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Measuring outcomes on a Medical Psychiatric Unit: HoNOS,, CANSAS and costs

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ABSTRACT

Objective: To study the course of the functional status and healthcare needs of patients on a Medical Psychiatric Unit (MPU).
Methods: In a single-centre observational prospective design the Health of the Nation Outcome Scales (HoNOS) and Camberwell Assessment of Needs Short Appraisal Schedule (CANSAS) instruments were administered at admission and discharge. Functional status and healthcare needs were assessed utilizing the HoNOS and CANSAS respectively. The total costs of healthcare claims related to the admission were calculated based on claims data.
Results: In total 50 patients were included with a mean improvement of 4.6 on the HoNOS and an effect size of 0.6.The total number of unmet needs fell from 208 to 115. The median costs per decreased HoNOS point were €2.842 and €6.880 per unmet need.
Discussion: Many patients improved, but due to a large standard deviation at baseline and a low Cronbach's alpha, only 4 patients showed a reliable improvement on functional status. That substantial remission was achieved was shown by the decrease in unmet needs of 93 (44.7%) for the whole group. These observations support the implementation of MPUs, although more research is warranted to ensure cost-effectiveness.

1. Introduction

Medical Psychiatric Units (MPUs) focus on the treatment of patients with medical and psychiatric comorbidity. These units tend to have: a large number of medical staff, a high nurse-to-bed ratio, and staff trained in both medical and psychiatric disorders (Alberque et al., 2009; Hussain and Seitz, 2014). MPUs were introduced in the 1970s in the US and have been established around the globe since then (Kathol, 1994). A recent study showed that 40 out of 90 hospitals (44%) contain such units in the Netherlands (van Schijndel et al., 2017). Since these units are developed to treat complex patients with concurrent medical and psychiatric morbidity, it would be helpful to chart the course of patient functional status, healthcare needs, and costs associated with an MPU. The added value of this study is in the use of the Health of the Nation Outcome Scales (HoNOS) and the Camberwell Assessment of Needs Short Appraisal Schedule (CANSAS). These outcomes have not, or only rarely, been explored in MPU research.

Indeed, over recent decades, only a few studies have examined the impact of treatments on outcomes and costs at these units. Most of these studies were conducted before the year 2000 and used process measures such as Length of Stay (LOS) to study the effectiveness of MPU admissions (Kishi and Kathol, 1999; Leue et al., 2010; Young and Harsch, 1989). Although LOS can give some insight into these impacts, in recent studies and healthcare policy the focus has been on outcome measures instead of process measures. This idea was primarily introduced by Michael Porter. As a consequence, the collection of patient-valued outcome measures with validated questionnaires became more important in healthcare and its financing (Porter, 2010). Porter described three tiers:

- Tier 1: Health status achieved or attained
- Tier 2: Process of recovery
- Tier 3: Sustainability of health

Most studies aimed at evaluating the cost-effectiveness of MPUs have used outcome measures that describe the process of recovery or sustainability of health in tier 2. However, studies that examine the impact of MPU treatments on health status achieved or attained (tier 1) in relation to costs, have not yet been undertaken (Porter, 2010). Achieved or attained health status can be measured by assessing a patient's functional status, which includes: mobility, social participation, Activities of Daily Living (ADL) and living conditions (Hayes et al., 2012). Functional status can predict care dependency, increased health care costs, mortality, and unplanned readmissions (Hayes et al., 2012; Hoyer et al., 2013; Perrin et al., 2011).

A widely-used instrument to measure functional status in mental

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healthcare is the Health of the Nation Outcome Scales (HoNOS). The HoNOS was developed to examine functional status in mental healthcare patients. Patients that are admitted to an MPU have both psychiatric and medical disorders; therefore valuation of the impact of the medical disorder may be overlooked. Other important outcome measures are the social and health needs of patients, which can be measured with the Camberwell Assessment of Need Short Appraisal Schedule (CANSAS) (Slade et al., 1999). These validated questionnaires were used in this study since they: 1)measure outcomes, 2) are often reported in the international literature, 3) are suitable for routine clinical use, and 4) provide a detailed characterization of the patient by measuring changes in health status, and can thus be placed in tier 1 of the outcome measure hierarchy as described by Porter (Lohrmann et al., 2003; Porter, 2010; Salvi et al., 2005; Slade et al., 1999).

