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Therapeutic Leave and Coercive Measures in Inpatient Psychiatry

A Clinical and Health Economic Viewpoint

Inaugural dissertation to attain the academic title Doctor of Philosophy submitted to the Faculty of Psychology of the University of Basel by

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Declaration of Scientific Integrity

I hereby declare that I wrote this thesis without the assistance of a third party and without using any help/tools other than the ones declared. References used in this work are presented as such. The published studies and the one submitted for publication have been written in collaboration with the co-authors. They have not been published or submitted for publication elsewhere, nor have they been submitted to another examination committee for any co-authors' candidature of an academic qualification.

This dissertation summarizes the following three studies. Parts of the articles have been used in this dissertation. To improve readability, no in-text citations have been made for the three articles.

- Tiziana Ziltener, Julian Möller, Lukas Imfeld, Roselind Lieb, Undine E. Lang, Christian G. Huber, Time to readmission in psychiatric inpatients with a therapeutic leave, *Journal of Psychiatric Research*, Volume 144, 2021, Pages 102-109, ISSN 0022-3956, https://doi.org/10.1016/j.jpsychires.2021.09.050

- Tiziana Ziltener, Julian Moeller, Roselind Lieb, Andrea H. Meyer, Undine E. Lang, Christian G. Huber, Therapeutic leave and direct inpatient healthcare costs in inpatients with mental illness, *Journal of Psychiatric Research*, Volume 162, 2023, Pages 187-192, ISSN 0022-3956, https://doi.org/10.1016/j.jpsychires.2023.05.023

- Tiziana Ziltener, Julian Moeller, Eva Kowalinski, Undine E. Lang, Christian G. Huber, Relative efficiency of staff resources regarding inpatient treatment without coercive measures in 11 German psychiatric hospitals using data envelopment analysis (DEA) [Manuscript submitted for publication]

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Tiziana Paola Ziltener

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Abstract

In inpatient psychiatric care, readmissions and coercive measures can be problematic in various aspects. More research on treatment variables is needed to improve the quality of care and reduce readmission and coercive measures. Inpatient care is also a large cost driver of healthcare systems. With a global increasing economic burden of mental ill health, health economic analyses are warranted to promote policy change according to scientific evidence. This dissertation, therefore, integrates a clinical and health-economic perspective to examine two treatment variables in inpatient care: therapeutic leave and staff resources relating them to readmission, direct inpatient costs, and coercive measures. Therapeutic leave (TL) is an established practice in inpatient psychiatry. However, research on its association with readmission and inpatient costs is scarce. Studies have addressed the association between staff resources and coercion but yield limited and heterogeneous results.

Study 1 assessed the readmission risk of patients with TL during their inpatient stay compared to patients without TL applying a survival analysis. The results showed a significantly longer cumulative survival and a reduced hazard of readmission for patients with TL compared to patients without TL. Study 2 was a follow-up study of Study 1 and examined whether there is an association between TL and direct inpatient costs in the months following discharge. We applied a Tweedie regression model. Study 2 showed TL is associated with lower direct inpatient costs after discharge. Study 3 examined how efficiently psychiatric clinics maximize inpatient cases without seclusion and restraint with their given staff number of full-time equivalents. The results suggest that clinics are relatively efficient at maximizing cases without coercion. However, changes in management and careful consideration of team composition are necessary to further increase cases without seclusion and restraint.

In conclusion, Study 1 and Study 2 add to the limited knowledge of TL in relation to readmission risk and direct healthcare costs. In addition, Study 3 sheds more light on staff-related factors in reducing coercive methods. By integrating a clinical and health-economic perspective, this dissertation considers an ever-present and growing conflict between economic motives and a patient-oriented psychiatry lead in line with ethical principles. This dissertation's results imply a link between TL during inpatient treatment, a lower readmission risk, and lower direct inpatient costs after discharge. Regarding TL, randomized controlled trials are needed to assess the causality of our results. We still need to better understand the underlying mechanisms of TL. More health economic analyses, especially including indirect costs, are required. TL might be a suitable intervention to improve the quality of care. Whilst our results of Study 3 show that clinics are relatively efficient at maximizing cases without coercion, economic and ethical considerations regarding staff numbers in psychiatric clinics need to be balanced out. Coercive measures should never, even implicitly, be driven by monetary factors. When it comes to the integrity of human beings, ethical considerations must outweigh economic motives.

List of Acronyms

CRS	Constant Returns to Scale
DEA	Data Envelopment Analysis
DMU	Decision-Making Unit
DRG	Diagnostic Related Groups
FTE	Full-Time Equivalents
LOS	Length of Stay
PCG	Psychiatric Cost Groups
SAMS	Swiss Academy of Medical Sciences
SE	Scale Efficiency
TE	Technical Efficiency
TL	Therapeutic Leave
VRS	Variable Returns to Scale

1. Introduction

Inpatient care can be distressing for patients and their environment under certain circumstances (Donisi, Tedeschi, Wahlbeck, et al., 2016). Readmissions to a psychiatric clinic (Donisi, Tedeschi, Salazzari, et al., 2016; Donisi, Tedeschi, Wahlbeck, et al., 2016; Evans et al., 2017; Han et al., 2020; Hewlett & Moran, 2014; Lien, 2002) or coercive measures during treatment (Chieze et al., 2019; Fugger et al., 2016; Krieger et al., 2018; Steinert et al., 2013; Whitecross et al., 2013) can both be problematic from clinical, social, ethical, and economic perspectives. Psychiatric inpatient care is also a large cost driver in healthcare systems, causing a significant financial burden (Gustavsson et al., 2011; WHO 2022). Inpatient costs make up the largest share of direct mental healthcare costs (Gustavsson et al., 2011).

Patient-level risk factors for readmission (Donisi, Tedeschi, Wahlbeck, et al., 2016) and coercive measures (Beames & Onwumere, 2022) have been studied widely. Research on inpatient treatment variables is needed to improve psychiatric inpatient care regarding readmission and coercive measures. With a global increasing economic burden of mental ill health (Vigo et al., 2016) and pressure on psychiatric clinics to be not only economically sustainable but also profitable, a conflict arises between saving costs and implementing the best practice possible. Health economic analyses are needed to promote policy change according to scientific evidence, bridging the gap between theory and practice (Knapp & Wong, 2020).

This dissertation addresses the outlined challenges by looking at two treatment variables in inpatient care integrating a clinical and a health-economic perspective: therapeutic leave (TL) and staff resources. Therapeutic leaves (TL) are planned time-limited absences from the inpatient ward where patients test their resilience in their usual environment (Barlow & Dickens, 2018; BfS, 2023). Despite their established practice in psychiatry, they remain barely researched (Barlow & Dickens, 2018). Studies on their association with readmission risk (Docteur et al., 2022; Moss et al., 2014) are scarce, and their association with direct healthcare costs had not been assessed before. Research on the association of staff resources and coercion presents limited and heterogeneous results (Bowers et al., 2012; Fukasawa et al., 2018; Husum et al., 2010; Janssen et al., 2007; Krieger et al., 2021).

The following subchapter will provide a more in-depth theoretical background of readmission, TL, and coercive measures in relation to staff resources.

1.1. Readmission

A readmission occurs when a patient has completed an inpatient stay in a psychiatric clinic, is discharged, and then readmitted again (Goldfield et al., 2008; Kim et al., 2019). Readmissions strain healthcare systems financially and can be detrimental to patients and their surroundings (Donisi, Tedeschi, Wahlbeck, et al., 2016; Evans et al., 2017; Han et al., 2020; Hewlett & Moran, 2014; Lien, 2002).

Readmission rates, therefore, often serve as a quality-of-care indicator (Baeza et al., 2018; Durbin et al., 2007; Han et al., 2020; Moss et al., 2014; Valevski et al., 2007; Zhang et al., 2011). However, this approach has been challenged (Durbin et al., 2007; Valevski et al., 2007). On the one hand, readmissions might reflect inadequate inpatient treatment, resulting in early relapse (Craig et al., 2000; Durbin et al., 2007). From this perspective, high readmission rates represent a poor treatment outcome (Baeza et al., 2018; Craig et al., 2000; Durbin et al., 2007). On the other hand, low readmission rates might indicate an exhausted healthcare system lacking resources or applying restrictive readmission policies (Leslie & Rosenheck, 2000). In that scenario, readmissions represent an accessible healthcare system with adequate resources (Leslie & Rosenheck, 2000). One might further argue that readmissions reflect a failure of outpatient care and are thus not a valid quality indicator for inpatient care (Durbin et al., 2007; Lyons et al., 1997).

Studies have identified patient-level risk factors and service characteristics associated with readmission (Donisi, Tedeschi, Wahlbeck, et al., 2016). On a patient level, a diagnosis of schizophrenia and or mania (Bockmann et al., 2019; Mascayano et al., 2022; Ortiz, 2019; Silva et al., 2009), a diagnosis of personality disorder (Del Favero et al., 2020; Tulloch et al., 2016), comorbidity (Han et al., 2020; Mascayano et al., 2022), male gender (Han et al., 2020; Rieke et al., 2016), younger age at first admission (Silva et al., 2009), not being married (Bockmann et al., 2019; Han et al., 2020; Ortiz, 2019), higher severity of symptoms at discharge (Baeza et al., 2018; Bockmann et al., 2019), and voluntary admission (Del Favero et al., 2020; Ortiz, 2019; Valevski et al., 2007) – although one study demonstrated a higher readmission risk for involuntarily admitted patients (Feigon & Hays, 2003) – are associated with higher readmission risk.

The most consistent patient-level readmission risk factor identified in the literature is a history of admissions (Baeza et al., 2018; Bernardo & Forchuk, 2001; Bockmann et al., 2019; Callaly et al., 2010; Donisi, Tedeschi, Salazzari, et al., 2016; Donisi, Tedeschi, Wahlbeck, et al., 2016; Han et al., 2020; Moss et al., 2014; Ortiz, 2019; Rieke et al., 2016; Silva et al., 2009; Tulloch et al., 2016; Zhang et al., 2011).

Regarding service characteristics, length of stay (LOS) has been assessed in multiple studies (Donisi, Tedeschi, Wahlbeck, et al., 2016). Research on LOS yields inconsistent results, with some studies reporting longer LOS associated with higher readmission risk (Del Favero et al., 2020; Feigon & Hays, 2003; Han et al., 2020) and others demonstrating a higher readmission risk with shorter LOS (Boaz et al., 2013; Donisi, Tedeschi, Salazzari, et al., 2016; Gentil et al., 2022; Lien, 2002; Ortiz, 2019; Tulloch et al., 2016). Yet another study reports no significant association between LOS and readmission risk (Moss et al., 2014).

Some studies report an association of reduced readmission risk with discharge planning and transitional interventions, e.g., structured pre-discharge needs assessment, transition manager (Vigod et al., 2013), communication of discharge plan to an outpatient provider (Steffen et al., 2009; Vigod et al., 2013), telephone follow-ups and home visits after discharge (Lien, 2002; Vigod et al., 2013), and direct contact with a primary care provider after discharge (Sfetcu et al.,

2017). Moreover, poor discharge planning has been linked to higher readmission risk (Callaly et al., 2010; Nelson et al., 2000; Ortiz, 2019; Silva et al., 2009) as has discharge against medical advice (Li et al., 2018; Spooner et al., 2020; Valevski et al., 2012). However, some studies showed that follow-up visits were positively associated with readmission (Callaly et al., 2010; Donisi, Tedeschi, Salazzari, et al., 2016).

In conclusion, patient-level risk factors of readmission have been widely studied (Donisi, Tedeschi, Wahlbeck, et al., 2016). Examining them is valuable as it helps identify those at risk of readmission (Del Favero et al., 2020). However, apart from discharge planning and LOS – which present inconsistent results – there is a lack of research on system and treatment variables during the inpatient stay (Donisi, Tedeschi, Wahlbeck, et al., 2016). Moreover, if readmissions serve as a quality of care indicator for psychiatric hospitals, hospitals must be able to influence that outcome with appropriate interventions (Durbin et al., 2007). Therapeutic leave (TL) might be a suitable inpatient care treatment variable to reduce readmission risk and healthcare costs, thereby increasing the quality of care.

1.2. Therapeutic Leave

The Swiss operational classification system (CHOP) defines TL as a time-limited leave from the psychiatric inpatient ward in agreement with the treating physician or psychologist, its aim being "[…] to test the realistic, autonomous reintegration into a patient's social environment (education, work, family, living situation) appropriate to their age" (BfS, 2023, p. 385).

Therapeutic leave is a well-known practice in psychiatric inpatient care and is applied internationally (Barlow & Dickens, 2018). Yet the clinical value of TL lacks scientific evidence. A systematic review concludes that there is little consensus about the purpose of TL and states that TL is often inadequately documented and prepared insufficiently (Barlow & Dickens, 2018). While a qualitative study demonstrated that staff and patients considered TL helpful for patients to successfully transition into their homes (Cronin-Stubbs et al., 1988), such commonly suggested TL outcomes have not been studied systematically (Barlow & Dickens, 2018).

Moreover, the changes accompanying the deinstitutionalization of psychiatry, i.e., shorter inpatient stays and fewer beds (Baeza et al., 2018; Lamb & Bachrach, 2001; Ravelli, 2006; Zhang et al., 2011), might impede longer TL, i.e. spending a night at home, in order to speed up discharge and avoid additional treatment costs. This economic pressure on healthcare providers is also reflected in TARPSY – an accounting system serving as a nationwide cost rate structure in Switzerland (SwissDRG AG, 2019b). According to TARPSY guidelines, TL over 24 hours is only partially remunerated, causing indirect costs for healthcare providers when granting TL over 24 hours (SwissDRG AG, 2019b; Trezzini, 2020). In conclusion, TL's potential clinical and economic merit might not be fully recognized due to the lack of research on TL. On a political level, this makes it hard to advocate for its therapeutic necessity.

At the time of the conceptualization of Study 1, there was only one publication on TL and readmission (Moss et al., 2014). The study found a 3.5 times higher readmission risk in the 180 days after discharge for patients with a TL during their inpatient stays than those without TL. Post-hoc analyses showed that patients granted a TL were more likely to be male and have a higher GAF (Global Assessment of Functioning), as well as longer inpatient stays. The authors hypothesized that patients at risk of readmission are successfully identified and granted TL to prepare for discharge, yet TL did not fully reduce the higher readmission risk (Moss et al., 2014).

As previously outlined, discharge planning and transitional interventions appear to prevent readmission (Lien, 2002; Sfetcu, 2017; Steffen et al., 2009; Vigod et al., 2013), whereas poor discharge planning is linked with a higher readmission risk (Callaly et al., 2010; Nelson et al., 2000; Ortiz, 2019; Silva et al., 2009). By allowing patients to stay connected with the outside world, TL is likely to facilitate transitioning to a patient's familiar environment and promote recovery (Barlow & Dickens, 2018; Walker et al., 2013). We, therefore, assumed that TL would be associated with a reduced readmission risk contrary to the above-mentioned findings (Moss et al., 2014). If TL was to be associated with a reduced readmission risk, it follows logically that it might relate to lower direct inpatient costs after discharge.

1.3. Coercive Measures and Staff Resources

The Swiss Academy of Medical Sciences (SAMS) states that "[…] measures applied in a medical context are coercive if they are carried out against the patient's self-determined wishes or in spite his/her opposition" (SAMS, 2017, p. 7). Within this definition, different subcategories of coercion exist. Measures restricting a person's freedom of movement include involuntary admission to a psychiatric hospital, seclusion, and restraint. Forced treatment refers to any kind of coercive medical treatment, such as administering pharmaceuticals against a patient's will. Moreover, informal coercion defines a more subtle form of coercion, meaning any form of psychological leverage, i.e., persuasion or pressure on the patient (Chieze et al., 2019; SAMS, 2017).

In Study 3, we studied seclusion and restraint, two widely applied coercive measures restricting freedom of movement (Chieze et al., 2019). Seclusion is defined as locking a patient in a designated room. Restraint refers to tying up (mechanical) or holding (physical) a patient (Chieze et al., 2019; SAMS, 2017).

It becomes apparent that coercive measures greatly undermine patients' autonomy and violate fundamental human rights (Chieze, Clavien, et al., 2021). In addition, they conflict with the principle of non-maleficence of medical professionals. They can, however, become necessary when a psychiatric patient is at immediate risk of self-harm or harm to others (Zaami et al., 2020). Coercive measures present us with an ethical dilemma, and they must only be used as a last resort when all other options have been exhausted (Chieze, Clavien, et al., 2021; Chieze, Courvoisier, et al., 2021; Kalisova et al., 2014; Krieger et al., 2021; SAMS, 2017; Wynn, 2006).

Coercive measures can harm patients and staff members (Chieze et al., 2019; Krieger et al., 2021); they can lead to traumatization of patients and staff members (Chieze et al., 2019; Fugger et al., 2016; Steinert et al., 2013; Whitecross et al., 2013), and are associated with feelings of punishment and distress (Chieze et al., 2019), as well as feelings of depression and helplessness (Fugger et al., 2016; Krieger et al., 2018).

Considering their controversial ethical aspects and adverse consequences of coercive measures, global efforts are being made to reduce them (Beames & Onwumere, 2022; Boumans et al., 2015; Chieze, Courvoisier, et al., 2021; Kalisova et al., 2014). In this context, many studies have addressed patient-level risk factors of coercive measures, as concluded by a systematic review (Beames & Onwumere, 2022). These factors alone, however, fail to explain variation in the use of coercive measures (Beames & Onwumere, 2022). Hospital and staff characteristics also contribute to their risk and prevention (Beames & Onwumere, 2022; Boumans et al., 2015; Chieze, Courvoisier, et al., 2021; DGPPN, 2018; Kalisova et al., 2014).

The S3 guidelines on prevention of coercion conclude that adequate staffing numbers are necessary to prevent coercion in psychiatry (DGPPN, 2018). However, the existing research on coercive measures and their association with staff is limited and inconclusive (DGPPN, 2018).

Bowers et al. (2012) showed that a higher number of junior medical doctors at the ward level was associated with reduced use of manual restraint, as was a higher number of ethnic minority staff. On the other hand, a higher number of qualified nursing staff at the ward level was associated with the increased use of manual restraint. In addition, manual restraint was related to locked ward doors during the entire shift (Bowers et al., 2012).

Another study also found increased rates of seclusion and restraint in wards with more nurses (Fukasawa et al., 2018). The authors suggest that patients at risk of coercive measures are more likely to be admitted to wards with higher staff numbers (Fukasawa et al., 2018).

Contrarily, Janssen et al. (2007) reported an increased use of seclusion in long-stay wards with smaller staff-to-patient ratios. Furthermore, more female staff than males on a shift and less variability in the team's work experience related to increased use of seclusion. More work experience was associated with reduced use of seclusion (Janssen et al., 2007). Husum et al. (2010) found no association between staff and bed ratio with seclusion or restraint (Husum et al., 2010).

According to the subjective perception of staff members, a low staff number increases the likelihood of coercion, as stated by two studies (Galbert et al., 2022; Krieger et al., 2021). Considering the multiple adverse effects of coercive measures, these inconsistent findings call for a deeper understanding of the association between staff resources and coercion.

In the following chapter, I[1] will present the aim of my dissertation and the research questions, followed by a short description of the three studies.

[1] The pronoun “I” is used when referring to the work of this dissertation. The pronoun “we” is used in this dissertation when referring to the work done in collaboration with the co-authors.

