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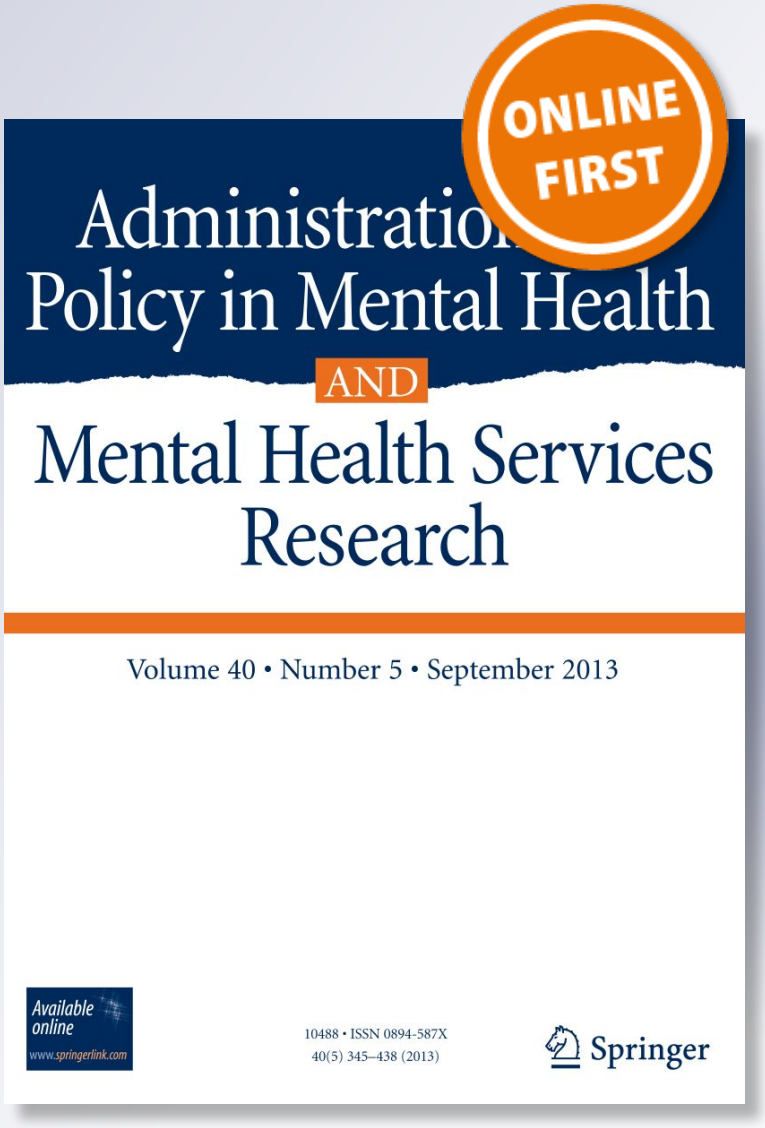

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ORIGINAL ARTICLE

Observed Outcomes: An Approach to Calculate the Optimum Number of Psychiatric Beds

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Abstract
The number of psychiatric beds, in most developed countries, has decreased progressively since the late 1950s. Many clinicians believe that this reduction has gone too far. But how can we determine the number of psychiatric beds a mental health system needs? While the population health approach has advantages over the normative approach, it makes assumptions about optimal and minimum duration of hospitalization required for various psychiatric disorders. In this paper, we describe a naturalistic approach that estimates the required number of psychiatric beds by comparing the bed levels at which negative outcomes develop in different jurisdictions. We hypothesize that there will be a threshold below which negative outcomes will be seen across jurisdictions. We predict that hospital key performance indices will be more sensitive to bed reductions than the clinical and social outcomes of patients. The observed outcome approach can complement other approaches to determining bed numbers at the national and local levels, and should be a priority for future health services research.