The aim of this study is to measure the course of both functional status and healthcare needs at an MPU. Since an MPU employs staff trained in both psychiatric and medical disorders, has a high nurse-to-bed ratio, and utilizes specialized equipment, we expect that MPU treatment results in improved functional status and reduced unmet needs.

2. Methods

2.1. Study design and cohort

This study uses a single-center observational prospective design. The study was carried out in the Medical Psychiatric Unit of the 'Onze Lieve Vrouwe Gasthuis' (OLVG), a Dutch general hospital. Optimally, a control group would be employed to assist the analysis of costs and effects; however, the present study is essentially exploratory without a control group and concentrates on an examination of the course of both patient functional status and healthcare needs.

The unit in the OLVG was inaugurated in 2012 and consists of 5 beds. The study was undertaken from January 2015 to April 2015. In this period, the unit was staffed by a 0.2 FTE internist, a 0.4 FTE hospital psychiatrist, and 1 psychiatry resident. The nursing staff consisted of 12 nurses rotated in 3 shifts (2 morning shift; 2 evening shift; 1 night shift) and had both medical and psychiatric training. The daily management of the patients was supervised by a psychiatrist. All medical treatments except for telemetry were available, including the provision of intravenous medicine, donor blood, cytostatics, and total parenteral feeding. Patients with severe suicidal tendencies or behavior could be admitted. After medical treatment was completed, patients were discharged from the MPU to a psychiatric hospital or outpatient setting. In cases where the psychiatric treatment was completed sooner than the in-hospital treatment for the somatic disorder, patients were discharged to a general ward.

The admission criteria of this unit are:

- Patients for which, due to psychiatric comorbidity, somatic diagnostics, treatment and nursing in a regular somatic nursing unit, cannot proceed optimally,
- Patients suspected of suicidality, such as auto-intoxication or serious auto-mutilation, who do not have an Intensive Care Unit (ICU) or Coronary Care Unit (CCU) indication.

The unit has the following exclusion criteria:

- Patients who do not have a somatic admission indication;
- Patients with cognitive disorders or psychopathology (without serious behavioral disorders) who can be handled in the regular somatic nursing ward;
- Patients with an admission indication for the ICU or CCU;
- Patients who must undergo treatment that cannot be provided on the MPU (for example, cytostatics).

Internal and external patients can be admitted in the following ways:

Internal patients:

- A patient that is admitted on a somatic unit in the OLVG can refer a patient to the MPU.
- An outpatient in the OLVG that is known for psychiatric comorbidity can be admitted for a psychiatric outpatient consult.

External patients:

- Referral out of a general medical hospital. This only possible after consultation of the somatic referrer with a OLVG MPU psychiatrist.
- Referral out of a mental healthcare institution. Psychiatrist of the referring ward and the OLVG discuss the admission indication. The referring psychiatrist also discusses the somatic disorder with the intended somatic specialist in the OLVG.
- Referral from home. The General Practitioner contacts the OLVG MPU psychiatrist and discusses the psychiatric admission indication.

The cohort studied consisted of all consecutively admitted patients in the inclusion period. Patients admitted for less than 24 h were excluded, since this time period was assumed to be too short for a change in functional status. Ethical approval was obtained from the Medical Ethical Committee of the hospital 'Onze Lieve Vrouwe Gasthuis'. Informed consent was waived since the data was administered by a nurse as part of the treatment and anonymized before the analyses.

2.2. Data collection

During the inclusion period, within 12 h after admission and at discharge the HoNOS and CANSAS questionnaires were administered by a registered nurse. Prior to the study all nurses were trained in using the questionnaires. Data was obtained from the nurses' admission and discharge notes. The main psychiatric and somatic diagnoses were derived from patient records. Scores on both questionnaires were measured at admission and discharge. HoNOS and CANSAS were utilised since they have been shown to measure different values; thus it was valuable to employ both (Slade et al., 1999).

HoNOS is a 12-item questionnaire whose items can be answered on a 5-point scale, ranging from 0–4. Responses were summed to an aggregate score with a range from 0–48. A lower score indicates fewer problems. The instrument measures the mental and social functioning of a patient, which ultimately evaluates the effectiveness of a (psychiatric) treatment (Mulder et al., 2004). It was used in this study since It has repeatedly been employed in different international mental health evaluations, has shown to provide good coverage in measuring patients' problems, and has suitable predictive validity and sensitivity for routine use (Kisely et al., 2010; Salvi et al., 2005).