2. Aim of the Thesis and Research Questions

Against this background and the research gaps outlined, the aim of this dissertation was to a) broaden the insight on TL and its association with readmission, b) expand on the clinical view by including health economic aspects of TL, and c) add to the still limited knowledge of staff resources and coercion. We aimed to integrate a clinical and health-economic viewpoint by addressing the following research questions:

a) What is the readmission risk of patients with a TL during their inpatient stay?
b) Is there an association between TL and direct inpatient costs in the months following discharge?
c) How efficient are psychiatric clinics at maximizing inpatient cases without seclusion and restraint with their given staff number of full-time equivalents (FTE)?

We conducted three studies to answer these questions. Study 1 (see Appendix A) was an observational cohort study on therapeutic leave and readmission risk. We applied a survival analysis to assess the risk of readmission of patients with TL during their inpatient stays compared to patients without TL. Study 2 (see Appendix B) was an observational cohort study on therapeutic leave and direct inpatient healthcare costs based on the same data as Study 1. We took a health economic perspective and looked at how TL relates to direct healthcare costs after discharge, applying a Tweedie regression model.

Study 3 (see Appendix C) was a naturalistic observational study on staff resources regarding inpatient treatment without coercive measures in 11 German psychiatric hospitals using data envelopment analysis (DEA). We tried to broaden the insight into the associations between staff resources and coercion by examining the relative efficiency of staff resources regarding the maximization of cases without seclusion and restraint.

Based on the three studies I will show in my dissertation that TL is associated with a lower readmission risk and lower direct inpatient healthcare costs after discharge. I will also show that clinics are relatively efficient at maximizing cases without coercion. However, changes in management and careful consideration of team composition are necessary to further increase cases without seclusion and restraint.

I will provide you with a summary of the three studies in the following chapters. First, I will present Study 1 and Study 2 in Chapter 3. Then, I will present Study 3 separately in Chapter 4. In Chapter 5, I will discuss the three studies, putting them into context with existing research and providing an outlook for future studies. I will discuss their strengths and limitations and end my thesis with the studies' conclusions in Chapter 6.

3. Study 1 and 2: Therapeutic Leave, Readmission Risk, and Direct Inpatient Costs

As Study 2 was a follow-up study of Study 1, I will present it in the same chapter. Wherever necessary, I have created separate subchapters for clarity. The full-length articles are in Appendix A (Study 1) and Appendix B (Study 2).

3.1. Methods

I will present the methods of Study 1 and Study 2 in the following section. Where necessary, I have created separate sub-chapters for the two studies for clarity.

3.1.1. Study Design

We conducted two observational cohort studies on TL at the Department of the Adult Psychiatric University Clinics Basel (UPKE) and the Private Clinic (UPKP) of the University Psychiatric Clinics (UPK) Basel using their routine clinical data between January 1st, 2018, and April 15th, 2020. The Psychiatric University Clinics Basel (UPK) is a large healthcare provider offering psychiatric in- and outpatient treatment for approximately 200’500 persons living in the canton of Basel-Stadt and surrounding areas. During the study period, 277 beds were available at UPKE and UPKP for treatment.

TL is routinely applied in all UPK divisions. The duration of TL varies between a few hours and over 24 hours, depending on the patient’s state and the goals of the TL. Patients can spend time away from the ward during TL and train skills in their usual environment outside the clinic. TL serves to assess treatment progress and discharge readiness. In addition, it can be viewed as exposition training as the patient is potentially confronted with aversive stimuli once outside of the shielded ward environment. Experiences gained during TL can help adjust the treatment plan and goals accordingly.

At the UPK Basel, TL may be granted to all patients if clinically indicated. Patients can also request TL themselves. Specific key criteria must be met, however, to grant TL: a patient must have adequate mental capacity, and there must not be any immediate risk of self-harm or harm to others. The senior physician oversees the granting of TL, and decisions are discussed in the interdisciplinary teams. Typically, nurses plan and prepare TL with the patients, discussing the goals of TL, handing out medication, and making a crisis plan (BfS, 2023).

In Switzerland, TL began to be recorded in a standardized form in 2018 when TARPSY was introduced into the Swiss healthcare system (SwissDRG AG, 2016, 2019b). We aligned our studies' beginning with the start of TARPSY to have comparable data on all TL. TARPSY not only dictates the standardized recording of TL but also sets strict billing guidelines for it. Firstly, all inpatient ward absences must be registered as administrative leave in the digital patient file (SwissDRG AG, 2019b). The sum of all administrative leaves greater than 24 hours during an inpatient stay has to be deducted from the number of treatment days in total (SwissDRG AG, 2019b). This reduces billable treatment days in case of absences longer than 24 hours and results

in indirect costs for the healthcare providers when TL is granted over 24 hours. In Switzerland, TL will thus hardly be granted for longer than 24 hours. In 2021, TARPSY 3.0 was introduced, and TLs over 24 hours are now partially remunerated with different compensatory rates: CHF 153 for absences between 24 to 48 hours and CHF 204 for absences longer than 48 hours (Trezzini, 2020). These compensations, however, cover only a small amount of the passive costs during TL.

3.1.2. Sample

For Study 1 and 2, we extracted clinical routine data from the UPK medical database in pseudonymized form. All inpatient cases between January 1st, 2018, and April 15th, 2020, counting 3'400 patients, were available for analysis.

In both studies, we only included patients with a complete inpatient stay within the observation period and with complete data on all the relevant variables to obtain the maximum statistical power of our models. Patients discharged to another psychiatric clinic or a general somatic hospital were either censored[2] (Study 1) or excluded (Study 2), as treatment at the UPK Basel could not be considered completed by the time of discharge. In Study 1, patients without readmission during the observation period were also censored.

In Study 1, this resulted in 3'302 patients, including 1'239 censored cases of patients without readmission during the observation period and patients discharged to a different psychiatric clinic or a somatic hospital. In Study 2, we included 3'151 patients.

3.1.3. Measures

I will now present the measures used in the two studies. Unless otherwise stated, the measures refer to both studies.

3.1.3.1. Therapeutic Leave. TL was operationalized through the absences registered in the digital patient files during the index inpatient stays (= the first admission during the study period). TLs were considered independent of their lengths. For multiple reasons, we included TL of less and more than 24 hours. From a clinical perspective, the duration of TL can vary depending on a patient's individual needs and treatment goals. Moreover, TL is often extended gradually. At the beginning of an inpatient stay, a patient might leave the ward to spend a few hours at home during the day, and as treatment progresses, a longer TL, like staying at home overnight, becomes possible. From an economic viewpoint, TL of less than 24 hours is common, as until 2021, the TARPSY accounting system did not budget for the remuneration of TL over 24 hours (Trezzini, 2020). In Study 1, we used a categorical approach (TL = yes/no) according to our research question. In Study 2, we included the number of TL as a continuous variable to gain more statistical power in our model.

[2] In survival analysis the event of interest (in our Study 1 this was the readmission to UPK Basel) may not be observed in some cases because of dropouts, individuals experiencing a different event irrelevant to the event of interest, or some individuals may not experience the event of interest during the time of the study period. These individuals are not excluded but remain in the analysis and are coded as censored cases. Kartsonaki, C. (2016). Survival analysis. *Diagnostic Histopathology*, *22*(7), 263-270. https://doi.org/https://doi.org/10.1016/j.mpdhp.2016.06.005

3.1.3.2. Time to Readmission (Study 1). In Study 1, we considered the first, and in case of readmission, the second admission during the observation period. The first admission was the index inpatient stay. For Study 1, we calculated the time to readmission as follows:

Readmission Date of the Second Admission – Discharge Date of the Index Inpatient Stay = The Number of Days until Readmission

3.1.3.3. Direct Inpatient Costs (Study 2). According to the Swiss Diagnostic Related Groups (DRG) and Psychiatric Cost Groups (PCG), as defined in TARPSY 2.0 (SwissDRG AG, 2019a), we operationalized healthcare costs through the effective cost weights of an inpatient stay (SwissDRG AG, 2019b, 2021). Effective cost weights are calculated as follows (SwissDRG AG, 2021):

Number of Billable Treatment Days X Day-Based Cost Weight

The number of billable treatment days is recorded as routine data at the end of an inpatient stay and is calculated as follows (SwissDRG AG, 2019b):

Discharge Date – Admission Date – Days of Administrative Leave + 1

The day-based cost weight depends on the relative treatment expense of a diagnostic group. They are calculated annually based on Swiss hospitals' most recent cost data reports. Daily cost weights follow a degressive gradient and differ depending on the PCG. Costs in CHF for a specific case are calculated by multiplying the effective cost weight with its base rate. The base rate is the amount in CHF to be reimbursed for an effective cost weight of 1.0 and is determined by the healthcare provider and the healthcare insurance. It is identical for all cases of a healthcare provider (SwissDRG AG, 2021). We used the effective cost weights as a proxy for the costs in CHF. The outcome variable was the sum of all effective cost weights during the study period after the index inpatient stay (note that the index inpatient stay is the same in Study 1 and Study 2). The cumulative effective cost weight is the equivalent of the cumulative direct inpatient healthcare costs divided by the base rate.

3.1.4. Statistical Analysis

In this section, I will present the statistical analyses of the two studies. We set the significance levels alpha of all statistical analyses to 5%. In Study 1, we performed all analyses with SPSS Statistics 26.0 (IBMCorp., 2019). In Study 2, we performed the analyses with SPSS Statistics 27.0 (IBMCorp., 2020) and R Studio (RCoreTeam, 2021).

3.1.4.1. Study 1: Therapeutic Leave and Readmission. With the Kaplan-Meier curve, we compared the cumulative time to readmission of patients with and without TL. We used the log-

rank test to assess the statistical significance between the groups. We then applied a Cox regression model to determine the association between TL and readmission risk, including the following covariates according to the literature on readmission: past admission to UPK Basel, age, gender, marital status, diagnosis, the severity of symptoms at admission, length of stay, involuntary admission, and comorbidity. We assessed correlations between them using the variance inflation factor (VIF) statistics, setting the threshold to VIF < 5 (Hair et al., 2019). The VIF statistics showed no multicollinearity with all values between 1.03 and 1.54.

We checked the proportional hazard assumption by including the covariates as interaction terms with time to the model (Kleinbaum & Klein, 2012). Past admission, being a widow compared to being single, and length of stay did not meet the assumption. We thus included them as time-dependent variables (Delgado et al., 2014; Kleinbaum & Klein, 2012).

3.1.4.2. Study 2: Therapeutic Leave and Direct Inpatient Costs. We applied a Tweedie multiple regression model with a log link assessing the association between the number of TL during the index inpatient stay and the cumulative effective cost weights. Tweedie models are especially suited in health economics or insurance business, where costs are often zero due to non-utilization, or if costs do occur, their distribution is usually right-skewed (Kurz, 2017). The predictor and outcome variables were highly skewed. We conducted a ln-transformation before analysis to avoid vastly influential data points. In addition, we adjusted our model for the following confounders: past admission to UPK Basel, age, gender, marital status, diagnosis, the severity of symptoms at admission, length of stay, involuntary admission, and comorbidity, observation time (representing the months from the discharge day to the end of the observation period), admission period based on the annual quarter in which a patient was admitted, and the effective cost weight of the index admission.

We set the reference categories of categorical variables depending on group size, setting the largest group as the reference category. Multicollinearity was low, with variance inflation factors < 2 for each predictor/confounder.

We assessed the robustness of our model by conducting a) a multiple linear regression model in which the confidence intervals of the coefficients were obtained using a bootstrap procedure and b) a multiple logistic regression model dichotomizing the outcome into the two categories of costs = 0 and costs > 0.

3.2. Results of Study 1

3.2.1. Descriptive Results

1’161 (50.3%) patients were male. The mean age at admission was 45.9 with a standard deviation of 17.2. 1’082 (32.8%) patients were readmitted to the UPK Basel during the observation period. The mean length of stay was 29.8 with a standard deviation of 32.2 days.

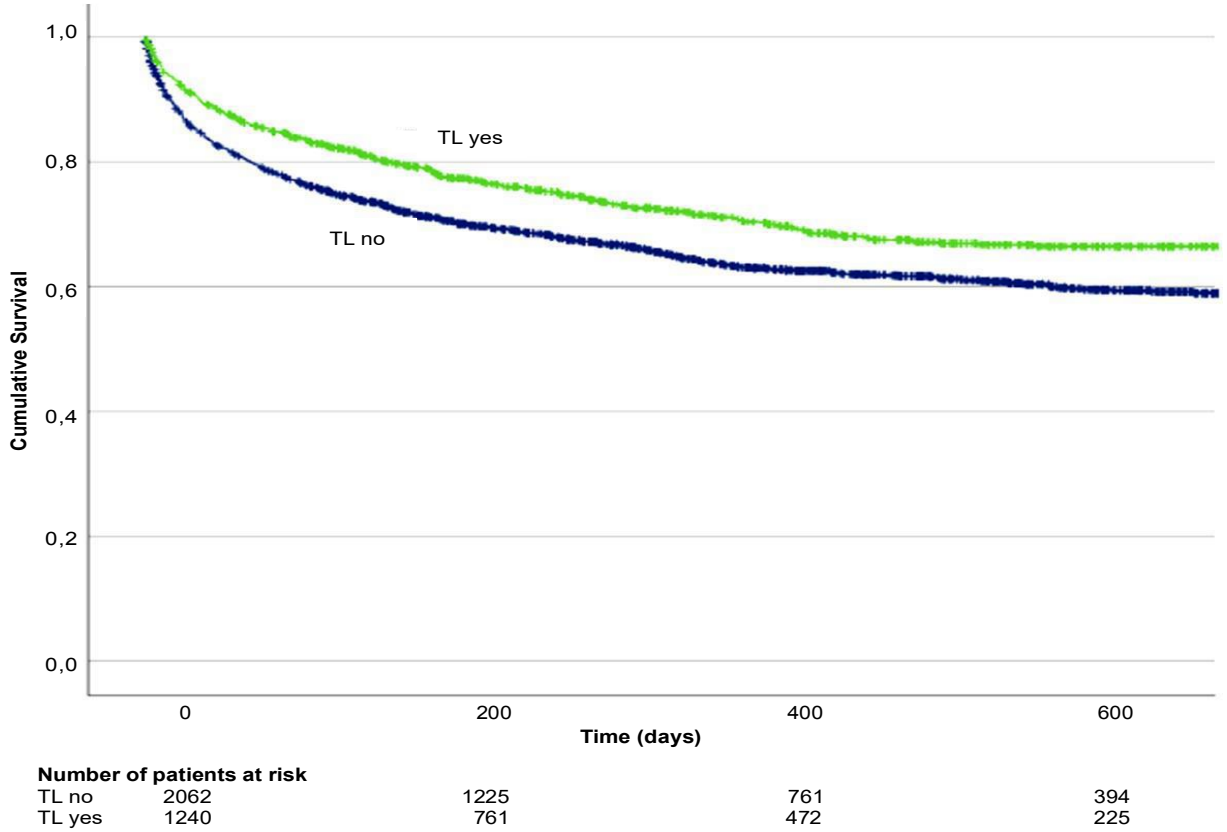
1’240 (37.6%) received at least one TL during their inpatient stay. The number of TLs ranged from 1 to 37 (*Mdn* = 4, *IQR* = 5). The mean duration of TL was 33.4 hours (*SD* = 9.5). Detailed descriptive results can be found in Table 1 Appendix A.

3.2.2. Kaplan Meier Curve and Cox Regression

The cumulative survival derived by the Kaplan-Meier Curve was longer for patients with a TL (*M*days = 598.2, *SE*days = 9.9, CI 95% = [578.6, 617.7]) than for those without TL during the index admission (*M*days = 550.7, *SE*days = 8.3, CI 95% = [534.5, 566.9]). This difference was statistically significant according to the log-rank test ($\chi 2(1) = 18.8$, $p < .05$).

Figure 1

Kaplan-Meier Curve Showing the Cumulative Survival of Patients with and without TL



Study 1, Appendix A, Figure 1: Ziltener et al. (2021). Font and format of the title have been adapted according to this thesis’ design.

The curve showed that readmission was highest in the period after discharge and gradually decreased with time (see Figure 1). We could not integrate the median survival because the cumulative survival did not drop below 50% in either of the two groups.

The Cox regression revealed a significantly reduced hazard for readmission for patients with a TL (*HR* = .735, *CI* 95% = [.639, .846], $p < .001$). Detailed results of the Cox regression are shown in Table 3, Appendix A.

3.3. Results of Study 2

3.3.1. Descriptive Results

1’579 (50.1 %) patients were male. The mean age at admission was 45.5 years, with a standard deviation of 17.0. 1’207 (38.3 %) patients went on at least one TL during their index inpatient stay. The number of TLs ranged from 1 to 37 (*Mdn* = 4, *IQR* = 5). The mean effective cost weight during the index inpatient stay was 28.5, with a standard deviation of 26.9. The mean cumulative effective cost weight after the index inpatient stay was 19.2, with a standard deviation of 41.1. Detailed descriptive results of all the variables are presented in Appendix B, Table 1.

3.3.2. Regression Models

The Tweedie multiple regression model showed that the number of TL was associated with lower costs following the index inpatient stay (*B* = –0.141, *CI* 95 % = [–0.225, –0.057], *p* < 0.001). Our results of the multiple linear regression model, including bootstrap confidence intervals (*B* = –0.200, *CI* 95 % = [–0.355, –0.048], *p* = 0.008) and the multiple logistic regression model (*OR* = 0.777, *CI* 95 % = [0.631, .958], *p* = 0.018) matched those of the Tweedie model.

4. Study 3: Staff Resources and Coercive Measures

I will now summarize the methods and results of Study 3. The full article is in Appendix C.

4.1. Methods

In the following sub-chapters, I will describe the study design, the sample characteristics, the measures, and the statistical analysis.

4.1.1. Study Design

For Study 3, we performed a naturalistic observational study using routine clinical data from eleven German psychiatric hospitals from 2008, 2010, and 2012. The routine clinical data had been gathered as part of the quality management and benchmarking of the Documentation Group Psychiatry (DGP, 1984-2013) in North Rhine-Westphalia, Lower Saxony, and Hessen, Germany. The DGP comprised 22 hospitals offering somatic and psychiatric treatment and community mental health services. The participating clinics were legally obliged to provide healthcare for residents of the respective area and were part of a single-tier psychiatric system (Huber et al., 2016; Schneeberger et al., 2017). We received informed consent from 21 of the 22 hospitals to analyze their data.

Starting in 2006, all hospitals in Germany were required to provide a standardized quality report every other year on key organizational factors, such as the organizational structure, available services, and therapies, and staff number. These quality reports were also available to use for analysis.

4.1.2. Sample

Eleven of the 21 clinics provided complete clinical routine data for 2008, 2010, and 2012, as well as the corresponding quality reports. This led to a sample of 51’418 inpatient cases available for analysis.

4.1.3. Measures

We operationalized coercive measures through seclusion and restraint, the occurrence of which was available as part of the clinical routine data. Information on the number of full-time equivalents (FTE) healthcare professionals (HCP) employed was available in the quality reports. Staff resources were operationalized through job percentages of nurses and physicians reported in the quality reports and calculated as the cumulative number of FTE. We calculated each year's cumulative number of inpatient treatment days by multiplying the number of inpatient cases by the mean length of stay in the reference year.