Keywords Psychiatric beds · Deinstitutionalization · Health services research

Introduction

In most high income countries the numbers of psychiatric beds per capita have decreased progressively since the late 1950s (Sealy and Whitehead 2004; Allison et al. 2018). Two factors contributed to the onset of this decrease. First, for much of the twentieth century, large mental hospitals, particularly those in the United States, were underfunded and overcrowded (Deutsch 1948). Neglect of patients in these institutions led to a socio-political movement to close the asylums (Goffman 1961). Second, the introduction of effective psychotropic medications in the 1950s, especially antipsychotic medication, made it possible to effectively treat large numbers of patients with serious mental illness (SMI) who could then be discharged from hospital (Chow and Priebe 2013).

Many countries subsequently developed psychiatric inpatient units in general hospitals, initially to complement, but ultimately to replace, large freestanding psychiatric hospitals. The architects of this deinstitutionalization movement did not attempt to establish the number of beds required by a well-functioning mental health system. Some jurisdictions eventually set benchmark figures for bed numbers, but these decisions were not based on empirical evidence. In the absence of established targets, funders and administrators generally reduced the numbers of psychiatric beds using a "how low can you go?" approach. As bed numbers declined problems in the functioning of psychiatric units and adverse patient outcomes were observed (Munk-Jorgensen 1999). Many clinicians believe that psychiatric beds have been reduced to levels that not only preclude the provision of good care, but also adversely affect patient safety (La et al. 2016; Torrey 2015; Fuller et al. 2016; Allison et al. 2018).

The assertion that there are insufficient numbers of psychiatric beds is often met by the statement that what is needed are additional community services rather than more beds (Rosen et al. 2018; Johnson 2011). While well-developed community mental health services can reduce the requirement for hospitalization, a core group of patients need a period of inpatient care when there is a significant risk of self-harm or harm to others. Most

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scholars conclude that the mental health care system should have both bedded and non-bedded services (Pirkis et al. 2007; Thornicroft and Tansella 2013). Some argue that the development of non-bedded services only reduce bed requirements when bed numbers are high and suggest that many countries have exhausted options for new community services that could facilitate further reduction of bed numbers: the law of diminishing returns (Tyrer 2011). The fact that countries with differently structured mental health systems have experienced intense pressure on inpatient services (Sisti et al. 2018; Tyrer 2011; Allison et al. 2018), and a worsening of the plight of patients with SMI as numbers of psychiatric beds decreased (Munk-Jorgensen 1999; Sisti et al. 2015), suggests that bed numbers may have been reduced below a minimal threshold.

But how can we tell how many beds are needed by a well-functioning mental health care system? Ideally, we would manipulate the number of bed numbers in different regions of a single jurisdiction and measure relevant outcomes. We are unaware of such experiments and in view of the practical and ethical barriers doubt that any will be conducted.

Three alternative approaches have been proposed to calculate the required number of psychiatric beds: (1) expert consensus, (2) the normative approach and (3) the population health approach (Harris et al. 2012).

Based on expert consensus, both the Canadian Psychiatric Association and the Treatment Advocacy Center in the United States recommended a target of 50 publicly funded psychiatric beds per 100,000 population (Gordon 1997; Torrey et al. 2008). While expert consensus collates the views of senior clinicians, the Canadian Psychiatric Association and the Treatment Advocacy Centre do not say how these clinicians arrived at their estimate. Moreover, evidence-based medicine considers expert opinion of limited value in a hierarchy of evidence (Toneli 1999).

The normative approach is based on the supposition that jurisdictions with broadly similar health care systems and demographics will require the same number of beds. A jurisdiction that is delivering good service can then act as a model on which a similar jurisdiction can base its estimate of the required number of beds.

The marked difference in numbers of psychiatric beds per capita reported by countries with broadly similar economies and health care systems poses a challenge for the normative approach. There is more than a ten-fold difference in the numbers of psychiatric beds reported to the Organization for Economic Cooperation and Development (OECD) by members of the European Union (Fig. 1). If these countries provide equivalent services, should bed targets be modelled on the higher or lower numbers?