The CANSAS consists of a 22-item scale; with a 3-point scale ranging from 0–2, measuring the amount of care. Each of the 22 items can be scored as follows: 0 = no need, 1 = no/moderate problem due to continuing intervention (met need), or 2 = current serious problem (unmet need) (Phelan et al., 1995; Slade et al., 1999). This questionnaire aims to identify the healthcare needs of a patient and whether these needs are being met. In this study the number of unmet needs was reported per item and in total at admission and discharge. CANSAS was included since it has proved to be a suitable instrument for outcome measurement in mental healthcare and explicitly identifies unmet needs, thus aiding in the assessment of the impact of a treatment on the improvement from unmet to met needs (Salvi et al., 2005; Slade et al., 1999).

Total healthcare costs were obtained from the electronic medical report and calculated based on actual claims data. This represents the total costs of claims per patient related to the MPU admission period. These costs were reimbursed by the health insurance companies for

medical and psychiatric treatment related to the MPU admission.

2.3. Statistical analysis

This study used descriptive statistics, which are presented with means, 95% confidence intervals and standard deviations for continuous data, medians and interquartile ranges for skewed data, and frequencies and percentages for categorical data.

2.4. Analysis of HoNOS data

Illness severity was calculated based on the HoNOS scores (Parabiaghi et al., 2005). Patients were classified into four different groups: sub clinical, mild, moderately sever, very severe. Were sub-clinical is each item <2; mild at least one item = 2; moderately severe one item ≥ 3; very severe at least two items ≥ 3.

For each HoNOS item, the number of severe patients with a score of3 or more was calculated. Subsequent average HoNOS scores were calculated at admission and discharge, and the effect size was calculated. In order to assess the reliable change for the group, the method as first applied on HoNOS scores by Parabiaghi et al. (2005) was used (Parabiaghi et al., 2005). The concept of reliable change is meant to make sure that an observed change in an individual is what could be attributed beyond a measurement error or chance (Parabiaghi et al., 2005). Since 2005 this method has been used in several other studies (Angelo et al., 2011; Reichert and Jacobs, 2018). The following formulae were used to assess change in functional status:

- Effect size = (admission score – discharge score)/ admission standard deviation
- $SE_{diff} = SD_1 \times \sqrt{2} \times \sqrt{(1\text{-}a)}$

where SD_1 is the standard deviation of the baseline observations and a is Cronbach's alpha.

- $RC_{index} = 1.96 \times SE_{diff}$

Reliable change was calculated using the RC index.

2.5. Analysis of CANSAS data

Since the aim of the MPU is to reduce the number of unmet needs, only these were included in the analysis. The number of unmet needs was calculated at admission and discharge for each item and in total.

3. Results

A total of 62 patients were admitted to the MPU between January 5th and April 28th, 2015. All were approached with respect to participation. Of these admitted patients, 12 were excluded: two patients (17%) due to a missing admission measurement and 10 (83%) because of a stay of less than 24 h.

3.1. Patient characteristics

Of the patients included, 34 (68%) were male and the mean age was 61.42 (SD = 16.38). The main psychiatric DSM-IV diagnoses were 'schizophrenia and other psychotic disorders' (n = 13, 26%), 'delirium, dementia and amnestic and other cognitive disorders' (n = 13, 26%), and 'mood disorders' (n = 10, 20%). A majority of the patients were admitted for internal medicine (60%, n = 30). The primary somatic ICD-10 diagnosis was 'injury, poisoning and certain other consequences of external causes' in a third of the patients (n = 16, 32%), followed by 'certain infectious and parasitic diseases' (n = 9, 18%). The median length of stay at the MPU was 5 days with a range varying from 1–37 and an IQR (inter quartile range) from 3 to 9. Table 1 gives a detailed description of the study cohort.

Table 1
Patient characteristics.

	Patients included (N = 50)
Age *mean (SD) years*	61.42 (16.38)
Male *N (%)*	34 (68)
Length of stay at MPU *median days (range) [IQR]*	5 (1–37) [3–9]
Referral *N (%)*	
– Emergency Department	22 (44)
– Ward	17 (34)
– Home	5 (10)
– Intensive Care Unit	3 (6)
– Other hospital	3 (6)
Planned admission *N (%)*	7 (14)
ICU admission during hospitalization N (%)	5 (10)
Main psychiatric DSM-IV classifications	13 (26)
– Schizophrenia and other psychotic disorders	13 (26)
– Delirium, dementia and amnesic and other cognitive disorders	10 (20)
– Mood disorder	8 (16)
– Substance related disorders	2 (4)
– Mental disorders due to a general medical condition	2 (4)
– Anxiety disorders	2 (4)
– Personality disorders	
Primary somatic ICD-10 classifications	
– Injury, poisoning and certain other consequences of external causes	16 (32)
– Certain infectious and parasitic diseases	9 (18)
– Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	6 (12)
– Mental and behavioural disorders	3 (6)
– Diseases of the genitourinary system	3 (6)
– Neoplasms	2 (4)
– Endocrine, nutritional and metabolic diseases	2 (4)
– Diseases of the nervous system	2 (4)
– Diseases of the respiratory system	2 (4)