4.1.4. Statistical Analysis

We performed a data envelopment analysis to assess the relative efficiency of staff regarding inpatient cases without coercion in the 11 psychiatric clinics using the DEAP 2.1 software (Coelli, 2019). DEA is a non-parametric analysis technique to evaluate the performance of so-called Decision-Making Units (DMU). DEA characterizes DMUs with inputs (independent variable) and outputs (dependent variable) (Cooper, 2011; Weatherall et al., 2020).

We defined the 11 clinics as our DMUs. The staff resources (FTE) were our input variable, and our output variable was the inpatient cases without coercion. As one assumption of DEA is to maximize the output variable, we used the percentage of inpatient cases without coercion (seclusion/restraint) during treatment as the output variable (instead of the number of cases with coercion, which would have required minimization). We included the input and output variables as a ratio to bed occupancy in the respective year (e.g. FTE per 100 occupied beds per year).

When constructing a DEA model, one must decide on the model orientation and the scale assumption. DEA can follow either an input orientation or an output orientation. In an input-orientated model, inputs are maximized while outputs are kept constant. On the other hand, output orientation focuses on maximizing outputs with a given set of inputs (Coelli et al., 2005). We chose an output-oriented approach because we were interested in which clinics were most efficient at maximizing their cases without coercion while the staff resources were considered fixed.

Regarding the scale assumption, DEA can follow a constant return to scale (CRS) or a variable return to scale (VRS) assumption. The CRS model assumes that input changes will lead to proportionate changes in the output variable. The VRS model, on the other hand, assumes that input changes will lead to disproportionate changes in the output variable (Coelli et al., 2005; Kumar & Gulati, 2008). We tested the model assumption using the R package rDEA (Simm & Besstremyannaya, 2020). According to these results, we rejected the H0 hypothesis of CRS for

all three years and applied a VRS model. The VRS approach gave us two efficiency scores: technical efficiency (TE) and scale efficiency (SE). TE indicates a DMU's ability to produce maximal output from its given inputs. SE is calculated as the ratio of TE under the CRS assumption and TE under the VRS assumption (Coelli et al., 2005; Kumar & Gulati, 2008). If there is a difference between CRS and VRS, a DMU faces scale inefficiency and is not operating at an optimal size (Coelli et al., 2005). This can be further distinguished into increasing returns to scale (IRS) versus decreasing returns to scale (DRS). A DMU facing IRS is generating a disproportionate increase in output with only a proportionate increase in input and can be considered too small. On the other hand, a DMU facing DRS has become too large and would have to decrease its scale to become efficient (Coelli et al., 2005; Huguenin et al., 2012; Kumar & Gulati, 2008). TE and SE measures can take values between 0 and 1. A value of 1 indicates optimal efficiency (Coelli et al., 2005).

We performed all remaining statistical analyses with IBM SPSS Statistics 28.0 (IBMCorp., 2021).

4.2. Results Study 3

In this section, I will present the results of the DEA. You can find detailed descriptive results in Appendix C, Table 1. The input and the output variables are presented in Tables 2-4, Appendix C. Note that in Tables 2-4, as well as in the result section, the percentage and number of inpatient cases per year without coercion, as well as the number of FTE of physicians and nurses, are reported as standardized values per 100 occupied beds. Detailed results of the data envelopment analysis are presented in Table 5, Appendix C.

4.2.1. Technical Efficiency

In 2008, clinics 1, 4, 7, 8, and 11 reached optimal technical efficiency with a TE score of 1. On average, the TE score was 97.4% in 2008. Clinics could have increased their cases without coercion by 2.6% on average. The average number of FTE of physicians per 100 occupied beds was 13.5 (*SD* = 2.7), and 56.9 (*SD* = 9.8) FTE of nurses per 100 occupied beds, respectively.

In 2010, clinics 1, 2, 4, 5, and 11 all had a TE score of 1. On average, the TE score was 97.1%. Clinics could have increased their cases without coercion by 2.9% on average. The average number of FTE of physicians per 100 occupied beds was 12.6 (*SD* = 3.1), and FTE of nurses per 100 occupied beds 56.3 (*SD* = 6.9) respectively.

In 2012, clinics 1, 4, 5, 7, 10, and 11 reached optimal technical efficiency of 1. On average, the TE score was 98.2%. Clinics could have increased their cases without coercion by 1.8% on average. The average number of FTE of physicians per 100 occupied beds was 13.4 (*SD* = 3.7), and FTE of nurses per 100 occupied beds 58.1 (*SD* = 16.9), respectively.

4.2.2. Scale Efficiency

In 2008, scale efficiency scores ranged from 73.8% to 100% across the eleven clinics. The clinics 4, 8, and 11 had an optimal scale efficiency of 1. The mean scale efficiency was 87.1% in 2008. On average, scale efficiency could be improved by 12.9%.

In 2010, the clinics 1, 2, 4, and 11 had perfect scale efficiency of 1. Scale efficiency ranged between 77.0% and 100%. The mean scale efficiency was 92.4%. On average, scale efficiency could be improved by 7.6%.

In 2012, clinics 4, 10 and 11 were perfectly scale efficient. Scale efficiency ranged between 55.1% and 100%. The mean scale efficiency was 84.8%. On average, scale efficiency could be improved by 15.2%.

In all three years, all clinics with a scale efficiency below 1 faced decreasing returns to scale.

5. Discussion

In my dissertation, I integrated a clinical and health-economic perspective to examine the inpatient treatment variables of therapeutic leave and staff resources in relation to readmission, direct inpatient costs, and coercive measures.

Study 1 and Study 2 examined the association of TL with readmission risk and direct inpatient costs after discharge. Study 3 assessed the relative efficiency of staff resources regarding seclusion and restraint. The results showed that patients with a TL during their inpatient stay have a lower readmission risk (Study 1) and lower direct inpatient costs after discharge (Study 2) than patients without TL. Moreover, Study 3 showed that the psychiatric clinics in our sample were relatively efficient at maximizing cases without coercion with their given number of staff.

I will discuss the core results of the three studies according to the research questions in the following subchapters.

5.1. Study 1 and 2: Therapeutic Leave, Readmission Risk, and Direct Inpatient Costs

In Study 1, our analyses revealed a significantly longer cumulative survival and a reduced hazard of readmission on any day during the observation period by 26.5% for patients with TL compared to patients without TL. These results seem promising at first sight. Considering the observational nature of our study, however, we cannot draw causal conclusions. Many underlying mechanisms seem plausible. For example, TL might not directly lower the readmission risk but indicate better treatment processes with higher patient adherence. Or, TL might be granted more often to patients with higher functioning levels and milder psychopathological impairments, which is itself associated with lower readmission risk (Baeza et al., 2018; Bockmann et al., 2019; Moss et al., 2014). Randomized controlled trials are needed to test our results for causality.

Research on TL and readmission is scarce, and at the time of Study 1, we only found one other study assessing it. Moss et al. (2014) report a higher readmission risk for patients with TL. Moss and colleagues (2014) argue that patients at risk of readmission are successfully identified.

However, TL must fail to alleviate other risk factors responsible for readmission (Moss et al., 2014). A second study, published shortly after our Study 1, demonstrated that patients were 3.3% more likely to be readmitted after six months with each TL (Docteur et al., 2022).

Our findings might differ from those of these studies for multiple reasons. Firstly, planning and evaluation of TL likely impact its usefulness, and both are often insufficient (Barlow & Dickens, 2018). TL is unlikely to reduce readmission risk if it is granted to patients identified at risk of readmission only shortly before discharge as a standard procedure without implications on the treatment plan. However, TL might serve as an intervention preventing premature discharge and conclusively relapse when it is thoroughly planned and evaluated with adjustments to the treatment plan (Donisi, Tedeschi, Salazzari, et al., 2016; Moss et al., 2014; Ortiz, 2019). In-depth analyses of patient characteristics, duration, number, and timing of TL could further explain the differences between study findings and is undoubtedly an important question to address in the future.

Moreover, the treatment setting might influence the use and characteristics of TL, influencing its success in reducing readmission risk. Since August 2011, the UPK Basel has implemented an open-door policy (Hochstrasser et al., 2018; Kowalinski et al., 2019). The open-door policy fosters self-agency and autonomy (Hochstrasser et al., 2018; Huber et al., 2016; Lang et al., 2010; Lang et al., 2016). It seems plausible that patients might benefit from TL to a greater extent in a setting where these factors are promoted. Lastly, the two studies were conducted in different healthcare systems, and their results might only apply to these settings.

In line with previous research, our results further revealed that the time shortly after discharge holds the highest risk for readmission (Durbin et al., 2007; Lay et al., 2019; Tulloch et al., 2016). Future studies need to investigate further whether TL is particularly suitable for preventing early relapse.

Study 2 showed TL is associated with lower direct inpatient costs after discharge. If these associations were causal, the systematic use of TL could help lower inpatient costs in the long term. This is highly relevant in the face of limited resources in the mental health sector (Knapp & Wong, 2020). TL is an existing intervention and can be applied using relatively low staff and time resources. For most patients, TL is likely to be a highly acceptable intervention.

From an economic perspective, the indirect costs due to empty beds during TL remain problematic. To promote TL, psychiatric clinics must not face a financial disadvantage when granting it. Otherwise, this is likely to create a discrepancy between two often conflicting goals of psychiatric clinics; a healthcare provider aiming to provide the best treatment possible to their patients versus an organization with economic interests. Switzerland has implemented partial remuneration for TL (Trezzini, 2020). In the future, lower base rates, however, will presumably follow this change, leveling out the remuneration of TL.

In conclusion, the results of Study 1 and Study 2 imply a beneficial association between TL and lower readmission risk and suggest a link between TL and lower direct treatment costs. As

mentioned above, the causal relationship between TL, readmission risk, and direct inpatient costs must be assessed in randomized controlled trials. If there was a causality, TL could be considered a relevant factor in improving the quality of care in inpatient treatment.

Future research might examine how TL is implemented in different psychiatric facilities and their units. Qualitative approaches could help identify the underlying mechanisms of TL. Furthermore, assessing how TL's frequency, duration, and therapeutical focus relate to readmission risk and healthcare costs might be promising. Who gets granted TL, when, and how often could yield interesting results regarding possible differences between genders, ages, and diagnostic groups, as well as identifying ideal timing for TL and “dose-response-effects”. How TL might relate to outpatient treatment costs and indirect costs associated with mental illness poses another important question to address. Moreover, identifying a period of effectiveness of TL after discharge, using a fixed observation period, would provide us with information on the lasting benefits of TL. By differentiating between different kinds of readmissions, we could acknowledge that readmissions are not detrimental per se. On a political level, we need actors who aim to balance the conflicting interests of psychiatric clinics as parts of a capitalistic economy and their role as healthcare providers. Further health economic studies on TL's usefulness and long-term financial benefits are necessary to promote political changes.

5.2. Study 3: Staff Resources and Coercive Measures

In Study 3, we assessed the relative efficiency of staff resources in 11 German psychiatric clinics regarding the maximization of inpatient cases without seclusion and restraint in 2008, 2010, and 2012. We used an output-oriented data envelopment analysis under the VRS assumption.

In summary, about 95% were cases without seclusion or restraint. These numbers are comparable to previous research (Flammer & Steinert, 2019). Our results revealed overall high technical efficiency for all 11 clinics in the three years but suggest that clinics could further increase their cases without coercion by management changes such as implementing an open-door policy (Hochstrasser et al., 2018; Huber et al., 2016; Kowalinski et al., 2019; Lang et al., 2010; Lang et al., 2016; Schneeberger et al., 2017), and follow recommendations of the S3 guidelines on the prevention of coercion (DGPPN, 2018; Steinert et al., 2023). Such implementations create a possible conflict between ethical and economic perspectives. Management changes potentially require a lot of time and staff resources (DGPPN, 2018).

Our results further revealed that most clinics are not operating at their optimal scale. Most clinics faced decreasing returns to scale, meaning that a further increase in staff would not yield a proportional increase in cases without coercion (Huguenin et al., 2012). This implies that these clinics should downsize their scale to become efficient (Coelli et al., 2005; Huguenin et al., 2012; Kumar & Gulati, 2008).

We did not have information on staff characteristics. Conclusively, our model might suggest that all healthcare professionals, regardless of their characteristics, such as e.g. work experience,

level of qualification, age, and gender, are equally efficient in realizing the output of cases without coercion. However, scale efficiency may vary depending on team composition, as research shows that team composition can play a relevant role in the occurrence of coercive measures (Bowers et al., 2012; Galbert et al., 2022; Janssen et al., 2007; Krieger et al., 2021). Higher scale efficiency might be achieved depending on the team composition with the same number of staff.

Conclusively, our results highlight that the reduction of coercion to an absolute minimum and the optimal efficiency of psychiatric clinics are conflicting goals. The SAMS states that staff shortages, work pressures, and economic factors must by no means justify coercive measures (SAMS, 2017). From a medico-ethical standpoint, we must prioritize reducing coercive measures over reducing staff due to economic pressures. This is challenging in light of rising mental healthcare costs and the growing financial burden of insurance premiums and taxes (FOPH, 2023; Vigo et al., 2016). It requires a careful balance and constant evaluation of ethical principles against economic motives.

In line with the S3 guidelines, we suggest adequate staff resources are necessary but insufficient to reduce seclusion and restraint (DGPPN, 2018). Health economic analyses are useful to help promote policy change and open political discussions (Knapp & Wong, 2020). Health economic analyses of existing effective interventions and hospital-based initiatives to reduce seclusion and restraint could advance their implementation in clinics. We must, however, interpret health economic results cautiously and apply them to practice only in combination with results from clinical studies and after careful evaluation of ethical aspects.

Future research should examine the association between team composition, staff number, and coercive measures more broadly. The question remains whether optimal staffing levels exist to reduce or eliminate coercive measures. Considering the adverse consequences of coercive measures, psychiatry without any coercion is warranted from an ethical standpoint, while a sole reduction seems questionable.

5.3. Strengths and Limitations

To the best of my knowledge, the three studies presented in this dissertation are the first to address the research questions posed. All three studies are composed of large datasets, rendering random findings unlikely. The three studies add to the limited knowledge of TL readmission risk and direct healthcare costs and shed more light on staff-related factors in reducing coercive methods. A key strength is the integration of a health economic perspective, which is becoming increasingly important in implementing evidence into practice and promoting policy change on a political level (Knapp & Wong, 2020). It highlights an ever-present – but often underestimated – conflict between ethical principles in healthcare and economic pressures.

Nevertheless, this dissertation has several limitations. Firstly, all three studies were observational, impeding causal conclusions. Moreover, the studies did not control for treatment or system variables that could have influenced readmission risk, direct costs, and coercive

measures, such as e.g., ward atmosphere, staff attitude, therapeutic relationship, individual treatment plan, team composition, and clinic culture (Bernardo & Forchuk, 2001).

Study 1 and Study 2 were monocentric studies in Switzerland, and their results might not transfer to other healthcare systems. Moreover, they only captured a limited time, and the prognostic value of the extended benefit of TL regarding readmission and healthcare costs over longer time frames remains unclear. This is a limitation faced by most health economic studies (Knapp & Wong, 2020).

Regarding Study 1, we did not have qualitative information on TL. Planning and monitoring of TL according to a patient's current state and treatment goals likely influence its therapeutic merit. Moreover, we might have missed some readmissions due to the monocentric design of our study. This, however, should be a minor effect without implications on the core results. Due to cantonal public health obligations, the study clinic UPK Basel treats most of the patient population of Basel-Stadt. Lastly, readmissions can but must not be detrimental. Indeed, they are necessary in some cases and can help prevent major crises and protect patients from self-harm or harm to others. We did not have qualitative information on readmissions besides information on involuntary admission. Future research could look more closely at the nature of admissions.

Study 2 is limited by its sole focus on direct inpatient costs. Indirect costs are particularly important when assessing the economic burden of severe mental illness, as these conditions often come with considerable social and professional decline (Gustavsson et al., 2011). How TL relates to indirect costs is critically important, as one of the key aims of TL is to help promote reintegration into a patient's environment (BfS, 2023).

Study 3 was multicentric. However, the results might not transfer to other healthcare systems outside Germany. Our results of Study 3 are further limited by the fact that they apply to the legal regulations of coercive measures during the study years. Importantly, adequate staff numbers cannot be solely determined by coercive measures; many other factors must be considered. From a medico-ethical view, a psychiatry without any coercion is desirable, and one could argue that an "optimal" level of cases without coercion is ethically questionable.

Lastly, DEA indicates potential improvements, and its results must not be transferred to practice in concrete numbers (Huguenin et al., 2012). Efficiency scores can open a dialogue on how to optimize resource use in organizations. Changes solely derived from efficiency scores would be inadvisable indeed (Huguenin et al., 2012).

6. Conclusion

In conclusion, this dissertation enriches the research on lowering readmission risk, direct inpatient costs, and coercive measures by looking at TL and staff resources. It combined a clinical and health-economic perspective, addressing an ever-present and growing conflict between economic motives and a patient-oriented psychiatry lead in line with ethical principles.

The results suggest a link between TL during inpatient treatment, a lower readmission risk, and lower direct inpatient costs after discharge. In addition, they showed that clinics are relatively efficient at maximizing cases without coercion. However, management changes and carefully matched teams are necessary to further reduce seclusion and restraint. Replications of the studies are required to validate their findings.

Regarding TL, randomized controlled trials are needed to test the causal relationship between TL, readmission risk, and direct inpatient costs. We still need to understand the underlying mechanisms of TL better and determine who benefits from TL, how many TLs are beneficial and at what point during the inpatient stay. Identifying a period of effectiveness of TL would draw a more complete picture about the long-term effects of TL. More health economic analyses are needed, especially including indirect costs.

Regarding coercive measures and staff resources, economic and ethical considerations need to be balanced regarding staff numbers in psychiatric clinics. Coercive measures should never, even implicitly, be driven by monetary factors. When it comes to the integrity of human beings, ethical considerations must outweigh economic motives.

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8. Declaration of Tools and Help

My friends Laura Schuhn, Lorena Bloch, and Maja Heiniger, and my fellow Ph.D. students Sarah Kuhn and Jana Krückl proofread my dissertation. My sister Claudia Ziltener helped me with some final formatting issues of the document in Microsoft Word Office.

I used Grammarly Premium: https://www.grammarly.com/premium by Grammarly, Inc., a Delaware corporation, as a Microsoft Office Word plug-in during the writing process of my dissertation for the following purposes:

- Grammar and punctuation “correctness”
- Adjustment of writing style according to the provided themes in Grammarly Premium: “clarity”, “engagement”, and “delivery”.

The last changes with Grammarly were made on the 10th of April 2024. I checked all the changes suggested by Grammarly for their accuracy before implementing them.

I used EndNote version 20.6 as a citation manager.

The EndNote Team (2013). *EndNote*. (Version 20.6) [64 bit]. Clarivate. Philadelphia, PA.

The APA 7th Edition was used as a citing and formatting guideline:

American Psychological Association. (2020). Publication manual of the American Psychological Association 2020: the official guide to APA style (7th ed.). American Psychological Association.

American Psychological Association. (2024, April). Style and Grammar Guidelines. https://apastyle.apa.org/style-grammar-guidelines

9. Appendix A: Study 1

Study 1: Tiziana Ziltener, Julian Möller, Lukas Imfeld, Roselind Lieb, Undine E. Lang, Christian G. Huber, Time to readmission in psychiatric inpatients with a therapeutic leave, *Journal of Psychiatric Research*, Volume 144, 2021, Pages 102-109, ISSN 0022-3956, https://doi.org/10.1016/j.jpsychires.2021.09.050.