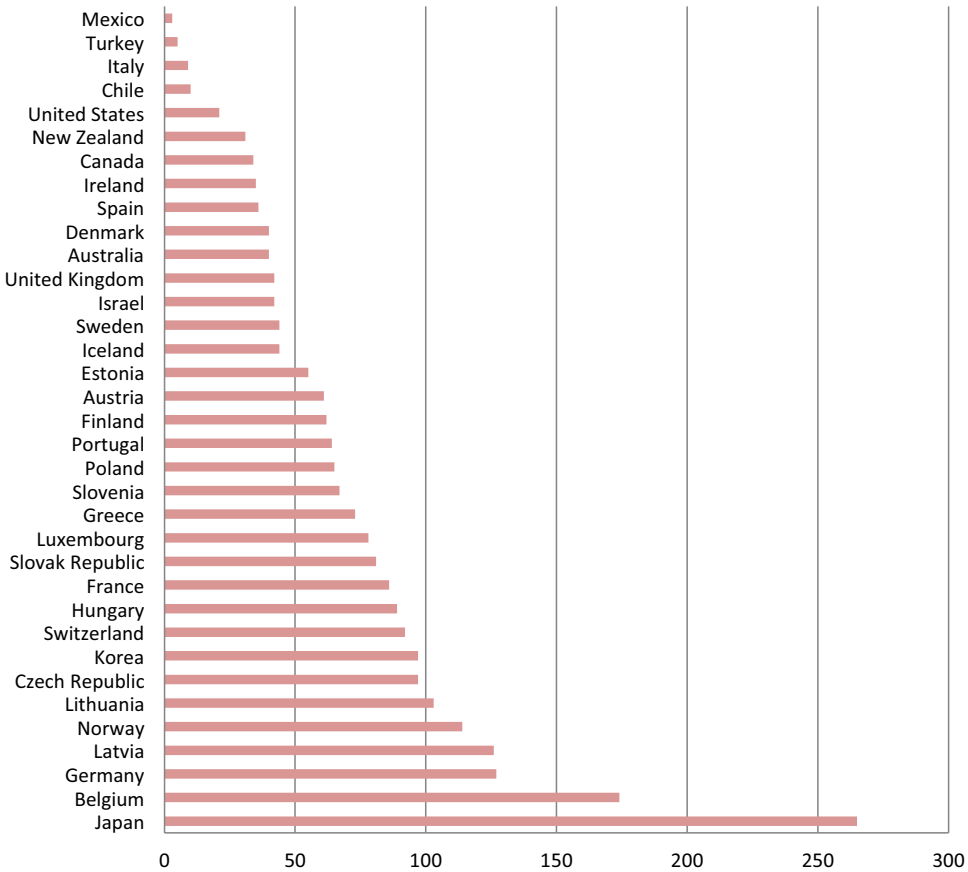

Fig. 1 Psychiatric care beds per 100,000 population, 2014–2016 (OECD website https://doi.org/10.1787/0191328e-en)

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Part of the disparity in the OECD bed figures is likely due to the definition of a psychiatric bed. For example some, but not all countries, classify residential services for individuals being withdrawn from, or receiving rehabilitation for, alcohol and drug addiction as psychiatric beds. Lack of a standard definition makes it difficult to understand the reported international differences in bed numbers. Italy reports 9 beds per 100,000 population (9/100,000), which is less than 25% of the number in the UK (Fig. 1). Italy's low number of beds has been the model for a normative approach that has had a major influence on service development in many countries around the world (Fioritti 2018). However, Italy underscores the problem of defining a psychiatric bed. Italy has a large number of residential treatment facilities that it does not consider to be hospitals even though many provide psychiatric rehabilitation in a manner that would be considered inpatient care elsewhere (Guaiana et al. 2018). This is a consequence of Italian Law 180, which bans large psychiatric hospitals (Burti and Benson 1996). These and other considerations make Italy's reported bed numbers too low to be used as the basis of a normative-based calculation (Guaiana et al. 2018).

The population health approach begins by evaluating the prevalence and severity of mental illness within a jurisdiction and then applies standards for the use of components of care, including inpatient care, to determine the required number of beds and other services. An advantage of the population health approach is that it can accommodate variations in the prevalence of psychiatric disorders between jurisdictions. Rates of psychiatric disorders, including substance abuse (Global Drug Survey 2017) and psychosis (Mulè et al. 2017), vary significantly between countries. The major weakness of a population health approach is that it is premised on propositions about volume of each service required for each disorder. However, there are few empirical data to indicate the optimal duration of inpatient services for the common psychiatric disorders. Therefore, the population health approach requires assumptions about optimal length of inpatient stay and these assumptions limit its ability to accurately predict the numbers of psychiatric beds a jurisdiction will need.