3.2. Analysis of HoNOS

In Fig. 1, the severity of the patients at admission is reported. Of the patients included 82% were placed in the very severe group and zero classified as sub-clinical.

Fig. 2 shows the patients with a score of ≥ 3 at admission and discharge per HoNOS item. The HoNOS items with the highest scores at admission were problems with activities of daily living (N 25, 50%), physical illness or disability problems (N 23, 46%), cognitive problems (N 23, 46%), and other mental and behavioral problems (N 22, 44%). After discharge for each item, the number of patients reporting a score of 3 or higher decreased. Of all the items, the reduction for non-accidental self-injury from 11 (22%) patients to 1 (2%) was the most marked.

The total HoNOS score at admission was 812 and fell with 232 points to 580. The average overall HoNOS score at admission was 16.2 (SD 8.0) and at discharge 11.6 (SD 6.5), resulting in an average change of 4.6 and an effect size of 0.6. Cronbach's alpha for the 12 items at admission was 0.63. This resulted in an RC index of 14, thus requiring a 14-point change to give 95% confidence that the changes that occurred were reliable.

Fig. 3 shows that a total of four (8%) patients improved by more than 14 points, according to the RC index. Interestingly, nine patients had a worse score on the HoNOS after discharge, although not beyond the RC. The total costs of claims were €832.446 giving median claims costs of €13.072; this was €2.842 per decreased HoNOS point. For six patients the total costs of claims were over €30.000. The high cost related to the LOS of these six patients, which had a mean of 17 (range 8–37), was significantly longer than in the whole group. Notably, these six patients seemed to benefit most from the MPU admission. With a

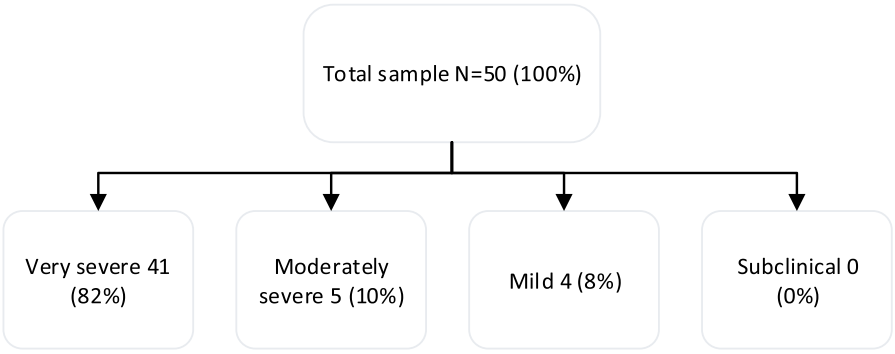

Fig. 1. Classification of severity based on frequency of HoNOS scores: sub-clinical, each item <2; mild, at least one item = 2; moderately severe, one item ≥3; very severe, at least two items ≥3. For 50 patients receiving treatment on the MPU.

mean HoNOS change of −8, the improvement was almost two times larger than for the whole group.

3.3. Analysis of CANSAS

In Table 2, the unmet needs at admission and discharge are reported per CANSAS item. The major sources of unmet need were: psychological distress (58%), physical health (52%), and psychotic symptoms (42%). At discharge occupation (24%), psychological distress (24%) and transport (18%) comprised the most unmet needs. The total number of unmet needs declined from 208 to 115. Interestingly, the items on which generally the focus of MPU treatment is on, like psychological distress, physical health and psychotic symptoms, are more improved compared to the items that can be considered less treatable like accommodation, household skills 'occupation', ' basic education', 'telephone', 'transport', 'money', and 'welfare benefits'. The average overall CANSAS score at admission was 4.2 (SD 2.6) and at discharge 2.3 (SD 2.7), this gives an average change of 1.9. This resulted in median costs of €6.880 per decreased unmet need.