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Time to readmission in psychiatric inpatients with a therapeutic leave

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Psychiatry

ABSTRACT

Aims: Interventions to decrease readmissions in psychiatric patients are urgently needed. In Switzerland therapeutic leave (TL) composes a cornerstone of inpatient treatment. TL is a planned time-limited absence from the inpatient ward giving patients the opportunity to test their resilience in their usual environment. Evidence of its applicability as an intervention reducing readmissions is lacking. Therefore, our objective was to examine the association between TL and readmission risk.

Methods: Using the Kaplan-Meier curve we compared the time to readmission of 3′302 inpatients at the UPK Basel with and without TL. Cox regression was applied, integrating other covariates associated with readmission.

Results: The Kaplan-Meier curve indicated longer cumulative survival in patients with TL. The log-rank test implied statistical significance ($\chi^2(1) = 18.8$, $p < .05$). The Cox regression showed a reduced hazard for patients with TL (HR = 0.735, CI 95% = [0.639, 0.846], $p < .001$) and for involuntarily hospitalized patients (HR = 0.760, CI 95% = [0.618, 0.934], $p < .01$). A higher readmission risk was found for a history of psychiatric admissions (HR = 1.005, CI 95% = [1.004, 1.005], $p < .001$), higher severity of symptoms at admission (HR = 1.029, CI 95% = [1.018, 1.040], $p < .001$), comorbidity (HR = 1.178, CI 95% [1.024, 1.355], $p = .022$), and a diagnosis with schizophrenia-spectrum disorders (HR = 1.401, CI 95% [1.164, 1.687], $p = .001$).

Conclusion: Linking TL with readmission risk, our results imply an easy way to improve quality of care, with possible implications for practice, policies and quality interventions. TL might be suitable to enhance recovery, reduce readmissions and health care costs. RCTs are needed for validation.

1. Introduction

Patient level characteristics are knowingly associated with readmission, i.e. a diagnosis of schizophrenia and or mania (Böckmann et al., 2019; Ortiz, 2019; Silva et al., 2009), comorbidity (Han et al., 2020), especially concomitant use of different substances (Böckmann et al., 2019), gender (Han et al., 2020; Rieke et al., 2016), age (Silva et al., 2009), marital status (Böckmann et al., 2019; Han et al., 2020; Ortiz, 2019), treatment status (voluntary vs. compulsory) (Ortiz, 2019; Silva et al., 2009; Valevski et al., 2007) and higher severity of symptoms at discharge (Baeza et al., 2018; Böckmann et al., 2019). A history of admissions was identified consistently as a predictor of readmission (Baeza et al., 2018; Bernardo and Forchuk, 2001; Böckmann et al., 2019; Callaly et al., 2010; Donisi et al., 2016; Han et al., 2020; Moss et al., 2014; Ortiz, 2019; Rieke et al., 2016; Silva et al., 2009; Zhang et al., 2011). However, patient characteristics cannot be changed whereas therapeutic approaches can. To mitigate the economic consequences of readmissions and to improve the quality of care within health care systems, increased knowledge of interventions to reduce readmissions is required (Donisi et al., 2016; Rieke et al., 2016).

Studies showed that community treatment orders did not reduce readmission rates or bed-days at 12-month follow-up, as observed in a meta-analysis, including 31 publications from 12 studies (Kisely et al., 2020); indeed patients treated in community treatment orders are readmitted sooner and spend more time hospitalized (Barkhuizen et al., 2020). Beside community treatment orders, compliance enhancement, adherence therapy and integrated treatment showed no evidence to reduce compulsory readmissions, evidenced in a meta-analysis involving 13 randomized controlled studies where the intent to reduce compulsory admission was the first or secondary outcome measure (De Jong et al., 2016). In this meta-analysis only advance statements showed a statistically significant reduction (23%) in the risk of compulsory

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admission (De Jong et al., 2016). Another meta-analysis demonstrated minimal efficacy of cognitive behavioral informed psychological interventions in reducing the likelihood of readmission (Wood et al., 2020). Numerous studies examined other risk factors of early readmissions, e.g. length of stay (Del Favero et al., 2020; Donisi et al., 2016; Han et al., 2020; Ortiz, 2019) and discharge against medical advice (Spooner et al., 2020). However, the patients' subjective perspective seems ineffective in predicting compulsory rehospitalization (Lay et al., 2019) but better nurse staffing levels (Park et al., 2020) and antipsychotic long-acting injections (Kim et al., 2020) are partially successful. Conclusively, although numerous studies examined risk factors of readmission, little is known about its association with therapeutic leave (TL).

In Switzerland TL composes a key component of psychiatric inpatient care (Bundesamt für Statistik BfS, 2018). Inpatients stays not only help patients stabilize in times of acute crises but offer a variety of opportunities for patients to grow and develop. Inpatient care allows for a dense treatment structure in which different aspects of a patient's life can be addressed effectively within a relatively short time span. This includes medical examination, adjustments to pharmaceutical therapy, psychotherapy, a variety of other therapies, social planning, and TL. According to the Swiss operational classification system (CHOP), TL is a time-limited leave from the psychiatric ward, its aim being "*to test the realistic, autonomous reintegration into a patient's social environment appropriate to their age*" [26, p. 346]. An early American qualitative study found little consensus among health care professionals and patients on the purpose and objectives of TL (Cronin-Stubbs et al., 1988). Although TL was perceived as important for patients to re-integrate into their communities, it was not specifically used for this and preparation and evaluation of TL were insufficient. Its usefulness thus remained unclear (Cronin-Stubbs et al., 1988). A recent systematic review showed that TL remains common practice and is applied internationally (Barlow and Dickens, 2018). Yet, there is little consensus about the purpose of TL, and its preparation and documentation tend to be inadequate (Barlow and Dickens, 2018; Cronin-Stubbs et al., 1988; Donner et al., 1990; Lyall and Bartlett, 2010; Walker et al., 2013). Furthermore, the authors stress that outcomes of TL commonly suggested by practitioners, such as community readjustment, have thus far not been tackled as a direct outcome, making it hard to advocate for its therapeutic necessity (Barlow and Dickens, 2018). Moreover, the changes accompanying deinstitutionalization of psychiatry, i.e. shorter inpatient stays and fewer beds (Baeza et al., 2018; Lamb and Bachrach, 2001; Ravelli, 2006; Zhang et al., 2011), might impede longer TL, i.e. spending a night at home, in order to speed up discharge and avoid additional treatment costs.

Against this background our goal was to assess the impact of TL on readmission risk, thus verifying its therapeutic merit. We propose TL as an intervention which might help to reduce readmission. Studies showed that poor discharge planning is associated with higher readmission risk (Callaly et al., 2010; Nelson et al., 2000; Ortiz, 2019; Silva et al., 2009) and strategies focusing on discharge planning together with transitional interventions, might prevent readmission (Steffen et al., 2009; Vigod et al., 2013). Conclusively, TL could ease the passage into a patient's familiar environment and enhance recovery (Walker et al., 2013).

1.1. Aim of the study

Our aim was to examine the association between TL and readmission risk.

2. Method

2.1. Setting

The University Psychiatric Clinics Basel (UPK) are a large health care provider offering psychiatric in- and outpatient treatment for approximately 200′500 persons living in the canton of Basel-Stadt and surrounding areas. The Clinic of Adult Psychiatry (UPKE) and the Private Clinic (UPKP) offer 277 beds for inpatient treatment. In the UPK Basel, TL constitutes an essential part of inpatient care. TL occurs in all divisions with the aim of assessing the treatment process and discharge readiness. It may also act as form of exposition training, as the protective hospital environment shields patients from aversive stimuli. Patients can train skills in the outside world and set new objectives according to their experiences during TL. Duration of TL varies from a few hours to over 24 h depending on a patient's state and treatment goals. Decisions about TL are discussed in interdisciplinary teams, taking different perspectives into account, with the head physician ultimately in charge of granting it. At the UPK Basel TL may be granted to all patients if clinically indicated as outlined above. However, certain key criteria have to be met for a patient to leave the ward. These include: no risk of immediate self-harm or harm to others and adequate mental capacity. Nurses schedule and prepare a patient for TL, including the setting of goals, handing out medication and conducting a crisis plan (Bundesamt für Statistik BfS, 2018). With the introduction of TARPSY in 2018, a new remuneration system for Swiss inpatient psychiatry, TL began to be recorded in a standardized form (SwissDRG AG, 2016, 2019). In order to have accurate and comparable information on all TL, we chose the beginning of our study accordingly. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by the EKNZ (Project-ID: PB_2020–00029). The study was categorized and accepted by the ethics committee as further use of routine data without consent according to HRA Art.34/HRO.

2.2. Sample

Clinical routine data for this cohort study was extracted from the UPK medical database in pseudonymized form. All inpatient cases between the January 1st, 2018, and April 15th, 2020, numbering 3′400 patients were originally available for analysis. Inclusion criteria were admission and completion of inpatient treatment within the observation period. Patients with incomplete data on any relevant variable were excluded in order to obtain maximum statistical power of our model. These criteria were applicable without having to exclude a large number of subjects. Finally, 3′302 patients remained in our data set.

2.3. Measures

TL was operationalized through the absences registered in the digital patient files, applying a binary approach; assigning patients with minimum one absence during the index inpatient stay to the "TL yes" group and patients with no absences to the "TL no" group. All TL recorded in the patient files were considered for this grouping independent of their length. We included TL of less and more than 24 h in our analysis for multiple reasons. From a clinical perspective, duration of TL can vary depending on a patient's individual needs and treatment goals. Moreover, TL is often extended gradually. In the beginning of an inpatient stay a patient might leave the ward to spend a few hours at home during the day and as treatment progresses longer TL, like staying at home overnight, become possible. From an economic viewpoint, TL of less than 24 h are common as up until 2021 the TARPSY accounting system did not budget for the remuneration of TL over 24 h (Trezzini and Meyer, 2020). The primary clinical diagnosis was included according to ICD, 10th revision (World Health Organisation, 2004). Any other diagnoses are reflected in the binary coded variable comorbidity; coded "yes" for patients with more than one clinical diagnosis and "no" in case of only one clinical diagnosis. The severity of symptoms was operationalized through the admission score on the Health of the Nations

Outcome Scales (HoNOS) (Wing et al., 1998). The HoNOS is recorded in the digital patient file as part of the standard admission procedure at UPK. Information on admission status (voluntary versus mandatory) and all demographic variables like age, gender and marital status were also retrieved from the patient database. As previous research identified a history of psychiatric admissions as risk factor of readmission, we included past admissions to UPK Basel 2.5 years prior to the observation period. This time period was chosen based on the literature on high utilizers (Frick and Frick, 2008). To avoid underestimating the impact of past hospitalizations to other psychiatric clinics as a risk factor in our statistical model, we included it as a binary variable. For the purpose of this study, we considered the first, and in case of readmission, the second admission during the observation period. The first admission was defined as the index admission. *Time to readmission* was operationalized through the number of days from the discharge day of the index admission to the admission day of the readmission (calculation: readmission date – discharge date of the index admission = number of days until readmission).

2.4. Statistical analysis

The Kaplan-Meier curve was used to compare the cumulative time to readmission of patients with and without TL. It displays the chance of survival *("to not be readmitted")* at different time points throughout the observation period separately for the two groups. The log-rank test was conducted to check for statistical significance of the difference between the two groups in cumulative time to readmission. Applying a Cox regression model, we examined whether TL during the index inpatient stay was significantly associated with readmission risk, also taking into account other covariates. Based on the research of patient level risk factors of readmission introduced above, we included nine other covariates in the model: age, gender, marital status, primary clinical diagnosis according to ICD, 10th revision (World Health Organisation, 2004), comorbidity, severity of symptom level at admission (HoNOS), admission due to involuntary hospitalization (FU), length of stay of the index admission, and past admissions to the UPK 2.5 years prior to the index stay. Correlations between predictors were assessed using the variance inflation factor (VIF) statistics. To avoid problems of multicollinearity, the VIF statistics should not be greater than 5, and ideally below 3 (Hair et al., 2019). We set the threshold to VIF <5.1′082 patients that were not readmitted during the observation period were treated as censored cases and coded as 0. Furthermore, 157 patients that were discharged to other psychiatric institutions or a general somatic hospital after their index stay were also considered censored cases and coded as 2 (i.e., lost to other facility), as treatment at the UPK Basel cannot be considered completed by the time of discharge. We assessed the proportional hazard assumption by extending the Cox regression model, introducing the covariates as interaction terms with time to the model (Kleinbaum and Klein, 2012). The proportional hazard assumption was not met for the covariates "past admissions to the UPK Basel 2.5 years prior to the index stay", "being a widow compared to being single", and length of stay. We accounted for this by including these variables as time-dependent covariates (Delgado et al., 2014; Kleinbaum and Klein, 2012).

Statistical analyses were performed with IBM SPSS Statistics 26.0 ("IBM Corp. Released, 2019. IBM SPSS Statistics for Macintosh, Version 26.0. Armonk, NY: IBM Corp," n.d.). We set the significance level of our analysis at 5% (p-value of <.05). Categorical data is summarized as frequency and the percentage of the group total. Results of quantitative data are presented either by mean ± standard deviation (SD) and range or as median and interquartile ranges.

3. Results

3.1. Patient characteristics

1′161 (50.3%) patients were male, the mean age at admission was 45.9 years with a standard deviation (SD) of ±17.2, and the mean length of stay was 29.8 ± 32.2 days. 1′240 (37.6%) patients received a TL during their inpatient stay. The mean duration of TL was 33.4 ± 9.5 h. In the TL-yes group frequency of TL ranged from 1 to 37 with a median of 4 and interquartile range of 5. In total, 1′082 (32.8%) were readmitted to the UPK Basel during the observation period. 859 (26.0%) had a history of at least one admission in the 2.5 years prior to the index admission. 363 (11.0%) patients were admitted involuntarily (FU). Analyses of between group differences indicated that significantly less people in the TL-yes group had a history of admissions, the mean length of stay was significantly longer for patients with TL, and there were significantly less patients who had been hospitalized involuntarily in the TL-yes group ($p < .05$). Descriptive results are shown in Table 1. Table 2 shows the crosstabs for involuntary hospitalization and TL.

3.2. Kaplan-Meier Curve

The cumulative survival was longer for patients receiving a TL (*M* (days) 598.2 ± *SD* 9.9 CI 95% = [578.6, 617.7]) compared to patients without TL (*M* (days) 550.7 ± *SD* 8.3, CI 95% = [534.5, 566.9]). The log-rank test indicated that this difference was statistically significant ($\chi^2(1) = 18.8$, $p < .05$). Looking at the shape of the curve, a very steep drop is noticeable in the beginning, between day 0 and 200. It then flattens to some extent between day 200 and 400 and almost plateaus between day 400–600. Conclusively, the readmission risk is highest in the period shortly after discharge and gradually decreases with time. The median survival cannot be displayed since cumulative survival did not drop below 50% in either of the two groups. Results of the Kaplan-Meier curve are shown in Fig. 1.

3.3. Cox regression

Statistically the designated covariates were independent. The VIF statistics showed no multicollinearity between predictors with all values being between 1.03 and 1.54. All covariates were thus included in the analysis. The Cox regression (cf. Table 3) showed a significantly reduced hazard for readmission in patients with a TL (HR = 0.735, CI 95% = [0.639, 0.846], $p < .001$) and for patients in involuntary hospitalization (FU) (HR = 0.760, CI 95% = [0.618, 0.934], p < .01). Covariates significantly associated with a higher readmission risk were a history of at least one admission in the last 2.5 years before the index stay (HR = 1.005, CI 95% = [1.004, 1.005], $p < .001$), higher HoNOS symptom levels at admission (HR = 1.029, CI 95% = [1.018, 1.040], $p < .001$), and comorbidity (HR = 1.178, CI 95% = [1.024, 1.355], $p = .022$). Patients diagnosed with schizophrenia-spectrum disorders had a significantly higher readmission risk than patients in the reference category of affective disorders (HR = 1.401, CI 95% = [1.164, 1.687], $p = .001$) as did patients diagnosed with behavioural and emotional disorders with onset usually occurring in childhood and adolescence (HR = 2.297, CI 95% = [1.016, 5.194], $p = .046$). No significant effect was found for gender and age. After adjusting for their interaction with time by including them as time-dependent covariates in the model marital status and length of stay were also not significantly associated with readmission risk. Results of the Cox regression are shown in Table 3.

Table 1
Descriptive results.

Demographics and clinical characteristics		Group total (n = 3302)	TL yes (n = 1240)	TL no (n = 2062)	p-values of group differences
Inpatient stay 2.5 years before index stay n (%)		859 (26)	286 (23.1)	573 (27.8)	.003*
TL during inpatient stay n (%)		1240 (37.6)	.	.	.
Duration of TL in hours, mean (SD)			33.4 (9.5)	.	.
Frequency of TL, median (IQR)			4 (5)	.	.
Age, mean (SD)		45.9 (17.2)	47.1 (16.8)	45.2 (17.4)	.003*
Gender, male n (%)		1161 (50.3)	620 (50.0)	1041 (50.5)	.787
Marital status n (%)					
unmarried		1799 (54.5)	606 (48.9)	1193 (57.9)	.000*
married, living together		643 (19.5)	308 (24.8)	335 (16.2)	.000*
married, living separately		156 (4.7)	60 (4.8)	96 (4.7)	.810
divorced		537 (16.3)	210 (16.9)	327 (15.9)	.417
widowed		135 (4.1)	52 (4.2)	83 (4.0)	.813
unknown		32 (1.0)	4 (.3)	28 (1.4)	.003*
Length of stay, mean days n (SD)		29.8 (32.2)	53.5 (34.0)	15.5 (20.6)	.000*
FU at admission n (%)		363 (11)	74 (6)	289 (14)	.000*
HoNOS, median (IQR)		15 (8)	15 (8)	15 (9)	.000*
Primary ICD-10 Diagnosis n (%)					
F0	Organic, including symptomatic, mental disorders	120 (3.6)	28 (2.3)	92 (4.5)	.001*
F1	Mental and behavioural disorders due to psychoactive substance use	891 (27.0)	327 (26.4)	564 (27.4)	.539
F2	Schizophrenia, schizotypal and delusional disorders	491 (14.9)	165 (13.3)	326 (15.8)	.050*
F3	Mood (affective) disorders	1003 (30.4)	483 (39)	520 (25.2)	.000*
F4	Neurotic, stress-related and somatoform disorders	496 (15.0)	113 (9.1)	383 (18.6)	.000*
F5	Behavioural syndromes associated with physiological disturbances and physical factors	11 (.3)	6 (.5)	5 (.2)	.244
F6	Disorders of adult personality and behaviour	220 (6.7)	101 (8.1)	119 (5.8)	.008*
F7	Mental retardation	12 (.4)	4 (.3)	8 (.4)	.762
F8	Disorders of psychological development	4 (.1)	.	4 (.2)	.121
F9	Behavioural and emotional disorders with onset usually occurring in childhood and adolescence	11 (.3)	2 (.2)	9 (.4)	.184
Other		43 (1.3)	11 (.9)	32 (1.6)	.103
Comorbidity (% yes)		2033 (61.6)	794 (64)	1239 (60.1)	.024*

Note. TL = Therapeutic leave; FU = "Fürsorgerische Unterbringung" (involuntary hospitalization); HoNOS = Health of the Nations Outcome Scale; SD = standard deviation; IQR = interquartile range; *$p < .05$.