In this paper, we propose an alternative method, which we call the "observed outcome approach," to calculate psychiatric beds requirements. The observed outcome approach proposes that varying access to psychiatric beds has observable effects on health systems and populations. The approach examines the relationship between bed numbers and key performance indicators (KPIs) for hospitals and population outcomes for people with mental illness to calculate minimum and optimum bed requirements. The observed outcome approach may aid international comparisons of access to inpatient care and assist governments to predict required bed numbers at both the national and local levels.

Table 1 Hospital key performance indicators and population outcomes

Hospital KPIs
Out of area placements
Boarding in emergency rooms
Involuntary admission
Occupancy rates in psychiatric units
Average length of stay in psychiatric units
Level of acuity on inpatient wards
Discharge to homelessness
Readmission rates
Population outcomes
Rates of homelessness amongst people with SMI
Rates of people with SMI in homeless shelters
Rates of all-cause mortality
Rates of suicide
Rates of crime committed by people with SMI
Rates of incarceration amongst people with SMI
Rates of people with SMI in jails
Burden on carers

A KPI is a quantifiable measure used to track and evaluate the success of an organization's performance as the organization works towards its strategic goals. Hospitals regularly use KPIs, such as wait times for specific services, to monitor their performance and plan for the future. A priori, some KPIs, such as bed occupancy and boarding patients in emergency rooms, seem especially likely to be affected by the number of available psychiatric beds. Reducing bed numbers likely results in higher occupancy rates for the remaining beds, and consequently lengthens stays in emergency rooms for patients needing admission. If patients are unable to be admitted in a timely way to a local bed, or are discharged prematurely from hospital, they may face additional risks, which contribute to adverse population outcomes such as rates of suicide and incarceration.

We hypothesize that there are thresholds for the safe minimal number of psychiatric beds below which further reduction will have a markedly negative effect on KPIs and lead to adverse population outcomes. Confidence in the utility of the observed outcome approach for planning will be strengthened if different countries show similar thresholds for a particular hospital KPI or population outcome.

We predict that hospital KPIs are likely to be more sensitive to changes in bed numbers than population outcomes because the latter are distal outcomes that are likely affected by a range of factors apart from bed numbers. We previously reported the relationships between changing bed numbers and a hospital KPI in the state of South Australia (Allison et al. 2018). Decreasing and subsequently increasing bed numbers was associated with the changes in the expected direction for duration of boarding in emergency rooms. In the current paper, we explore the evidence for these relationships at the national and international levels.

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In Table 1, we list KPIs and population outcomes that may be affected by increasing or reducing psychiatric bed numbers. The current paper examines the potential and limitations of these indices for the observed outcomes approach. The list of indices was compiled through a scan of the literature and consultation with colleagues in four countries, Australia, Canada, UK and US who were asked to identify measurable factors that could indicate when a mental health system has too few beds. Each of these four countries has experienced a rapid decrease in psychiatric bed numbers and has a strong tradition of health policy research.

We briefly describe each KPI and population outcome and discuss how they may be affected by the available number of psychiatric beds. Some research has been conducted on the relationship between psychiatric bed numbers and a number of these variables. While it is beyond the scope of this article to provide a systematic review of the research for each variable, we will discuss some selected studies to indicate how the observed outcomes approach may work.

Hospital KPIs

Out of Area Placement

Out of area placements (OAPs) occur when a local hospital has no available beds and a patient, who needs inpatient care, is transferred to a neighbouring or distant hospital which has an available bed. The use of OAPs varies between countries and sometimes between regions within a country. Sending a patient to a distant hospital is problematic as it isolates patients from family and friends (Edwards et al. 2012), causes discontinuity of care during the critical period after discharge (Killaspy and Meier 2010) and increases length of stay and overall costs (Killaspy and Meier 2010; Edwards et al. 2012). The use of OAP has increased in the UK during a period of bed reductions (McNicoll 2015; Kentish 2017). While some suggest that an increase in OAPs is caused by the decreasing availability of beds (Kentish 2017), we are unaware of research that has formally studied the relationship between the bed numbers and OAPs.