4. Discussion

MPUs are developed to improve the care for complex patients with concurrent medical and psychiatric morbidity. These units often have higher staffing ratios compared to other units and a double trained staff. The impact of MPU treatment on functional status, healthcare needs, and costs of claims has not yet been studied. Advancing our knowledge on this topic could guide in health service organization and health care policy.

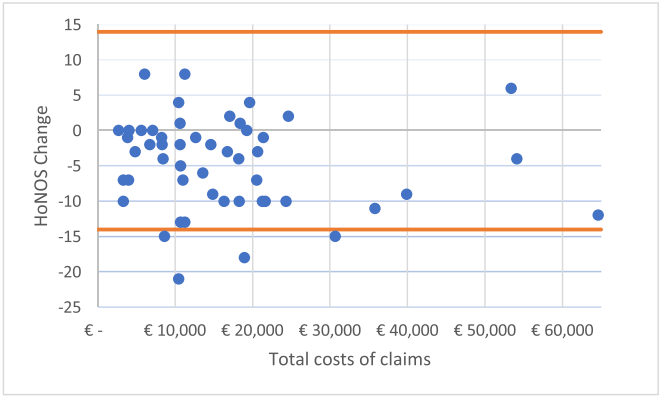

Fig. 3. Change of score on the HoNOS in relation to the total costs of claims.

The analysis showed that the cohort admitted displayed, overall, had very severe functional status at admission. A reliable change was

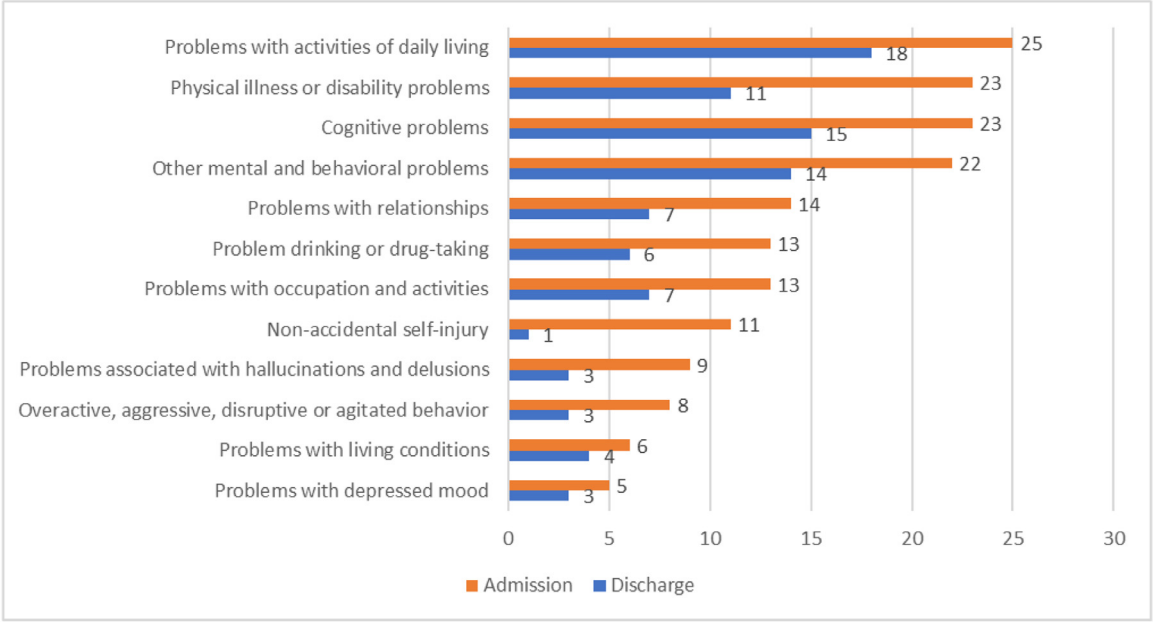

Fig. 2. Number of severe patients (score of 3 ≥) per HoNOS item at admission and discharge.

Table 2
Percentage of patients ($N = 50$) reporting unmet needs at admission and discharge.