4. Discussion

This study looked at the impact of TL on readmission risk. The Kaplan-Meier curve indicated longer cumulative survival for patients with TL compared to patients without TL. The log-rank test implied statistical significance. The Cox regression showed a reduced hazard of readmission on any day during the observation period by 26.5% for patients with TL. TL therefore might be considered a predictor for readmission risk. However, numerous explanations seem plausible. TL might not directly influence readmission risk but instead indicate more favorable treatment processes with higher degrees of patient adherence. Thus, decreasing the risk of readmission. Secondly, TL might be more frequently granted to patients with higher functioning levels and milder psychopathological impairments which is itself associated with a lower readmission risk (Baeza et al., 2018; Böckmann et al., 2019; Moss et al., 2014). However, in our model TL significantly reduced the readmission risk even when other variables (i.e., symptom severity) were taken into account in the model. Therefore, following our study hypothesis, we suggest TL as an effective intervention leading to better treatment outcomes. From a recovery-oriented viewpoint, its therapeutic benefit becomes apparent (Barlow and Dickens, 2018; Walker et al., 2013). Recovery illustrates overcoming an illness as more than simply treating symptoms. It is a continuous process teaching the individual to overcome the handicaps caused by their illness fostering hope, motivation and self-worth. It centers around self-growth, enabling people to re-integrate into society and preserve or ameliorate their quality of life (Amering and Schmolke, 2007; Davidson et al., 2008; Roder et al., 2019). By providing patients with the opportunity to stay connected with the outside world, TL is likely to enhance recovery (Barlow and Dickens, 2018; Walker et al., 2013). However, our results are correlational and conclusions about causality cannot be drawn from the methods applied. A prospective randomized controlled trial experimentally manipulating the number and systematic use of TL could be used to assess the causality of our hypothesis.

Our findings contradict research from Moss et al. (2014) who found an increased readmission risk for patients with TL (Moss et al., 2014). The authors argue that health care professionals succeed in identifying those at readmission risk, but TL fails to level out other risk factors. The question arises as to when TL is therapeutically beneficial in acting as a protective factor. Since our model included different patient characteristics, our results might differ due to how TL is carried out. Planning and evaluation of TL likely impact its usefulness and both are often insufficient (Barlow and Dickens, 2018). Patients who are granted TL because they are considered at higher readmission risk will unlikely benefit from TL, if it is granted shortly before discharge as a standard procedure without implications on the treatment process. Contrarily, if TL is systematically evaluated and the treatment plan is adjusted to meet the patient's individual needs, integrating the experiences made during TL, it can be used not only as an intervention but also as an evaluation tool reducing the risk of premature discharge and conclusively prevent relapse (Donisi et al., 2016; Moss et al., 2014; Ortiz, 2019). Progress and change knowingly happen in-as well as outside of therapy, making TL essential for inpatient treatment. As the Kaplan-Meier curve displays (cf. Fig. 1) the time shortly after discharge holds the highest risk for

Table 2
Distribution for people hospitalized due to involuntary hospitalization and TL.

			TL		Total
			no	yes	
FU	no	count, % of Total	1773, 60.3	1166, 39.7	2939, 100.0
	yes	count, % of Total	289, 79.6	74, 20.4	363, 100.0
Total		count, % of Total	2062, 62.4	1240, 37.6	3302, 100.0

Note. TL = Therapeutic leave; FU = "Fürsorgerische Unterbringung" (involuntary hospitalization).

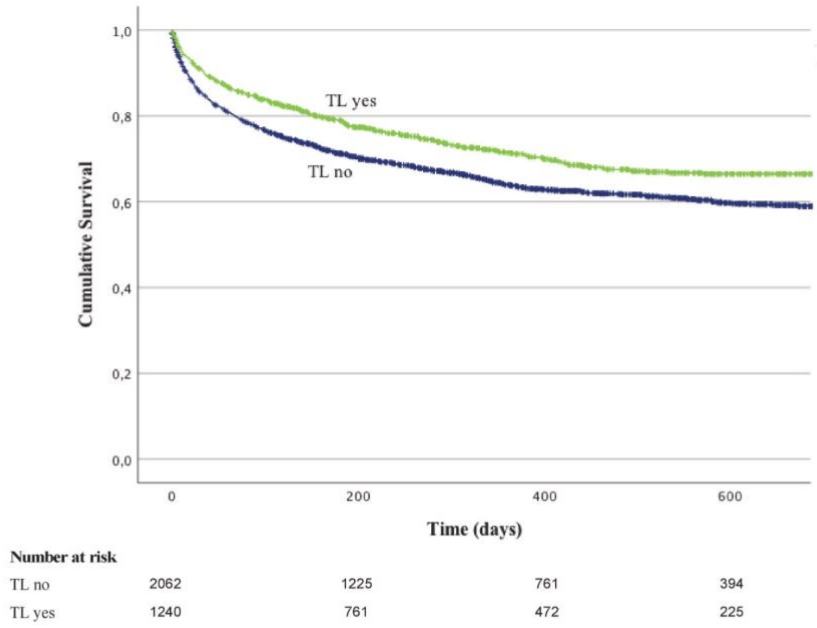

Fig. 1. Kaplan-meier curve showing the cumulative survival of patients with and without TL.

readmission, which is in line with previous research (Durbin et al., 2007; Lay et al., 2019). Patients seemingly well adjusted in the clinical setting are faced with additional challenges and stressors outside the hospital potentially causing them to relapse.

The setting in which TL is applied might further contribute to its successfulness. Recovery is encouraged at UPK Basel by its open-door-policy. It provides patients with a non-restrictive treatment setting, giving them the opportunity to practice self-agency and go about their daily lives (Hochstrasser et al., 2018; Huber et al., 2016; Lang et al, 2010, 2016). This shortens *the bridge* to normal life making it easier for patients *to cross over*. The treatment structure might influence characteristics or the use of TL in a way which makes it more therapeutically beneficial.

If TL was to prolong inpatient stays, another conflict about its usefulness might arise. In our sample the mean length of stay was significantly longer in the TL-yes-group. It is unclear whether this difference was due to TL or other factors. Statistically, we accounted for this by integrating length of stay in the Cox regression model. After adjusting for its interaction with time, results of the overall Cox regression model indicated that length of stay was not significantly associated with readmission risk. This is in line with findings of Callaly et al. (2010) although findings vary among different studies (Del Favero et al., 2020; Donisi et al., 2016; Han et al., 2020; Ortiz, 2019). In the past decades clinical practice shifted towards shorter inpatient stays (Baeza et al., 2018; Callaly et al., 2010; Ortiz, 2019). This trend might make TL less attractive for psychiatric hospitals because they risk prolonged inpatient stays which is not remunerative due to regulations in health care systems. As our results suggest, TL may constitute a factor in helping patients stabilize for longer periods of time. Although at first glance TL may constitute a cost burden, the opposite might be the case.

In total, five covariates increased the readmission risk and two (TL included) decreased the risk. A higher symptom level at the index admission increased the readmission risk, replicating findings of other studies (Baeza et al., 2018; Han et al., 2020). Comorbidity also increased the readmission risk by 17.8%, indicating that more severely ill patients likely relapse sooner. No significant effects were found for gender and age. In line with previous research (Ortiz, 2019; Silva et al., 2009), a diagnosis of schizophrenia increased the readmission risk by 40.1% in comparison to the reference category of affective disorders. Patients diagnosed with behavioural and emotional disorders with onset usually occurring in childhood and adolescence also had an increased readmission risk. After adjusting for its interaction with time, marital status was not associated with readmission risk. Our findings again highlight a history of past admissions as an important readmission risk factor, as numerous studies showed consistently (Baeza et al., 2018; Bernardo and Forchuk, 2001; Böckmann et al., 2019; Callaly et al., 2010; Donisi et al., 2016; Han et al., 2020; Moss et al., 2014; Ortiz, 2019; Rieke et al., 2016; Silva et al., 2009; Zhang et al., 2011).

Somewhat surprising, compulsory admitted patients showed a reduced readmission risk by 24.0% compared to those admitted voluntarily. This supports previous research which identified voluntary admission as a risk factor for readmission (Ortiz, 2019; Valevski et al., 2007). When tested individually there was no effect of admission status on readmission risk; significance only showed in combination with other covariates. Other contributing factors appear to have been levelled out by the model making this effect apparent. Several aspects ought to be considered interpreting this result: Possibly, compulsory admitted patients are treated with greater care from the beginning because they show lower levels of functioning at the time of admission than voluntarily admitted patients. Treatment progress may be assessed more extensively, and the point of discharge is evaluated more cautiously, making premature discharge less likely. Moreover, there might be greater emphasis on the planning of subsequent outpatient treatment as health care professionals consider these patients at higher risk of relapse. Poor discharge planning can constitute a risk factor of readmission (Callaly et al., 2010; Nelson et al., 2000; Ortiz, 2019; Silva et al., 2009). Taking a different perspective, patients themselves might want to avoid readmission due to the restriction of personal freedom in involuntary hospitalization.

4.1. Strenghts and limitations

The strengths of our study are the large sample size and the completeness of the data. It is, to our knowledge, one of the first studies to outline the possible beneficial association of TL during inpatient stays on readmission risk. A limitation to our study is the inability to control

Table 3
Cox regression with time-dependent variables.

Results of the Cox Regression ($N = 3'302$)		B	p	HR	95% CI for HR	
					Lower	Upper
Past admission*time		.005	.000*	1.005	1.004	1.005
TL		-.308	.000*	.735	.639	.846
Age		-.003	.156	.997	.993	1.001
Gender		.061	.333	1.063	.939	1.204
Marital status*time						
unmarried		*reference category*				
married, living together		.000	.446	1.000	.999	1.001
married, living separately		.000	.948	1.000	.998	1.002
widowed		.000	.766	1.000	.998	1.002
divorced		.000	.445	1.000	.999	1.001
unknown		-.004	.255	.996	.988	1.003
Length of stay*time		.000	.280	1.000	1.000	1.000
FU at admission		-.275	.009*	.760	.618	.934
HoNOS Score		.028	.000*	1.029	1.018	1.040
Primary ICD-10 Diagnosis (%)						
F0	Organic, including symptomatic, mental disorders	-.391	.071	.676	.443	1.033
F1	Mental and behavioural disorders due to psychoactive substance use	.017	.850	1.017	.855	1.209
F2	Schizophrenia, schizotypal and delusional disorders	.338	.000*	1.401	1.164	1.687
F3	Mood (affective) disorders	*reference category*				
F4	Neurotic, stress-related and somatoform disorders	-.115	.272	.892	.726	1.094
F5	Behavioural syndromes associated with physiological disturbances and physical factors	-.559	.432	.572	.142	2.304
F6	Disorders of adult personality and behaviour	-.022	.869	.978	.753	1.271
F7	Mental retardation	.427	.345	1.533	.631	3.720
F8	Disorders of psychological development	1.028	.080	2.794	.886	8.814
F9	Behavioural and emotional disorders with onset usually occurring in childhood and adolescence	.831	.046*	2.297	1.016	5.194
Other		-.547	.127	.579	.286	1.169
Comorbidity		.164	.022*	1.178	1.024	1.355

Note. Past admission = inpatient stay 2.5 prior to index admission (yes/no). Reference categories: Marital status = unmarried; Primary ICD-10 Diagnosis = F3 Mood (affective) disorders. CI = Confidence Interval; B = regression coefficient; HR = hazard ratio; TL = therapeutic leave; FU = "Fürsorgerische Unterbringung" (involuntary hospitalization); HoNOS = Health of the Nations Outcome Scale. *$p < .05$.

for certain treatment or system variables (Bernardo and Forchuk, 2001) that themselves might impact the readmission risk such as ward atmosphere, staff attitude, therapeutic relationship and individual treatment plan. Information on post discharge factors such as medication adherence or psychiatric aftercare could have contributed to the understanding of our findings. As one study by Barnett et al. (2020) showed, medication non-adherence is associated with a higher readmission risk (Barnett et al., 2020). Moreover, the lacking information on the nature of TL can be viewed critically. As outlined previously, planning, monitoring and evaluation of TL likely impact its therapeutic effect. Additionally, we would like to point out that despite statistical independence of the covariates, dependence in terms of content cannot be fully accounted for. Furthermore, we cannot preclude having missed some readmissions to other psychiatric institutions by only looking at the UPK population. This however should be a minor effect and not impact our core results, since the UPK do have public health obligations in Basel-Stadt and people living in Basel-Stadt are commonly readmitted to UPK. In particular heavy users in the UPK area, accounting for a relevant portion of early readmissions, are predominantly treated by the UPK. We would also like to raise awareness as to the fact that, despite their detrimental effects, readmissions can also be beneficial and are sometimes indeed necessary to prevent patients from harm. Especially for chronically ill patients, planned elective readmissions can be highly valuable in helping to prevent major crises. In that context, elective readmissions are not a reflection of inadequate initial inpatient treatment but should be regarded as an indicator of high standard inpatient care. Our study was a monocentric study in Switzerland and our findings may not be transferable to other healthcare systems like the US. Replications of our findings will be necessary to validate them as we cannot make any assumptions about their generalization to other samples.

5. Conclusion

Our study provides first evidence of the beneficial association of TL and readmission risk. Focusing on preventative therapeutic interventions seems promising in helping reduce readmission risk. Future research might look at how TL is implemented in different psychiatric facilities and their different units, respectively. Randomized controlled trials are needed to test the causal relationship of TL and readmission risk. Qualitative approaches would be appropriate to fully understand the underlying mechanisms of TL. Furthermore, a categorical approach dividing readmissions on a content level, into e.g. inadequate versus beneficial readmissions, would do justice to the fact that readmissions are not detrimental per se.

Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by the EKNZ (Project-ID: PB_2020–00029). The study was categorized and accepted by the ethics committee as further use of routine data without consent according to HRA Art.34/HRO.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author of this study upon reasonable request.

Role of funding source

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CRediT authorship contribution statement

Tiziana Ziltener: Methodology, Software, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Julian Möller:** Writing – review & editing, Supervision. **Lukas Imfeld:** Methodology, Software, Formal analysis, Investigation, Data curation, Writing – review & editing. **Roselind Lieb:** Writing – review & editing, Supervision. **Undine E. Lang:** Conceptualization, Supervision, Writing – review & editing, Project administration. **Christian G. Huber:** Conceptualization, Methodology, Formal analysis, Data curation, Writing – review & editing, Supervision, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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10. Appendix B: Study 2

Study 2: Tiziana Ziltener, Julian Moeller, Roselind Lieb, Andrea H. Meyer, Undine E. Lang, Christian G. Huber, Therapeutic leave and direct inpatient healthcare costs in inpatients with mental illness, *Journal of Psychiatric Research*, Volume 162, 2023, Pages 187-192, ISSN 0022-3956, https://doi.org/10.1016/j.jpsychires.2023.05.023.

The supplementary materials of Study 2 are illustrated on pages 46 to 48.

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Therapeutic leave and direct inpatient healthcare costs in inpatients with mental illness

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ABSTRACT

Aims: Balancing the economic costs related to mental illness is a pressing matter globally. Scarce monetary and staff resources impose an ongoing challenge. Therapeutic leaves (TL) are an established clinical tool in psychiatry possibly improving therapy outcome and potentially lowering direct mental healthcare costs in the long term. We thus examined the association between TL and direct inpatient healthcare costs.
Methods: We analyzed the association between the number of TL and direct inpatient healthcare costs in a sample of 3151 inpatients, using a tweedie multiple regression model, including eleven confounders. Using multiple linear (bootstrap) and logistic regression models we assessed the robustness of our results.
Results: The tweedie model showed that the number of TL was associated with lower costs following the initial inpatient stay (B = –.141, CI 95% = [–0.225, –.057], $p < 0.001$). Results of the multiple linear and the logistic regression models matched those of the tweedie model.
Conclusion: Our findings suggest a link between TL and direct inpatient healthcare costs. TL might lower direct inpatient healthcare costs. In the future RCTs might examine whether an increased utilization of TL leads to a reduction of outpatient treatment costs and evaluate the association of TL with outpatient treatment costs and indirect costs. The systematic use of TL during inpatient treatment could reduce healthcare costs following the initial inpatient stay which is highly relevant due to global rise of mental illness and the associated financial pressure on healthcare systems.

1. Introduction

One in two people is affected by a mental disorder at least once across their lifespan (Trautmann et al., 2016) and recent estimates show that mental illness accounts for approximately 13.1 disability-adjusted life years (DALYS) (Vigo et al., 2016). In addition to the suffering caused by mental illness, the decrease in the quality of life and the shorter life expectancy of those with impaired mental health, mental illness accounts for a large proportion of monetary healthcare costs worldwide (Doran and Kinchin, 2019; Knapp and Wong, 2020; Trautmann et al., 2016). Moreover, recent research showed that the economic burden of mental illness appears to have been highly underestimated (Vigo et al., 2016). Lowering the economic costs related to mental illness is therefore becoming a pressing matter on a global scale.

According to the human capital approach mental illness generates two different kinds of monetary costs (Bloom et al., 2011; Trautmann et al., 2016), namely direct and indirect costs. The latter refer to costs caused by the loss of economic output due to the inability to work and premature death. The former include all costs of diagnostics, in- and outpatient treatment, rehabilitation, medication, social services, special housing and community treatment programs (Christensen et al., 2020; Trautmann et al., 2016). Direct healthcare costs make up about 52% of total costs of mental disorders, with inpatient treatment contributing the largest share (Gustavsson et al., 2011).

As of today, there is a large variety of treatment approaches including pharmacotherapy, psychotherapy, and integrated care that have proven efficient in treating mental illness and are recommended by government guidelines (NICE, 2022). However, decisions on the implementation of clinical interventions as standard care are not solely based on their clinical merit. The implementation of practices and policies in clinical reality highly depend on their economic costs and on the availability of the already scarce resources on a staff and monetary

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healthcare budget level. This often constitutes a challenge for applying evidence into practice (Knapp and Wong, 2020).

1.1. TL

Therapeutic leave (TL) is an existing intervention with a long tradition in psychiatry and is applied internationally in inpatient treatment (Barlow and Dickens, 2018; Ziltener et al., 2021). It is commonly defined as a time-limited planned absence from the inpatient ward with the general aim to examine treatment progress, to apply coping strategies and therapeutic measures in a real-world context, to promote the autonomous reintegration into a patient's familiar environment, and to assess discharge readiness (BfS, 2018; Ziltener et al., 2021). It can be administered easily using limited staff resources. However, TL should be prepared and followed up in the therapeutic process.

Its major downsides are costs for the treating hospital due to empty beds during TL and a potentially longer lengths of stays which are considered unfavorable due to the global downscaling of bed capacity (Lamb and Bachrach, 2001). Based on results of our previous work showing TL to be associated with a lower risk of readmission (Ziltener et al., 2021), it seemed plausible that TL might also be negatively associated with direct inpatient healthcare costs in the long term. We argue that, whilst TL might prolong the index inpatient stay and thus might produce higher short-term direct inpatient costs, they act as a protective factor against relapse and might thus be associated with lower direct inpatient healthcare costs in the months after discharge.

2. Aim of the study

To compare direct inpatient healthcare costs of psychiatric inpatients with and without TL post discharge, in the months following their initial inpatient stay during the study period.