Boarding in Emergency Room

When patients need admission and there are no available beds in the psychiatric unit, an alternative to OAP is to officially admit the patients but keep them in the emergency department (ED). This is known as "psychiatric boarding" (Simpson et al. 2014). Patients are boarded in the ED when inpatient care is considered absolutely necessary and thus often restricted to patients who meet criteria for involuntary admission based on their risk of harm to themselves or others (Applebaum 2015). The duration of ED boarding varies from hours to days (Alakeson et al. 2010; Bender et al. 2008). Limited psychiatric treatment is provided to these patients (Bender et al. 2008) apart from chemical restraint that may be used for agitation precipitated by overstimulation in a chaotic environment (Allison et al. 2018). Boarding has a detrimental effect on other patients using the ED, and on ED staff (Chalfin et al. 2007; Bender et al. 2008; Nicks and Manthey 2012; Alakeson et al. 2010).

Psychiatric boarding is increasing in US hospitals (Applebaum 2015) and many believe that the cause is a lack of psychiatric beds (Bender et al. 2008; Chang et al. 2011; Swartz 2016). However, the lack of systematically collected data on ED boarding makes it a difficult phenomenon to study (O'Neil 2016), and there are few longitudinal or comparative studies.

Rate of Involuntary Admission

The rate of involuntary admissions is rising in Canada (Lebenbaum et al. 2018) and has increased in many, but not all, European countries (Priebe et al. 2005). The increase in involuntary admission in the UK correlates with the reduction in psychiatric bed numbers (Keown et al. 2011). The reasons for this association are unclear. A reduction in bed availability limits the option for elective admission and may result in a deterioration of a patient's condition to a level at which the patient must be admitted involuntarily. Alternatively, increased acuity levels have made psychiatric wards unpleasant environments and patients may refuse voluntary admission leading to higher rates of involuntary admissions. Decisions about involuntary admissions are complex and influenced by factors apart from bed availability.

Occupancy Rates

Bed occupancy is defined as the sum of the number of days in hospital for all patients divided by the time the beds were available. The Royal College of Psychiatrists in the UK notes that occupancy rates are the main driver of inpatient care standards and stipulates that bed occupancy rates in psychiatric units should be maintained at 85% or less (Royal College of Psychiatrists 2011). This is also the level recommended in other health care specialties (Green 2003). Occupancy rates in psychiatric units appear to have increased as bed numbers have declined (Jones 2013; Crisp et al. 2016). A recent survey of mental health trusts in the UK reported that bed occupancy on psychiatric wards ranged from 57 to 147% with an average of 104% (Crisp et al. 2016). While it seems likely that occupancy rates have increased as bed numbers have decreased, we were unable to locate studies to confirm this.

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Length of Stay

As psychiatric bed numbers have decreased so has the average length of stay (LOS) per admission (Lee et al. 2012; Jacobs et al. 2015). Indeed, the reduction of LOS has been an intentional response of many hospitals faced with bed shortages (Slade and Goldman 2015). Reduction in LOS is a phenomenon that is seen in many medical specialties (OECD: Health Data 2009) and is sometimes an objective of health care systems attempting to reduce costs (Caplan et al. 1999). Reducing LOS appears to be a feasible approach to cost containment for procedural-based services, but even for procedural services the reduction of LOS below a critical point increases morbidity and mortality (Wong et al. 2011) and rates of readmission (Nordström et al. 2015). The critical LOS below which adverse outcomes occur for patients receiving psychiatric care is likely significantly longer than for procedural-based services, because inpatient psychiatric care often requires a period of evaluation. Furthermore, many psychiatric treatments have a time lag before the onset of effectiveness. Remarkably, in the US, median LOS in psychiatric units of community hospitals has fallen to 6 days (Sisti et al. 2018). These ultra-short admissions do not accommodate the delayed onset of action of most psychiatric medications, provide inadequate time for discharge planning and may contribute to homelessness (Backer et al. 2007). A systematic review by the Cochrane Collaboration concluded that there was no evidence of adverse effects of short LOS (Babalola et al. 2014). However, in addition to low quality of available studies, this review defined a short LOS as less than 28 days. Well-designed studies need to be undertaken to determine if there are adverse effects of current ultra-short admissions.

