an electronic copy of the final feedback (**annexure 9**) within six months of completion of your project. This can be submitted to the provincial Research Co-ordinator ([Health.Research@westerncape.gov.za](mailto:Health.Research@westerncape.gov.za)).
3. In the event where the research project goes beyond the *estimated completion date* which was submitted, researchers are expected to complete and submit a progress report (**Annexure B**) to the provincial Research Co-ordinator ([Health.Research@westerncape.gov.za](mailto:Health.Research@westerncape.gov.za)).
4. The reference number above should be quoted in all future correspondence.

Yours sincerely

**DR M MOODLEY**  
**DIRECTOR: HEALTH IMPACT ASSESSMENT**  
DATE:  
CC

**Dr Melvin Moodley**  
Director: Health Impact Assessment  
02 OCT 2019