3. Methods

3.1. Setting

This observational cohort study was conducted at the Department of Adult Psychiatry (UPKE) and the Private Clinic (UPKP) of the University Psychiatric Clinics (UPK) Basel. The UPK Basel offers in-as well as outpatient treatment for approximately 200,500 people living in the canton of Basel-Stadt and the surrounding areas. TL is a well-established part of treatment throughout psychiatry internationally and constitutes a cornerstone of inpatient stays at UPK (Ziltener et al., 2021). It allows inpatients to spend time at home away from the ward, enabling them to test their resilience in their usual environment. Duration of TL varies individually and highly depends on a patient's current psychological state and treatment goals (Ziltener et al., 2021). TL is proposed to the patient by the treatment team if clinically indicated. However, TL can also be requested by the patient. The head physician is ultimately in charge of granting TL. Full mental capacity and no risk of immediate self-harm or harm to others are required criteria for the granting of TL (Ziltener et al., 2021).

In Switzerland, TL will hardly be granted for longer than 24 h at a time due to the accounting system currently in place. In January 2018, a new accounting system called *TARPSY* was implemented into the Swiss healthcare system. With the introduction of TARPSY, a new nationwide cost rate structure for psychiatric inpatient treatment was created. One particular guideline of TARPSY is the registration of absences as so-called *administrative leave* in the digital patient file (SwissDRGAG, 2019). The sum of all administrative leaves greater than 24 h during an inpatient stay has to be deducted from the number of treatment days in total (SwissDRGAG, 2019). The number of billable treatment days is thereby reduced in case of absences longer than 24 h even though passive costs for the psychiatric hospital still persist during leave. In 2021 TARPSY 3.0 was introduced. Along with other changes, TL over 24 h is now partially remunerated. Two different compensatory rates are granted depending on the time of absence: CHF 153 for absences between 24 and 48 h and CHF 204 for absences longer than 48 h (Trezzini and Meyer, 2020). However, these compensations only cover a small proportion of the costs persisting during TL and healthcare providers still face indirect costs when granting TL.

3.2. Sample

This study was conducted using a large dataset of clinical routine data of UPK inpatients from a previous study on TL and readmission (Ziltener et al., 2021). The dataset contains pseudonymized data of all 3′400 UPK inpatient cases of the UPKE and UPKP within the time period between January 1st, 2018, and April 15th, 2020. For the purpose of the current analysis, only patients with complete data on all relevant variables as well as patients who had completed their inpatient stay by the time of the data extraction were included. Patients discharged to another psychiatric clinic or a general somatic hospital were excluded from the analysis as their treatment at UPK could not be considered completed. After applying these criteria, 3′151 cases remained in our dataset and were considered for analysis. The study was categorized and accepted by the responsible ethics committee (EKNZ) as further use of routine data without consent according to HRA Art.34/HRO. Ethics committee approval for this study was granted by the EKNZ (Project-ID: PB_2020-00029).

3.3. Measures

To identify patients with and without TL, we used the administrative leaves recorded in the digital patient file as grouping variable. Patients with a minimum of 1 absence were assigned to the "TL-yes" group and patients without any registered absences to the "TL-no" group. Within the "TL-yes" group TL was included as a continuous variable.

Healthcare costs were operationalized through the effective cost weights of an inpatient stay according to the Swiss DRG Psychiatric Cost Groups (PCG), TARPSY 2.0 (SwissDRG AG, 2019). Effective cost weights are calculated as follows:

Number of Billable Treatment Days X *Day-Based Cost Weight*

The number of billable treatment days are recorded as routine data at the end of an inpatient stay and are calculated as follows:

Discharge Date - Admission Date - Days of Administrative Leave +1

In this analysis, we did not use costs in CHF but instead, we used the effective cost weights as a proxy for treatment costs. The day-based cost weight depends on the relative treatment expense of a diagnostic group. They are calculated on a yearly basis, based on the most recent cost data reports of Swiss hospitals. Cost weights per day follow a degressive gradient and are different depending on the PCG. Costs in CHF for a specific case are calculated by multiplying the effective cost weight with its base rate. The base rate is the amount in CHF to be remunerated for an effective cost weight of 1.0 and is determined by the healthcare provider and the healthcare insurance (SwissDRG AG, 2021). It is identical for all cases of a healthcare provider. Thus, the outcome variable was the sum of all effective cost weights during the study period after the initial inpatient stay, which is the equivalent of the cumulative direct inpatient healthcare costs divided by the base rate. The observation time was calculated for each patient individually and represents the time (months) from the discharge day to the end of the observation period (day of the data extraction). The admission period was operationalized based on the annual quarters and patients were assigned to the four groups depending their admission date (first quarter: January to March; second quarter: April to June; third quarter: July to September; fourth quarter: October to December). The Health of the Nations Outcome Scales (HoNOS) is administered as part of the admission procedure at the UPK Basel and was used as an indicator of the severity of

Table 1
Descriptive results.

Demographics and clinical characteristics			
	Group total (n = 3151)	TL-yes (n = 1207)	TL-no (n = 1944)
TL during inpatient stay n (%)	1207 (38.3)	.	.
History of past admissions n (%)	824 (26.2)	281 (23.3)	543 (27.9)
Age, mean (SD)	45.47 (16.95)	47.04 (16.88)	44.49 (16.94)
Gender, male n (%)	1579 (50.1)	602 (49.9)	977 (50.3)
Marital status n (%)			
unmarried	1721 (54.6)	589 (48.8)	1132 (58.2)
married, living together	608 (19.3)	296 (24.5)	312 (16)
married, living separately	153 (4.9)	59 (4.9)	94 (4.8)
divorced	513 (16.3)	208 (17.2)	305 (15.7)
widowed	125 (4.0)	51 (4.2)	74 (3.8)
unknown	31 (1.0)	4 (0.3)	27 (1.4)
FU at admission n (%)	323 (10.3)	71 (5.9)	252 (13)
Billable treatment days during the initial stay, mean (SD)	28.58 (28.84)	48.17 (29.69)	16.42 (20.36)
Cumulative billable treatment days, mean (SD)	47.41 (49.63)	64.56 (47.31)	36.77 (48.05)
Observation Time Months (SD)	15.46 (7.18)	14.43 (7.18)	16.09 (7.10)
Admission Period n (%)			
First Quarter	981 (31.1)	358 (29.7)	623 (32.0)
Second Quarter	787 (25.0)	300 (24.9)	487 (25.1)
Third Quarter	740 (23.5)	292 (24.2)	448 (23.0)
Fourth Quarter	643 (20.4)	257 (21.3)	386 (19.9)
Effective Cost Weight at Index (SD)	28.53 (26.99)	46.49 (27.57)	17.37 (19.61)
Cumulative Effective Cost Weight (SD)	19.24 (41.14)	16.34 (36.27)	21.05 (43.80)
HoNOS, median (IQR)	15 (8)	15 (8)	15 (9)
Primary ICD-10 Diagnosis n (%)			
F0 Organic, including symptomatic, mental disorders	91 (2.9)	26 (2.2)	65 (3.3)
F1 Mental and behavioural disorders due to psychoactive substance use	858 (27.2)	320 (26.5)	538 (27.7)
F2 Schizophrenia, schizotypal and delusional disorders	464 (14.7)	163 (13.5)	301 (15.5)
F3 Mood (affective) disorders	960 (30.5)	467 (38.7)	493 (25.4)
F4 Neurotic, stress-related and somatoform disorders	488 (15.5)	110 (9.1)	378 (19.4)
F5 Behavioural syndromes associated with physiological disturbances and physical factors	10 (0.3)	5 (0.4)	5 (0.3)
F6 Disorders of adult personality and behaviour	215 (6.8)	99 (8.2)	116 (6)
F7 Mental retardation	12 (0.4)	4 (0.3)	8 (0.4)
F8 Disorders of psychological development	4 (0.1)	0	4 (0.2)
F9 Behavioural and emotional disorders with onset usually occurring in childhood and adolescence	11 (0.3)	2 (0.2)	9 (0.5)
Other	38 (1.2)	11 (0.9)	27 (1.4)
Comorbidity (% yes)	1942 (61.6)	773 (64)	1169 (60.1)

Note. TL = Therapeutic leave; the two groups TL-yes and TL-no contain patients with at least one or no TL, respectively.
History of past admissions = inpatient stay 2.5 years prior to index admission (yes/no). FU = involuntary admission ("Fürsorgerische Unterbringung"); HoNOS = Health of the Nations Outcome Scales; SD = standard deviation; IQR = interquartile range.

symptoms (Wing et al., 1998). Information on involuntary admission ("Fürsorgerische Unterbringung"; FU) is also recorded as standard procedure and could be retrieved from the digital patient file. The primary clinical diagnoses are presented according the ICD, 10th revision (Organisation, 2004). The variable comorbidity displays information on any other potential clinical and/or somatic diagnoses. We applied a binary approach, meaning the variable was coded "yes" for patients with at least one secondary diagnosis, and "no" for patients without any secondary diagnoses. The variables effective cost weights of the initial inpatient stay, admission period, TL, age, gender, marital status, symptom severity, involuntary admission, primary clinical diagnoses, and comorbidity were all measured at the index admission.

In addition, we included previous admissions 2.5 years prior to index admission as a binary covariate in the model (Frick and Frick, 2008; Ziltener et al., 2021). Prior studies have shown a history of admissions to increase readmission risk (Donisi et al., 2016; Han et al., 2020; Ortiz, 2019; Zhang et al., 2011). They are thus likely associated with direct inpatient healthcare costs.

3.4. Statistical analysis

Statistical analyses were conducted using IBM SPSS Statistics 27.0 (IBMCorp, 2020) and R (RCoreTeam, 2021).

The predictor variable was the number of TL during the initial inpatient stay and the outcome variable were the cumulative effective cost weights. Based on the literature, their association was controlled for the following eleven confounders: history of past admissions to the UPK Basel, age, gender, marital status, involuntary admission, observation time (months), admission period, effective cost weights of the initial inpatient stay, symptom severity at admission (HoNos score), primary clinical diagnosis, and comorbidity.

In a first step, we performed a zero-order correlation including the predictor and outcome variable as well as all the confounders. For the main analysis, a tweedie multiple regression model with log-link was applied to test whether the number of TL during the initial inpatient stay was associated with lower inpatient costs during the study period. Tweedie models are especially suited in the fields of health economics or insurance business, where costs are often zero due to non-utillisation or, if costs do occur, their distribution is usually right-skewed (Kurz, 2017).

Number of TL and effective cost weights of the initial inpatient stay were both highly skewed and ln-transformed prior to analysis to avoid highly influential data points. Reference categories of categorical variables were chosen depending on group size, with the largest group as the reference category. Multicollinearity was low, with variance inflation factors being <2 for each predictor/confounder. In order to assess the robustness of our Tweedie model, we conducted two additional models: a multiple linear regression model in which the confidence intervals of the coefficients were obtained using a bootstrap procedure and a multiple logistic regression model in which the outcome was dichotomized using the two categories costs = 0 and costs >0. The significance level alpha was set at 5%.

4. Results

4.1. Patient characteristics

1579 (50.1%) patients were male and the mean age at admission was 45.5 years ($SD = 17.0$). 1207 (38.3%) patients went on at least one TL during their inpatient stay. The number of TL ranged from 0 to 37. The mean effective cost weight during the initial inpatient stay was 28.53 ± 26.99, the mean cumulative effective cost weight was 19.24 ± 41.14 and the mean observation time was 15.46 ± 7.18 months. 824 (26.2%) patients had been admitted to UPK at least once in the 2.5 years prior to initial inpatient stay. Descriptives are shown in Table 1.

4.2. Zero order correlations

Results of the zero-order correlations among the involved variables are presented in Table 2 in the supplementary materials.

4.3. Regression models

The Tweedie multiple regression model showed that when controlling for the 11 confounders, the number of TL was associated with lower costs following the initial inpatient stay (B = −0.141, CI 95% = [−0.225, −0.057], $p < 0.001$). Results of the multiple linear regression model, including bootstrap confidence intervals (B = −0.200, CI 95% = [−0.355, −0.048], $p = 0.008$) and the multiple logistic regression model (OR = 0.777, CI 95% = [0.631, 0.958], $p = 0.018$), overall matched those of the Tweedie model.

5. Discussion

This observational cohort study examined whether the utilization of at least one TL during an index inpatient stay was associated with lower direct inpatient healthcare costs in the months after discharge. Indeed, TL was significantly associated with lower costs following the initial inpatient stay. If the associations found in our study are causal, the systematic use of TL during inpatient treatment could reduce healthcare costs following the initial inpatient stay.

A lot of variables that have been shown to be associated with treatment costs, such as e.g. diagnosis and age, are given and cannot be changed through treatment (Wolff et al., 2015). On the contrary, TL can be considered a modifiable treatment variable. It can be managed by altering timing, duration, and frequency according to a patient's needs. Thus, it can be used systematically during inpatient treatment, potentially lowering inpatient costs in the long term. Whilst TL might increase costs in the short term due to longer lengths of stay during the index admission, our analysis suggests that TL is associated with lower direct inpatient healthcare costs when looking at an extended period. Bearing in mind the challenge of providing optimal care with limited financial resources and a scarcity of qualified healthcare professionals, using TL as a cost reduction could prove advantageous. Not only is TL an existing intervention on a global level, but it can also be carried out using relatively low staff resources. From a patient perspective, TL is considered a highly acceptable intervention in most cases. Being given the opportunity to leave the ward might help uphold a sense of autonomy even in a crisis. From a clinical viewpoint, TL serves as an assessment tool for treatment progress and discharge readiness as patients get to test their coping strategies and therapeutic measures in their usual environment (Ziltener et al., 2021). TL is associated with a lower readmission risk and might be considered an effective intervention to enhance recovery (Ziltener et al., 2021).

However, a critical aspect is the indirect costs for the psychiatric hospital generated by empty beds during patients' absenteeism. To incent TL, it must be renumerated appropriately. The indirect costs through TL might otherwise cause a discrepancy between the role of a psychiatric clinic as a healthcare provider whose primary goal is to ensure the wellbeing of its patients by providing the best treatment possible, whilst at the same time having to pursue their economic interests as an organization. With the introduction of TARPSY 3.0, Switzerland has recently implemented the partial remuneration of TL (Trezzini and Meyer, 2020). However, this change presumably comes at the cost of lower base rates in the future.

Although not of primary interest to our research question, we would like to point out some results of the zero-order correlation due to their clinical relevance regarding past and potential future research. In our sample, a history of previous admissions and a diagnosis of schizophrenia spectrum disorder were, among others, both positively associated with cumulative direct inpatient costs. A history of past admissions has been frequently found to be a strong predictor of readmission (Donisi et al., 2016; Han et al., 2020; Ortiz, 2019; Zhang et al., 2011). Its association with inpatient costs was thus unsurprising. How to effectively prevent readmission and provide adequate alternative care models for those suffering from a chronic disease with the often-unfavorable progression of illness remains an ongoing challenge in psychiatric healthcare systems all over the world. Karow et al. showed integrated care to be a cost-effective approach for schizophrenia spectrum disorder regarding an increased quality of life at comparable annual costs to treatment as usual (Karow et al., 2012). In the inpatient setting, an open-door policy has been found to be associated with a reduction of seclusion and forced medication (Hochstrasser et al., 2018).

Furthermore, the zero-order correlation showed that symptom severity was positively associated with costs at the index admission as well as the cumulative costs. This highlights the beforementioned and is further in line with previous research. Symptom severity has been shown to be associated with poorer health outcomes (Huber et al., 2012), and severe mental illness has been found to be associated with high direct and indirect costs (Chong et al., 2016). This might be especially true in our sample for patients diagnosed with a schizophrenic spectrum disorder. The UPK Basel treats a large proportion of high utilizer patients of this diagnostic group with often severe mental impairments. Schizophrenia is a highly disabling disease, and a systematic review showed a substantial economic burden caused by schizophrenia, with annual costs ranging from USD 94 million to USD 102 billion (Chong et al., 2016).

5.1. Strenghts and limitations

A key strength of our study is the large sample size which makes the occurrence of random effects unlikely. Furthermore, our results appear to be robustly judged by the overall consistency of the three models. Our study is one of the first of its kind to highlight the benefits of TL from an economic perspective – a critically important aspect when it comes to promoting changes in clinical practices and policies. However, this study has several limitations. Firstly, only direct inpatient healthcare costs were considered. We did not have information on outpatient treatment costs or indirect costs. Indirect costs are particularly important when assessing the economic burden of SMI, as these conditions often come with considerable social and professional decline (Gustavsson et al., 2011). In addition, it could be interesting to assess to what extent TL might impact indirect costs as its key goal is to promote the successful reintegration into patients' environment (BfS, 2018). Secondly, our study only captured a limited time period, and the prognostic value of the extended benefit of TL regarding healthcare costs over longer time frames remains unclear – a challenge that is faced by most studies looking at economic aspects of mental health (Knapp and Wong, 2020). Thirdly, the study design was retrospective and observational, and we cannot draw causal conclusions from our results. Lastly, monetary costs do by no means reflect the enormous emotional burden lived by those suffering from mental illness and their surroundings. Economic evaluations are critically important to promote healthcare system changes and accelerate mental health investments. Yet, political decision-making should and must not be driven solely by monetary evaluations when it comes to a person's health and well-being.

5.2. Conclusion

In conclusion, our study addressed the important question of how direct inpatient mental healthcare costs might be reduced with limited resources using an existing intervention. Our findings imply that TL might effectively lower inpatient treatment costs for most diagnostic groups. Future research could look at how TL might impact outpatient treatment costs and indirect costs associated with mental illness. Identifying a period of effectiveness of TL after discharge, using a fixed observation period, could also be promising. Furthermore, assessing how the frequency, duration and therapeutical focus of TL might impact healthcare costs might be promising. Randomized controlled trials ought to be applied to validate the causality of our results.

Ethics committee approval

Study procedures were conducted in accordance with all local and national regulations, and the local ethics committee EKNZ approved the study (Project-ID 287-13/PB_2020-00029).

Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by the EKNZ (Project-ID: PB_2020-00029). The study was categorized and accepted by the ethics committee as further use of routine data without consent according to HRA Art.34/HRO.

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Authors' contributions

CGH and TZ designed the study, and TZ and CGH wrote the initial draft of the paper. TZ collected the data. TZ, AHM and CGH analyzed and interpreted the data. AHM supervised the statistical analyses. JM, RL, AHM and UEL contributed in interpreting the results and revising the manuscript. All authors have contributed to, read and approved the final version of the manuscript. TZ had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author of this study upon reasonable request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2023.05.023.

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Table 2. Zero Order Correlations including the predictor, the outcome variable, and all confounders.