Level of Acuity on Inpatient Units

As the numbers of psychiatric beds have declined admission has increasingly been limited to patients with the most severe illnesses. Many of these patients are agitated; this appears to have caused an increased incidence of disturbed behaviour on inpatient units, including violent assaults towards staff (Virtanen et al. 2011; Bowers et al. 2011). Although an important KPI, there appears to have been limited systematically collected longitudinal data on behavioural disturbance on psychiatric wards. Level of acuity could be measured either using standard measures of psychopathology or calculation of the number incidents of aggression. Other factors such as staffing levels, staff training, level of stimulation and ward programming have been shown to affect the level of violence and would need to be controlled for (Bowers et al. 2011).

Frequency of Discharge to Homelessness

Homelessness has increased in most western countries over the last 30 years (Lee et al. 2010). It is a complex problem that likely has multiple causes (Gaetz et al. 2013). Homelessness is a stressor that can increase the risk of relapse of mood and psychotic disorders, but it is also an outcome of untreated severe mental illness (Fazel et al. 2008) and therefore an indicator of failure of the mental health system. Prior to deinstitutionalization, people who were unable to look after themselves because of severe and persistent mental illness were provided permanent housing in large asylums. In the early years of deinstitutionalization, placement in appropriate housing was viewed as an important component of discharge planning for patients admitted to a psychiatric unit. More recently the pressure to free up beds, and limited availability of high support placements, has meant that a place to live at the end of an inpatient stay is not guaranteed and patients are discharged to homelessness even following psychiatric rehabilitation in tertiary care facilities (Forchuk et al. 2006). There has been little systematic study of the phenomenon of discharge to homelessness.

Readmission to Hospital

Readmission within a short period of discharge from a psychiatric unit often indicates a failure to adequately treat the primary condition or to make a plan to deal with environmental stressors that the patient will experience following discharge (Gaynes et al. 2015) and readmission rates are sometimes used as a proxy indicator for quality of inpatient care (Ashton et al. 1997). In the US, psychotic illnesses have the highest readmission rate for the first seven days after discharge and are second after congestive heart failure for readmission within 30 days of discharge from hospital. A systematic review of the literature on psychiatric readmission and system variables including bed numbers found that limited research has been published in this area (Kalseth et al. 2016).

Population Outcomes

Homelessness

People with mental illness are overrepresented in homeless populations with higher rates not only for individuals with alcohol and substance abuse, but also for mood and psychotic disorders (Fazel et al. 2008). These rates have been reported to be increasing (North et al. 2004) and the percentage of homelessness in people suffering from chronic psychotic disorders, such as schizophrenia, may be as high as 11% (Folsom and Jeste 2002). One study of homelessness

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in US cities demonstrated an inverse correlation between homelessness and numbers of psychiatric beds (Markowitz 2006). However, homelessness and specifically rates of homelessness in people who suffer from serious mental illness is a complex problem. Lack of availability of psychiatric beds may be one of many causative factors but other factors such as employment rates, availability of supported housing or of assertive community treatment almost certainly affect rates of homelessness of people with serious mental illness.

Rates of Suicide

Some scholars have suggested that increasing difficulty securing a bed on a psychiatric unit and rapid turnover leading to premature discharge has led to an increase in the suicide rate (Munk-Jorgensen 1999). Several groups of researchers have reported a significant correlation between psychiatric bed numbers and suicide (Bastiampillai et al. 2016; Yoon and Bruckner 2009; Goldacre et al. 1993). In contrast, a number of other studies have failed to show this relationship (Vyssoki et al. 2011; Pirkola et al. 2007; Madsen and Nordentoft 2013).

Rate of All-Cause Mortality

People with mental illness have a shorter life-expectancy than the general population (Lawrence et al. 2013; Walker et al. 2015; Gatov et al. 2017). Most of this premature mortality is due to physical illness such as cardiovascular and respiratory conditions rather than from suicide or other causes directly attributable to mental illness (Walker et al. 2015; Gatov et al. 2017). Mortality rates have fallen steadily for the general population (Wang et al. 2012) and for people suffering from mental illness, including those with severe mental illnesses such as schizophrenia (Gatov et al. 2017). While some studies show a widening gap in the mortality rates between people with mental illness and the general population (Lawrence et al. 2013), others report a narrowing (Wahlbeck et al. 2011). Reduction of beds has not resulted in an increase in all-cause mortality in people with mental illness.

Rates of Violent Crime Committed by Individuals with Serious Mental Illness

People suffering from a mental illness are more likely to commit crimes than the general population (Brennan et al. 2000; Vogel 2014) with the greatest risk in those who are untreated (Torrey 2015) or have comorbid substance abuse (Vogel 2014). Some scholars have suggested that decreasing numbers of psychiatric beds is associated with increased incidents of violent behaviour by people with SMI (Torrey 2015). We identified one recent study showing a correlation between reduced state hospital beds in the US and firearm related deaths (Meszaros 2017), but could not find studies that more generally examined rates of violence by people with mental illness and number of available psychiatric beds.

Rate of Incarceration of People with Serious Mental Illness

In 1939, Lionel Penrose reported an inverse correlation in the number of patients in psychiatric hospitals and the size of the prison population based on cross-sectional data from 18 European countries (Penrose 1939). This correlation, sometimes referred to as Penrose's law or Penrose's hydraulic theory, has been replicated in many subsequent longitudinal studies (Chow and Priebe 2016; Mundt et al. 2015; Primeau et al. 2013; Hartvig and Kjelsberg 2009; Steadman et al. 1984). However, scholars are sceptical of the simplistic assumptions associated with the hydraulic model. For example, while Large and Nielssen (2009) found a negative correlation between hospital and prison beds in 158 countries in 2004, they noted that this correlation was not seen in a sub-analysis of 38 high income countries. Chow and Priebe (2016) reported that when gross domestic product was added as a potential covariate, the correlation between beds and prison placements disappeared. Raphael and Stols (2013) found a negative correlation in the US after 1980 but not before. Bluml et al. (2015) found a negative correlation between hospital and prison beds across 26 European countries, but noted that this association was not significant in a mixed multivariate regression model suggesting a more complex association.

Methodological issues may account for some of the difference in findings (Dae-Young 2016). While Penrose's hydraulic theory remains controversial, it is clear that in the current era of low bed availability, people with mental illness are overrepresented in jail populations (Fazel and Danesh 2002). The prevalence of psychotic disorders in inmates of US jails is approximately five times that of the general population (Raphael and Stols 2013) and one analysis estimated that 4–7% of the prison population is accounted for by reduced numbers of psychiatric beds (Raphael and Stols 2013).

Burden on Care Givers

Most people with severe mental illness live with their families (Lauber et al. 2003; Sinha 2012) who then carry the primary burden of caring for these individuals (Flyckt et al. 2013). When a person has an exacerbation of their mental illness and there is no bed available, it usually falls to the family member(s) to provide the extra support for the person at home (Allison et al. 2017). We could not find systematic

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research on the relationship between psychiatric bed numbers and family burden.

Discussion

Bedded services are an important component of a comprehensive and balanced mental health care system (Thornicroft and Tansella 2013). As such we should attempt to establish targets for psychiatric beds in the same way we do for other components of mental health services such as the number of assertive community treatment teams or psychiatrists per capita. Many clinicians assert that a lack of available psychiatric beds is having serious deleterious effects on individuals with mental illness. Thus, the establishment of an accepted bed target should be a priority for mental health planners. Bed targets should be based on the best available evidence. We note that the normative approach and population based approach have flaws that lead to an inaccurate estimation of required bed numbers. Indeed, many jurisdictions eschew these approaches, and have reduced psychiatric bed numbers based using a "how low can you go approach." Ironically, the observed outcome approach may actually answer the question "how low can you go."