Variables	1	2	3	4	5.1	5.2	5.3	5.4	5.5	5.6	6	7	8	9	10	11	12.1	12.2	12.3	12.4
1. TL	-																			
2. History of past admissions	-.07	-																		
3. Age	.01	.07	-																	
4. Gender	.06	.01	.08	-																
5.1 unmarried	-.05	.04	-.49	-.18	-															
5.2 married, living together	.09	-.13	.22	.03	n.a.	-														
5.3 married, living separately	-.02	-.04	.03	-.03	n.a.	n.a.	-													
5.4 widowed	-.01	.04	.32	.28	n.a.	n.a.	n.a.	-												
5.5 divorced	-.04	.13	.25	.09	n.a.	n.a.	n.a.	n.a.	-											
5.6 unknown	-.04	-.21	.01	-.20	n.a.	n.a.	n.a.	n.a.	n.a.	-										
6. FU at admission	-.12	.02	.08	-.04	.01	-.14	-.03	.11	.05	.44	-									
7. Observation Time (Months)	-.15	.36	-.00	.02	.04	-.07	.00	-.03	.04	-.02	.00	-								
8. Admission period	.03	-.19	.01	.00	-.04	.05	.00	.04	-.01	-.01	-.01	-.54	-							
9. Effective Cost Weight	.58	.00	.22	-.04	-.08	.04	-.01	.09	.05	-.06	-.02	-.12	.01	-						
10. Cumulative Effective Cost Weight	-.09	.35	.00	.00	.06	-.07	.00	-.02	.01	-.03	.02	.31	-.18	-.02	-					
11. HoNOS Score	-.06	.15	.06	-.05	.00	-.05	.01	-.00	.04	.02	.22	.30	-.17	.09	.16	-				
12.1 F0 Organic, including symptomatic, mental disorders	-.03	-.09	.25	.06	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.36	.01	.01	.09	-.02	.08	-			
12.2 F1 Mental and behavioural disorders due to psychoactive substance use	-.06	.09	-.00	-.30	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.00	-.09	.01	.03	.02	.06	n.a.	-		

Note. TL = Therapeutic leave; the two groups TL-yes and TL-no contain patients with at least one or no TL, respectively; history of past admissions = inpatient stay 2.5 years prior to index admission (yes/no); variables 5.1 to 5.6 are the subcategories of the variable "marital status"; FU = involuntary admission ("Fürsorgerische Unterbringung"); HoNOS = Health of the Nations Outcome Scales; n.a. = not applicable. Correlations between two metric variables and between metric and dichotomous variables were calculated using the Pearson correlations coefficient. Correlations between metric and ordinal and between ordinal and dichotomous variables were calculated using the Spearman correlations coefficient. Correlations between two dichotomous variables and dichotomous and nominal variables were calculated using tetrachoric correlations. Correlations between two nominal variables with more than two possible characteristics are not reported and marked with n.a. as such correlations are statistically faulty and unreliable.
Metric variables: TL; age; observation time (months); effective cost weight; cumulative effective cost weight; HoNOS. Ordinal variable: admission period. Dichotomous variables: history of passed admissions; gender; FU at admission; comorbidity. Nominal variables with more than 2 characteristics: unmarried; married, living together; married, living separately; divorced; unknown; F0 Organic, including symptomatic, mental disorders; F1 Mental and behavioural disorders due to psychoactive substance use; F2 Schizophrenia, schizotypal and delusional disorders; F3 Mood (affective) disorders; F4 Neurotic, stress–related and somatoform disorders; F5 Behavioural syndromes associated with physiological disturbances and physical factors; F6 Disorders of adult personality and behaviour; F7 Mental retardation; F8 Disorders of psychological development; F9 Behavioural and emotional disorders with onset usually occurring in childhood and adolescence; Other).

Variables	1	2	3	4	5.1	5.2	5.3	5.4	5.5	5.6	6	7	8	9	10	11	12.1	12.2	12.3	12.4
12.3 F2 Schizophrenia, schizotypal and delusional disorders	-.09	.18	-.01	-.04	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.37	.07	-.03	-.01	.11	.12	n.a.	n.a.	-	
12.4 F3 Mood (affective) disorders	.15	-.03	.14	.19	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-.25	-.02	.00	.13	-.04	-.08	n.a.	n.a.	n.a.	-
12.5 F4 Neurotic, stress–related and somatoform disorders	-.07	-.20	-.14	.07	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-.16	.05	.01	-.22	-.07	-.14	n.a.	n.a.	n.a.	n.a.
12.6 F5 Behavioural syndromes associated with physiological disturbances and physical factors	-.01	-.20	-.05	.38	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-.12	.01	.01	-.06	-.01	-.02	n.a.	n.a.	n.a.	n.a.
12.7 F6 Disorders of adult personality and behaviour	.12	.06	-.17	.05	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-.15	.03	-.01	.02	-.01	.03	n.a.	n.a.	n.a.	n.a.
12.8 F7 Mental retardation	-.01	.07	-.03	-.14	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.20	.03	-.02	.01	.01	.03	n.a.	n.a.	n.a.	n.a.
12.9 F8 Disorders of psychological development	-.02	-.01	-.06	-.33	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.18	-.01	-.01	-.03	.02	-.01	n.a.	n.a.	n.a.	n.a.
12.10 F9 Behavioural and emotional disorders with onset usually occurring in childhood and adolescence	-.01	-.08	-.07	-.40	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-.14	.01	.02	-.02	.03	.01	n.a.	n.a.	n.a.	n.a.
12.11 Other	-.04	-.08	.03	.07	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-.04	.02	-.01	-.02	-.03	-.02	n.a.	n.a.	n.a.	n.a.
13. Comorbidity	.04	.30	-.04	-.15	.10	-.13	.06	-.04	.07	-.19	-.06	.10	-.08	.10	.09	.17	-.01	.50	-.25	-.24

Variables	12.5	12.6	12.7	12.8	12.9	12.10	12.11	13
1. TL								
2. History of past admissions								
3. Age								
4. Gender								
5.1 unmarried								
5.2 married, living together								
5.3 married, living separately								
5.4 widowed								
5.5 divorced								
5.6 unknown								
6. FU at admission								
7. Observation Time (Months)								
8. Admission period								
9. Effective Cost Weight								
10. Cumulative Effective Cost Weight								
11. HoNOS Score								
12.1 F0 Organic, including symptomatic, mental disorders								
12.2 F1 Mental and behavioural disorders due to psychoactive substance use								
12.3 F2 Schizophrenia, schizotypal and delusional disorders								
12.4 F3 Mood (affective) disorders								
12.5 F4 Neurotic, stress–related and somatoform disorders	-							
12.6 F5 Behavioural syndromes associated with physiological disturbances and physical factors	n.a.	-						
12.7 F6 Disorders of adult personality and behaviour	n.a.	n.a.	-					
12.8 F7 Mental retardation	n.a.	n.a.	n.a.	-				
12.9 F8 Disorders of psychological development	n.a.	n.a.	n.a.	n.a.	-			
12.10 F9 Behavioural and emotional disorders with onset usually occurring childhood and adolescence	n.a.	n.a.	n.a.	n.a.	n.a.	-		
12.11 Other	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	
13. Comorbidity	-.16	.07	.15	-.03	.11	.10	-.06	-

11. Appendix C: Study 3

Study 3: Tiziana Ziltener, Julian Moeller, Eva Kowalinski, Undine E. Lang, Christian G. Huber, Relative efficiency of staff resources regarding inpatient treatment without coercive measures in 11 German psychiatric hospitals using data envelopment analysis (DEA). [Manuscript submitted for publication].

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Relative Efficiency of Staff Resources regarding Inpatient Treatment without Coercive Measures in 11 German Psychiatric Hospitals using Data Envelopment Analysis (DEA)

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ABSTRACT

Aims: Assessing the relative efficiency of staff resources in 11 German psychiatric clinics regarding inpatient cases without any seclusion and restraint in 2008, 2010, and 2012.

Methods: We conducted a naturalistic observational study on routine data from 11 German psychiatric hospitals in 2008, 2010, and 2012, applying an output-oriented Data Envelopment Analysis (DEA) model under the assumption of variable returns to scale.

Results: The mean technical efficiency (TE) was 97.4% in 2008, 97.1% in 2010, and 98.2% in 2012. On average, the clinics could increase cases without coercion by 2.6, 2.9, and 1.8% with the same number of staff. The clinics 1, 4 and 11 reached optimal technical efficiency (TE) scores in all three years. The clinics 7 and 8 did so in 2008, the clinics 2 and 5 in 2010, and the clinics 5, 7, and 10 in 2012. The average scale efficiency (SE) was 87.1% in 2008, 92.4% in 2010, and 84.8% in 2012. Clinic 4 reached an SE of 1 in all three years. The clinics 8 and 11 did so in 2008, 1, 2, and 11 in 2010, and 10 and 11 in 2012. All clinics with SE > 1 faced decreasing returns to scales, indicating they would have to downsize their scale to become efficient.

Conclusion: The clinics examined were relatively efficient at maximizing cases without coercion. Management changes could increase TE. Regarding SE, the team composition must be considered. Decisions on staff numbers and team composition cannot solely be economically driven. Health economic analyses are necessary to increase the likelihood of policy change. However, they do not suffice. Knowledge from clinical and health economic studies and ethical considerations must be combined to form a patient-oriented and ethical psychiatric healthcare system regarding staff work conditions and the treatment of its patients.

Word count: 296

BACKGROUND

Coercion in psychiatry is a controversial topic both within psychiatry and on a global political level (Chieze, Clavien, et al., 2021; Huckshorn, 2006a; Kalisova et al., 2014; Krieger et al., 2018). Coercive measures undermine patients' autonomy and violate fundamental human rights (Chieze, Clavien, et al., 2021). They form an ethical dilemma and must only be used as a last resort (Chieze, Clavien, et al., 2021; Chieze, Courvoisier, et al., 2021; Kalisova et al., 2014; Krieger et al., 2021; SAMS, 2017; Wynn, 2006).

The term coercion is broad and entails different subcategories of coercive measures (Chieze, Clavien, et al., 2021). In this article, we apply the Swiss Academy of Medical Sciences (SAMS) meaning. The SAMS defines coercion as "[…] measures in spite of the fact that the person concerned either indicates or has indicated previously – that he or she does not consent to it" (SAMS, 2017, p. 7). Within this definition, different forms of coercion can be further distinguished. On the one hand, there are measures restricting a person's freedom of movement. These include compulsory hospitalization, seclusion, or restraint (SAMS, 2017).

On the other hand, forced treatment refers to all kinds of coercive medical treatment (SAMS, 2017). Furthermore, one can distinguish informal coercion from these *formal* coercive measures. Informal coercion includes any form of psychological leverage, i.e., persuasion or pressure on a patient (Chieze, Clavien, et al., 2021; Chieze et al., 2019; SAMS, 2017). In this study, we focused on seclusion and restraint. Seclusion refers to locking a patient in a designated room, whereas restraint means tying up (mechanical) or holding (physical) a patient (Chieze et al., 2019; SAMS, 2017).

Research has shown multiple adverse consequences of coercive measures (Chieze et al., 2019; Krieger et al., 2021). They can lead to traumatization (Chieze et al., 2019; Fugger et al., 2016; Steinert et al., 2013; Whitecross et al., 2013), and are associated with feelings of punishment and distress(Chieze et al., 2019), as well as feelings of depression and helplessness (Fugger et al., 2016; Krieger et al., 2018). In addition, patients perceive coercive measures as degrading (Rüsch et al., 2014). Coercive measures can harm the patient-therapist relationship and lower treatment adherence (Jaeger et al., 2013; Sashidharan et al., 2019; Swartz et al., 2003).

Considering these potential adverse outcomes, the goal of every psychiatric clinic must be to keep coercion at the lowest possible level. Globally, efforts are being made to reduce coercive measures throughout psychiatry (Chieze, Courvoisier, et al., 2021; Kalisova et al., 2014). In this context, extensive research has concerned the risk factors of coercive measures (Beames & Onwumere, 2022; Boumans et al., 2015; Chieze, Courvoisier, et al., 2021; Kalisova et al., 2014; Krieger et al., 2021).

A recently published systematic review identified different categories of risk factors for coercive measures examined in the literature: patient-level risk factors, staff characteristics, and organizational factors (Beames & Onwumere, 2022). Many studies focused on patient-level risk factors (Beames & Onwumere, 2022). However, these factors alone fail to explain variation in the use of coercive measures (Beames & Onwumere, 2022). Organizational and staff characteristics also play a fundamental part in their risk and prevention (Beames & Onwumere, 2022; Boumans et al., 2015; Chieze, Courvoisier, et al., 2021; Kalisova et al., 2014). On an organizational level, programs designed to reduce coercion in psychiatry, such as Safewards (Bowers, 2014; McKeown et al., 2019; Stensgaard et al., 2018), the Weddinger Model (Czernin et al., 2020) or the Six Core Strategy (Huckshorn, 2006b; McKeown et al.,

2019; Riahi et al., 2016), prove successful. Structural changes, such as an open-door policy, also reduced coercion (Blaesi et al., 2015; Bowers et al., 2012; Hochstrasser et al., 2018; Kowalinski et al., 2019). A recently published umbrella review on the reduction of coercive treatment reports moderate evidence for staff training and shared decision-making and low evidence for integrated care models for reducing coercive measures in psychiatry (Barbui et al., 2020).

Adequate staffing levels are crucial for successfully implementing organizational changes such as coercion reduction programs and an open-door policy (DGPPN, 2018; McKeown et al., 2019). They share a paradigm shift from a paternalistic treatment approach to a patient-oriented model of care, which places shared decision-making at its core. Such a treatment approach requires the team to build a stable relationship with their patients. This is time-consuming; thus, adequate resources are necessary (DGPPN, 2018).

However, research looking at the association of staff resources and the use of coercive measures is limited and heterogeneous. One study by Bowers et al. (2012) found that a higher number of junior medical doctors at the ward level was associated with reduced use of manual restraint and show of force. Higher numbers of qualified nursing staff at the ward level were associated with increased use of these coercive measures. A more substantial number of ethnic minority staff was related to less usage. Coercive measures were associated with locked ward doors during the entire shift (Bowers et al., 2012). Another study also found increased rates of seclusion and restraint in wards with more nurses The authors suggest that patients at risk of coercive measures are more likely to be admitted to better-equipped wards (Fukasawa et al., 2018). However, Janssen et al. (2007) report an increased use of seclusion in long-stay wards with smaller staff-to-patient ratios, with more female staff than males on a shift and less variability in the team's work experience. More work experience was associated with a decreased use of seclusion (Janssen et al., 2007). Husum et al. (2010) did not find any association between staff and bed ratio with seclusion or restraint (Husum et al., 2010). According to the subjective perception of staff members, a low staff number increases the likelihood of coercion, as stated by two studies (Galbert et al., 2022; Krieger et al., 2021).

In summary, the current literature on staff levels concerning the minimal use of coercive measures is inconclusive. A deeper understanding is necessary as reducing coercive measures in psychiatry remains a pressing issue due to their multiple adverse effects. With the current study, we are trying to broaden the insight into the associations between staff resources and coercion by looking at the relative efficiency of staff resources regarding the minimal use of seclusion and restraint.

OBJECTIVE

We aimed to examine the relative efficiency of staff resources in eleven German psychiatric clinics regarding inpatient cases without coercion (seclusion and/or restraint) in 2008, 2010, and 2012.

METHODS

Setting and data sources

We conducted a naturalistic observational study using data from eleven German psychiatric hospitals in the years 2008, 2010, and 2012. All clinics formed part of the Documentation Group Psychiatry (DGP: 1984-2013). The DGP was founded to enhance quality management and benchmarking in psychiatric clinics in North Rhine-Westphalia, Lower Saxony, and Hesse, Germany (Huber et al., 2016; Schneeberger et al., 2017). Participating hospitals routinely gathered routine clinical data with a standardized questionnaire used consistently across institutions. The availability of a central office for direct inquiries, a separate documentation guide, and centralized data entry, coding, cleaning, and review for plausibility at the main administrative office ensured optimal data quality. The collected data formed part of the routine clinical assessments and were anonymized during extraction. In total, the DGP comprised 22 hospitals, all offering somatic and psychiatric treatment as well as community mental health services. All hospitals were legally bound to provide health care for residents of the respective area and were part of a single-tier psychiatric system (Huber et al., 2016; Schneeberger et al., 2017). Informed consent was received from 21 of the 22 hospitals to analyze their data. However, not all clinics provided data over the whole duration of the DGP.

In addition, all hospitals in Germany were required to provide organizational key data in the form of a standardized quality report beginning in 2006, submitting a new report every two years. Amongst other variables, information on the number of full-time equivalents (FTE) of healthcare professionals (HCP) employed was available from these reports.

We included eleven clinics from the DGP with a total of 51’418 inpatient cases. These provided clinical routine data for the years 2008, 2010, and 2012, as well as the obligatory quality reports for the respective years. We did not require approval from the local ethics committee as all clinical data were documented as part of routine data and analyzed in anonymized form. All information regarding HCP is publicly available. This study was conducted following the principles of the Declaration of Helsinki (WMA, 2013).

Measures

Coercion was operationalized to encompass seclusion and restraint. Categorical data on coercion (seclusion/restraint) was available as part of the routine data. We operationalized staff resources through job percentages of nurses and physicians reported in the quality reports and calculated the cumulative number of FTE. In addition, each year's cumulative number of inpatient treatment days was calculated by multiplying the number of inpatient cases by the mean length of stay in the reference year.

Statistical Analysis

We conducted a Data Envelopment Analysis (DEA) to calculate the relative efficiency of staff resources among eleven psychiatric clinics regarding inpatient cases without coercion. DEA is a non-parametric analysis technique used to evaluate the performance of so-called Decision-Making Units (DMU) (Cooper, 2011; Weatherall et al., 2020). We chose the psychiatric clinics as the Decision-Making Units (DMU). As one assumption of DEA is to maximize the output variable, we used the percentage of

inpatient cases without coercion (seclusion/restraint) during treatment as the output variable (instead of the number of cases with coercion, which would have required to be minimized). We defined the staff resources as our input variable. We included the input and output variables as a ratio to the bed occupancy in the respective year (e.g., FTE per 100 occupied beds per year) with ten decimal places.

We conducted DEA under the assumption of variable returns to scale (VRS) and using an output orientation. The VRS model assumes that changes in inputs will lead to disproportionate changes in the output variable (Coelli et al., 2005). We tested this model assumption using the R package rDEA (Simm & Besstremyannaya, 2020). According to the results, we rejected the H0-Hypothesis for constant returns to scale for all three years. For this study, output orientation means that staff resources were fixed in each clinic and we assessed which clinic was most efficient in maximizing cases without coercion.

We will present two different efficiency measures in the result section: technical efficiency (TE) and scale efficiency (SE). TE represents an entity's ability to produce maximal output from its given inputs. It allows indication about the performance of management (Coelli et al., 2005; Kumar & Gulati, 2008). SE represents the ratio of constant returns to scale to variables returns to scale. It can take the form of increasing returns to scale (IRS) versus decreasing returns to scale (DRS). A DMU facing IRS is too small for its scale. On the other hand, a DMU facing DRS has become too large and would have to decrease its scale to become efficient (Coelli et al., 2005; Kumar & Gulati, 2008). For technical as well as scale efficiency, a value of 1 marks optimal efficiency and lower values indicate poorer efficiency (Coelli et al., 2005; Kumar & Gulati, 2008).

We tested the VRS assumption using R (RCoreTeam, 2021) and performed DEA using DEAP 2.1 software (Coelli, 2019).

The remaining statistical analyses were performed with IBM SPSS Statistics 28.0 (IBMCorp., 2021). In the results section, we present the results of quantitative data by mean ± standard deviation (SD), range, and the median.

RESULTS

Descriptive Statistics

Descriptive Results are presented in Table 1.

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Data Envelopment Analysis

Descriptive statistics are displayed in Table 1. The input and output variables used in the data envelopment analysis are presented in Tables 2-4. Note that, in tables 2-4 and the result section, the percentage and number of inpatient cases per year without coercion and the number of FTE of physicians and nurses are reported as standardized values per 100 occupied beds. Detailed results of the data envelopment analysis are presented in Table 5.