We have identified eight hospital KPIs and eight community outcomes that may be affected by reductions in the number of psychiatric beds. We conducted a selected literature review to determine the importance of these outcomes and their relationship to bed numbers. This review suggests that several hospital KPIs may have deteriorated over time. For example, in many hospitals occupancy rates remain stubbornly above the recommended 85% level. However, we could not find decisive data showing an increase in occupancy rates over time or evidence that occupancy rates correlate with bed numbers. Likewise, while it appears that OAPs and boarding in the ED are relatively new phenomena, little formal research has been undertaken to determine whether they are related to decreasing bed numbers.

Intuitively, it seems likely that the decreased number of psychiatric beds has affected hospital KPIs such as occupancy, LOS, OAPs and ED boarding. If so, systematic study should be able to determine if there is a critical number of beds per capita below which a KPI such as ED boarding occurs. If ED boarding occurs at similar bed numbers across jurisdictions, and especially if those jurisdictions had varied non-bedded mental health services, policy planners would have a narrow range for psychiatric bed numbers below which OAPs or ED boarding would be expected to occur.

While hospital KPIs are important to policy planners, clinical and social outcomes are what concern patients and their carers. The utility of population variables in calculating bed requirements may be more limited than hospital KPIs. Population variables are almost certainly affected by factors apart from the number of psychiatric beds. Studies of the relationship between the number of psychiatric beds and population variables, such as incarceration of individuals with SMI and suicide rates, show inconsistent results. It is possible that some negative outcomes, such as increase in suicide rates or all-cause mortality, may only become apparent if beds are reduced to a very low number per capita. Elucidation of this type of relationship requires more systematic and fulsome research approach than has been undertaken to date.

It appears that a vigorous effort to assess the effects of reducing psychiatric bed numbers is an important and urgent need for mental health services. To facilitate international comparisons, there must be agreement on the definition of what constitutes a psychiatric bed. We suggest starting from three basic types of psychiatric bed, (1) Acute care beds, which are nearly always located in general hospitals and provide short-term admission and treatment. (2) Rehabilitation beds, which are usually located in stand-alone facilities and provide longer-term treatment and rehabilitation. (3) Supervised residential placements, which provide a range of time-limited or permanent places to live. Supervised residential placements are not usually considered as psychiatric beds, and not reported as such by the OECD. However, they play an important role in the mental health care system and residential placements with 24-h clinical support likely have a significant effect in reducing demand for hospitalization. At a minimum, meaningful comparisons require information on all three types of beds. However, the devil is in the details. There are variations in how countries manage behavioural problems and consequently how they define acute psychiatric beds. For example in Italy, children, and elderly patients with dementia, who have behavioural problems are usually admitted to paediatric and general medicine units respectively, rather than to psychiatric units as happens in many other countries (Guaiana et al. 2018). A taxonomy of residential placements has been developed (McPherson et al. 2018) and the development of a similar type of taxonomy for hospital beds would be helpful. In the meantime, countries should provide a more detailed breakdown of their psychiatric bed numbers to include the portion that are used for children and adolescents, cognitively impaired older patients, detoxification from substances and rehabilitation from substance abuse.

Health service research using the observed outcome approach can be undertaken using data that are routinely collected by governments. These studies can elucidate whether reductions of bed numbers affect hospital KPIs such as occupancy rate, OAPs and ED boarding. Countries that maintain national health registries which collect longitudinal data on patient outcomes, including several Nordic countries, may be particularly well placed to undertake these studies. Interpretation of this research must consider

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the possibility that there are thresholds in the number of beds below which adverse outcomes occur. Much of the available research examining the effect of reducing the numbers of psychiatric beds was conducted in an era when bed availability was much higher than it is now and some of this research needs to be repeated.

In conclusion, the observed outcomes approach may allow governments to make more confident decisions about targets for psychiatric bed numbers, based on health services research using hospital KPIs and population outcomes summarized in this paper. When indicators such as bed occupancy, out of area admissions and length of stay in emergency rooms increase despite the provision of additional community resources, adjusting bed numbers upwards would seem to be the most appropriate action. If our hypothesis, that there are thresholds for the number of psychiatric beds below which adverse outcomes begin to appear, is correct the development of bed targets may avoid turmoil within hospital systems and ultimately improve the outcomes for patients and their families.

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Compliance with Ethical Standards

Conflict of interest The authors have no conflicts of interest related to this article.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

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