2008

In 2008, we five clinics reached an optimal TE score of 1. Of these, clinic 1 reached 1'581.32 inpatient cases without any coercion (seclusion/restraint) – 98.21 % of the total of 1'610.21 inpatient cases within the year – with 12.88 FTE of physicians and 65.30 FTE of nurses per 100 occupied beds. Clinic 4 reached 1'153.04 inpatient cases without any coercion (seclusion/restraint) – 94.45 % of the total of 1'220.81 inpatient cases within the year – with 10.12 FTE of physicians and 41.27 FTE of nurses per 100 occupied beds. Clinic 7 reached 1'497.48 inpatient cases without coercion (seclusion/restraint) – 96.89 % of all 1'545.61 inpatient cases – with 10.72 FTE of physicians and 48.40 FTE of nurses per 100 occupied beds. Clinic 8 reached 1'415.84 inpatient cases without coercion (seclusion/restraint) – 94.04 % of all 1'505.55 inpatient cases – with 15.58 FTE of physicians and 56.75 FTE of nurses per 100 occupied beds. Clinic 11 reached 1'211.82 inpatient cases without coercion (seclusion/restraint) – 96.08 % of all 1'261.20 inpatient cases – with 13.78 FTE of physicians and 55.13 FTE of nurses per 100 occupied beds.

The other six clinics must be considered technically inefficient as their TE score was below 1. However, all the clinics had a TE score above 80%. Clinic number 9 had the lowest score, 86.2%. The average TE score was 97.4% in 2008, indicating that outputs could be increased by 2.6% on average while keeping the inputs constant.

Regarding SE clinics 4, 8, and 11 had an optimal SE score of 1. The other eight clinics had a SE score below 1, and all faced decreasing returns to scale. The average SE score was 87.1%. On average, SE could be improved by 12.9%.

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2010

In 2010, five clinics had an optimal TE score of 1. Of these, clinic 1 reached 1'550.98 inpatient cases without any coercion (seclusion/restraint) – 98.03 % of the total of 1'582.14 inpatient cases within the year – with 13.04 FTE of physicians and 65.29 FTE of nurses per 100 occupied beds. Clinic 2 reached 1'181.17 inpatient cases without any coercion (seclusion/restraint) – 96.11 % of all 1'228.96 inpatient cases – with 13.48 FTE of physicians and 53.91 FTE of nurses per 100 occupied beds. Clinic 4 reached 1'110.03 inpatient cases without any coercion (seclusion/restraint) – 94.73 % of all 1'171.75 inpatient cases – with 11.80 FTE of physicians and 47.02 FTE of nurses per 100 occupied beds. Clinic 5 reached 1'163.53 inpatient cases without coercion (seclusion/restraint) – 95.86% of 1'213.83 inpatient cases within the year – with 20.34 FTE of physicians and 48.17 FTE of nurses per 100 occupied beds. Clinic 11 reached 1'086.19 inpatient cases without any coercion (seclusion/restraint) – 97.34 % of all 1'115.87 inpatient cases – with 11.30 FTE of physicians and 50.60 FTE of nurses per 100 occupied beds. The other six clinics must be considered technically inefficient as their TE score was below 1. Clinic 9 had the lowest TE score in 2010, with 86.0%. The average TE score was 97.1%, indicating that outputs could be increased by 2.9% on average while keeping the inputs constant.

Regarding SE clinics 1, 2, 4, and 11 reached an optimal SE score of 1. The other seven clinics had a SE score below 1, and all faced decreasing returns to scale. The average SE score was 92.4%. On average, SE could be improved by 7.6%.

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2012

Finally, in 2012 six clinics reached optimal TE scores of 1. Of these, clinic 1 reached 1'553.33 inpatient cases without coercion (seclusion/restraint) – 98.38 % of the total of 1'578.95 inpatient cases within the year – with 12.64 FTE of physicians and 65.58 FTE of nurses per 100 occupied beds.

Clinic 4 reached 1'185.89 inpatient cases without any coercion (seclusion/restraint) – 93.48 % of all 1'268.63 inpatient cases – with 9.86 FTE of physicians and 41.45 FTE of nurses per 100 occupied beds. Clinic 5 reached 1'294.34 inpatient cases without any coercion (seclusion/restraint) – 95.77 % of all 1'351.55 inpatient cases – with 17.00 FTE of physicians and 42.04 FTE of nurses per 100 occupied beds. Clinic 7 reached 1'355.10 inpatient cases without any coercion (seclusion/restraint) – 95.45 % of all 1'419.71 inpatient cases – with 9.81 FTE of physicians and 45.37 FTE of nurses per 100 occupied beds. Clinic 10 reached 1'880.14 inpatient cases without any coercion – 98.22 % of all 1'914.23 inpatient cases – with 11.65 FTE of physicians and 56.00 FTE of nurses per 100 occupied beds. Clinic 11 reached 1'324.39 inpatient cases without any coercion – 96.25 % of all 1'375.94 inpatient cases – with 11.81 FTE of physicians and 50.61 FTE of nurses per 100 occupied beds. The other five clinics were technically inefficient, as their TE score was below 1. Clinic 9 had the lowest TE score of 90.8%. The average score was 98.2%, indicating that outputs could be increased by 1.8% on average while keeping the inputs constant.

Regarding SE the clinics 4, 10, and 11 showed perfect SE of 1. The other eight clinics had a SE score below 1, and all faced decreasing returns to scale. The average SE score was 84.8%. On average, SE could be improved by 15.2%.

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In summary, the clinics 1, 4 and 11 reached optimal TE scores in all three years. 7 and 8 did so in 2008. 2 and 5 reached a TE score of 1 in 2010. Finally, the clinics 5, 7 and 10 did so in 2012. Overall, TE was high for all the clinics in the three years with an average of 97.4% in 2008, 97.1% in 2010 and 98.2% in 2012.

Furthermore, clinic 4 had a perfect SE of 1 in all three years. The clinics 8 and 11 did so in 2008. The clinics 1, 2, and 11 had perfect SE of 1 in 2010. Finally, the clinics 10 and 11 in had an SE score of 1 in 2012. All other clinics faced decreasing returns to scale. The average scale efficiency was 87.1% in 2008, 92.4% in 2010, and in 84.8% 2012.

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DISCUSSION

We examined the relative efficiency of eleven German psychiatric clinics regarding the maximization of inpatient cases without coercion in the years 2008, 2010, and 2012. We applied an output-oriented DEA model under the assumption of variable returns to scale. To our knowledge, this is the first study to examine the relative efficiency of staff resources in different clinics regarding cases without coercion. We had an appropriately large data set to rule out random effects. Our study adds to the still limited knowledge of staff-related factors in the reduction of coercive measures. Furthermore, by applying a DEA model, we took an economic approach. Health economic analyses are relevant as changes in the healthcare system become more and more economically driven (Knapp & Wong, 2020).

In summary, the mean number of cases without coercion among all eleven clinics was 1’413.00 in 2008 (94.10% of all inpatients cases), 1’475.09 in 2010 (94.49% of all inpatients cases), and 1’537.00 in 2012 (95.44% of all inpatient cases). We found high technical efficiency among all eleven clinics over the three years. The clinics could increase the number of cases without coercion between 1.8 to 2.9 percent on average with the same number of staff. This could be realized by adopting a change in management, e.g., implementing coercion reduction programs such as Safewards (Bowers, 2014; McKeown et al., 2019; Stensgaard et al., 2018), the Weddinger Model (Czernin et al., 2020) or the Six Core Strategy (Huckshorn, 2006b; McKeown et al., 2019; Riahi et al., 2016), or applying an open-door policy (Blaesi et al., 2015; Hochstrasser et al., 2018; Kowalinski et al., 2019). In line with the S3 guidelines, our results suggest that adequate staff levels are necessary but insufficient to prevent coercion in psychiatry (DGPPN, 2018).

Regarding SE, our findings indicate that most clinics are not operating at their optimal size (SE as most clinics faced decreasing returns to scales. A further increase of staff would thus not yield a proportional increase of cases without coercion (Huguenin et al., 2012). On the other hand, this result implies that these clinics should downsize their scale to become efficient (Coelli et al., 2005; Huguenin et al., 2012; Kumar & Gulati, 2008). These results seem underwhelming, and they show plainly that the reduction of coercion to an absolute minimum and an optimal efficiency of a mental health clinic are conflicting goals. Indirectly, economic factors might influence coercive measures. The SAMS points out that staff shortages, work pressures, and economic factors must by no means justify coercive measures (SAMS, 2017). From a medico-ethical view, we must prioritize the reduction of coercion over working with an optimized smaller team of healthcare professionals. With the rising direct costs of mental healthcare and the growing economic burden due to insurance premiums and taxes (FOPH, 2023; Vigo et al., 2016), however, even the medico-ethical discussion may face balancing the number of cases without coercion and staff costs.

In addition, staff numbers used as input in our model imply that all healthcare professionals from the physician and the nursing staff, are equally efficient in realizing the output of cases without coercion. The mix of staff, however, plays a relevant role in reducing coercive measures (Bowers et al., 2012;

Galbert et al., 2022; Janssen et al., 2007; Krieger et al., 2021). More experienced team members (Janssen et al., 2007; Krieger et al., 2021), females (Galbert et al., 2022), more qualified nurses (Galbert et al., 2022), and those who have never been part of a coercive measure (Galbert et al., 2022) appear less supportive of coercive measures. It has, however, also been demonstrated that nurses view coercion less critically than psychiatrists or psychologists (Krieger et al., 2021). Another study reports fewer coercive measures with a more significant number of junior medical doctors at ward level and more staff from ethnic minority groups whereas higher numbers of coercive measures were associated with more qualified nursing staff present (Bowers et al., 2012). In addition, the number of coercion varies in relation to male and female staff-ratio, and variability of work experience – with more female nurses and less variability in work experience predicting more seclusion (Janssen et al., 2007).

These findings imply that the number of staff in a ward might be as essential as the mix of the staff. Unfortunately, we did not have information on the level of qualification, work experience of the staff or their gender. It appears likely that the team composition would influence scale efficiency measures while keeping the total number of staff constant.

Although our analyses cannot shed insight on this topic, it is highly relevant. Globally, there is a lack of financial and staff resources in the mental health sector (WHO, 2022). These circumstances form a possible challenge for reducing coercive measures in psychiatry, and the COVID-19 pandemic has increased challenges in the mental health sector (Schaefert et al., 2023; Schaefert et al., 2022; Schneeberger & Huber, 2022; Sovold et al., 2021). One study by Flammer et al. (2022) showed that coercive measures increased by 24.6% during the pandemic (Flammer et al., 2022). These challenges ought to be considered in future studies.

Limitations

Our study has several limitations. Firstly, we performed a naturalistic observational study, and we cannot draw causal conclusions from our results. Secondly, our results apply to the legal regulations regarding coercive measures during the years examined. Moreover, although the examined clinics shared key structural features and can be considered comparable, other factors might influence the use of coercive measures, such as patient-related factors, team composition, and clinic culture. In addition, coercive measures are not the only decisive factor for adequate staff levels. Many other factors at the clinic and patient level play a key role in determining staff numbers.

From a medico-ethical perspective, one could challenge this analysis as an “optimal” level of cases without coercion might seem questionable, and a psychiatric healthcare system with minimal coercion at the expense of higher staff levels – despite not being economically optimal – is much more desirable.

Furthermore, it is essential to state that DEA results should not be applied strictly to practice. DEA indicates potential improvements and does not generate results that can or should be applied directly in practice in concrete numbers. Efficiency scores form a basis for dialogue on optimizing resource use by changing management strategies, team composition, or size (Huguenin et al., 2012). Cutting staff members or changing them based on an efficiency score from DEA would be inadvisable.

Conclusions

Our results, in line with the S3-Guidlines on the prevention of coercion (DGPPN, 2018), suggest that adequate staffing levels are needed, however insufficient, to reduce the seclusion of restraint. Reducing coercion is likely to be most effective by taking a multi-level approach combining knowledge on patient-level risk factors, organizational changes, staff characteristics and the number of staff (Hirsch & Steinert, 2019). Health economic informed analyses are necessary to increase the likelihood of policy change (Knapp & Wong, 2020). Yet, they do not suffice and should only be applied to practice in considering ethical aspects as well as knowledge from clinical studies. The question remains whether there are indeed optimal staffing levels to reduce the use of coercion. From an ethical standpoint, we must ask ourselves whether the sole reduction is an appropriate aim. Bearing in mind the multiple adverse effects of coercion, psychiatry without coercion seems sensible from an ethical viewpoint. Economically, we must consider that treatment costs might increase in the long term due to inadequate treatment and the adverse effects of coercive measures.

In summary, we advocate that decisions on staff numbers and team composition cannot solely be economically driven. Knowledge from clinical and health economic studies and ethical considerations must be combined to form a psychiatric healthcare system that is patient-oriented and ethical regarding the work conditions of staff and the treatment of its patients. When taking an economic perspective, we should ask ourselves – are we ethical when trying to be efficient?

AI STATEMENT

Grammarly Premium https://www.grammarly.com/premium was used by the first author for correction of grammar and punctuation as well as to adjust writing style. The suggestions made by Grammarly were carefully reviewed before implementation. No text was generated by Grammarly on a content level.

Table 1. Descriptive statistics of clinics for 2008, 2010 and 2012.

Descriptive statistics						
2008	Nurses	Physicians	Total staff	Inpatient days	Inpatient cases	Cases without coercion (% of total inpatient cases)
Mean	57.30	13.59	70.89	37181.59	1501.36	1413.00 (94.10%)
Median	55.00	13.40	67.90	36212.28	1460.00	1373.00
SD	8.66	2.61	8.88	4311.33	295.63	290.75
2010	Nurses	Physicians	Total staff	Inpatient days	Inpatient cases	Cases without coercion (% of total inpatient cases)
Mean	61.63	13.56	75.19	39778.67	1564.73	1475.09 (94.49%)
Median	63.90	13.00	76.00	40214.65	1656.00	1546.00
SD	11.29	2.47	11.47	4568.43	348.96	322.43
2012	Nurses	Physicians	Total staff	Inpatient days	Inpatient cases	Cases without coercion (% of total inpatient cases)
Mean	60.99	14.16	75.15	39510.26	1608.27	1537.00 (95.44%)
Median	61.00	14.70	74.90	40944.96	1518.00	1448.00
SD	11.79	2.89	13.32	6028.42	261.87	269.19

Note. Mean, median, and standard deviation (SD) were calculated over all eleven clinics for the respective year. Nurses = number of FTE of nurses; physicians =number of FTE of physicians; total staff = number of FTE of nurses and physicians combined; inpatient cases = number of inpatient cases; inpatient days = number of inpatient days calculated as the number of inpatient cases x mean length of stay; cases without coercion = number of inpatient cases without any coercion (seclusion/restraint).

Table 2. Input and output variables as used in the data envelopment analysis for the year 2008.

	2008				
	Inputs			**Output**	
	nurses	physicians	total	% of all inpatient cases	no s/r
1	65.30	12.88	78.18	98.21	1581.32
2	70.29	11.10	81.39	94.11	1299.74
3	59.41	13.14	72.56	92.25	1261.68
4	41.27	10.12	51.39	94.45	1153.04
5	50.60	19.12	69.72	94.59	1198.72
6	64.47	15.69	80.15	94.46	1483.76
7	48.40	10.72	59.12	96.89	1497.48
8	56.75	15.58	72.34	94.04	1415.84
9	45.35	14.28	59.62	82.74	1217.20
10	69.46	11.51	80.97	97.31	1970.88
11	55.13	13.78	68.91	96.08	1211.82

Note. Input and output variables were included as a ratio to the bed occupancy in the respective year. The numbers displayed in the table refer to FTE (nurses and physicians) per 100 occupied beds and the number of cases without coercion in 2008 per 100 occupied beds; no s/r = inpatient cases without any seclusion/restraint; % of all inpatient cases = frequency of cases without coercion relative to the total number of inpatient cases in 2008.

Table 3. Input and output variables as used in the data envelopment analysis for the year 2010.

	2010				
	Inputs			**Output**	
	nurses	physicians	total	% of all inpatient cases	no s/r
1	65.29	13.04	78.33	98.03	1550.98
2	53.91	13.48	67.39	96.11	1181.17
3	67.63	12.60	80.24	93.36	1343.14
4	47.02	11.80	58.81	94.73	1110.03
5	48.17	20.34	68.51	95.86	1163.53
6	50.82	8.24	59.07	91.70	1284.86
7	56.58	10.61	67.19	96.30	1340.03
8	58.69	11.11	69.80	93.65	1357.05
9	60.36	15.09	75.45	84.90	1534.01
10	60.59	11.47	72.06	97.41	1886.24
11	50.60	11.30	61.91	97.34	1086.19

Note. Input and output variables were included as a ratio to the bed occupancy in the respective year. The numbers displayed in the table refer to FTE (nurses and physicians) per 100 occupied beds and the number of cases without coercion in 2008 per 100 occupied beds; no s/r = inpatient cases without any seclusion/restraint; % of all inpatient cases = frequency of cases without coercion relative to the total number of inpatient cases in 2010.

Table 4. Input and output variables as used in the data envelopment analysis for the year 2012.

	2012				
	Inputs			**Output**	
	nurses	physicians	total	% of all inpatient cases	no s/r
1	65.58	12.64	78.21	98.38	1553.33
2	56.75	10.26	67.01	96.83	1329.38
3	89.70	18.57	108.26	96.58	1526.34
4	41.45	9.86	51.31	93.48	1185.89
5	42.04	17.00	59.04	95.77	1294.34
6	52.90	13.14	66.04	95.82	1354.07
7	45.37	9.81	55.19	95.45	1355.10
8	49.71	11.98	61.69	93.55	1358.65
9	88.69	20.56	109.25	89.51	1580.31
10	56.00	11.65	67.65	98.22	1880.14
11	50.61	11.81	62.42	96.25	1324.39

Note. Input and output variables were included as a ratio to the bed occupancy in the respective year. The numbers displayed in the table refer to FTE (nurses and physicians) per 100 occupied beds and the number of cases without coercion in 2008 per 100 occupied beds; no s/r = inpatient cases without any seclusion/restraint; % of all inpatient cases = frequency of cases without coercion relative to the total number of inpatient cases in 2012.

Table 5. Results of the data envelopment analysis showing the technical and scale efficiency scores for the different clinics in the three years, 2008, 2010, and 2012.

	2008			**2010**			**2012**		
Clinic	TE	SE		TE	SE		TE	SE	
1	1.00	0.819	drs	1.000	1.000	-	1.000	0.770	drs
2	0.975	0.789	drs	1.000	1.000	-	0.980	0.772	drs
3	0.949	0.865	drs	0.949	0.770	drs	0.980	0.551	drs
4	1.000	1.000	-	1.000	1.000	-	1.000	1.000	-
5	0.980	0.836	drs	1.000	0.990	drs	1.000	0.997	-
6	0.960	0.738	drs	0.938	0.975	drs	0.976	0.825	drs
7	1.000	0.872	drs	0.986	0.916	drs	1.000	0.968	drs
8	1.000	1.000	-	0.954	0.853	drs	0.963	0.880	drs
9	0.862	0.922	drs	0.860	0.816	drs	0.908	0.569	drs
10	0.990	0.742	drs	0.993	0.839	drs	1.000	1.000	-
11	1.000	1.000	-	1.000	1.000	-	1.000	1.000	-
Mean	0.974	0.871	n/a	0.971	0.924	n/a	0.982	0.848	n/a

Notes. TE = Technical efficiency. SE = Scale Efficiency. Drs = decreasing returns to scale.

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12. Appendix D: Curriculum Vitae Tiziana Paola Ziltener

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