	Unmet need admission $N = 50$ (%)	Unmet need discharge $N = 50$ (%)	Change in unmet need $N = 50$
Accommodation	5 (10%)	3 (6%)	−2
Food	11 (22%)	6 (12%)	−5
Household skills	8 (16%)	4 (8%)	−4
Self-care	9 (18%)	3 (6%)	−6
Occupation	19 (38%)	12 (24%)	−7
Physical health	26 (52%)	10 (20%)	−16
Psychotic symptoms	21 (42%)	5 (10%)	−16
Information about condition and treatment	16 (32%)	4 (8%)	−12
Psychological distress	29 (58%)	12 (24%)	−17
Safety to self	14 (28%)	6 (12%)	−8
Safety to others	5 (10%)	5 (10%)	0
Alcohol	9 (18%)	3 (6%)	−6
Drugs	8 (16%)	5 (10%)	−3
Company of others	10 (20%)	8 (16%)	−2
Intimate relationships	2 (4%)	6 (12%)	4
Sexual expression	1 (2%)	0 (0%)	−1
Child care	1 (2%)	1 (2%)	0
Basic education	1 (2%)	1 (2%)	0
Telephone	5 (10%)	5 (10%)	0
Transport	5 (10%)	9 (18%)	4
Money	1 (2%)	4 (8%)	3
Welfare benefits	2 (4%)	3 (6%)	1
Total	208 (19%)	115 (10%)	−93

achieved if a patient improved by more than 14 points on the HoNOS instrument, which was the case for four patients. The total number of unmet needs was 208 at admission and this decreased by 93 (44.7%) to 115 at discharge. The total median healthcare cost per patient for the admission period were €13.072, resulting in total costs of claims of €2.842 and €6.880 per decreased point of the HoNOS and unmet need respectively.

There were six patients with costs over 30.000€, these patients had a significantly longer LOS. Five patients improved on the HoNOS with a score larger than the mean for the total sample. The MPU of the OLVG is focused on the treatment of complex patient with concurrent medical and psychiatric disorders. Interestingly, these six patients with a long LOS and high costs also showed a large improvement on the HoNOS. This of course, are only small numbers, but future research could focus more on these most complex patients.

4.1. Interpretation of the results

In comparison to Parabiaghi et al. (2005) patients had a more severe functional status level at admission. These authors researched patients at ten community mental health services in Italy and found that of 9817 patients at baseline 22% had very severe functional status, 21% moderately severe, 40% mild, and 17% sub-clinical (Parabiaghi et al., 2005). The patients in our study were classified as 82%, 10%, 8% and 0% respectively. MPUs are known for their ability to treat complex patients and our results did indeed show that most of the patients admitted displayed very severe mental health status in addition to their medical problem(s).

Considering the RC index of 14, four (8%) patients had a reliable change and nobody deteriorated with over 14 points, giving a stable population of 92%. By comparison Parabiaghi et al. (2005) found that 5.6% of patients improved, 1.8% worsened and 91.6% were stable (Parabiaghi et al., 2005). With a group that was very severe at admission and a median LOS of 5 days, a reliable change of 8% was thus considered a good result. The RC index is used to make sure that a observed change in an individual is what could be attributed beyond a measurement error or chance (18). At 14, the RC index was high, mostly due to the low Cronbach's alpha, which is related to the small study sample. Obviously, a larger sample would result in a higher Cronbach's alfa. This was demonstrated in the study of Eager et al. (2005) and Mulder et al. (2004) (Eagar et al., 2005; Mulder et al., 2004). With 20,748 HoNOS assessments, Eager et al. (2005) found a Cronbach's alfa of 0.8 (Eagar et al., 2005). Mulder et al. (2004) researched the HoNOS in 559 patients and found a Cronbach's alfa of 0.78 (Mulder et al., 2004). If we use their numbers in our study, this would have resulted in a RC of 10. Resulting in 14 (28%) patients, instead of 4 (8%), that had a positive reliable change and still zero deteriorate with more than the RC index.

Other studies have examined the impact of inpatient treatment on functional status utilizing HoNOS. Page et al. (2001) researched functional status in five inpatient settings - three private psychiatric, one public psychiatric and one public general - in Australia. An effect size between 0.88 and 1.58 was reported (Page et al., 2001). These results were achieved with a mean LOS ranging from 9–20 days. The outcomes per 10 days of stay were between 0.44 and 1.75. Our study found an effect size of 0.6, the median LOS was 5 days and a mean of 7, resulting in an outcome per 10 days of 0.86. This effect size was higher than the outcome per 10 days in 4 out of 5 hospitals as described by Page et al. (2001) and shows that treatment on the MPU of the OLVG was effective and favourable with respect to comparable hospitals (Page et al., 2001).

Only one previous research study examined the effectiveness of integrated care treatment on an MPU. This research was conducted on an eight bed unit in a Dutch academic hospital. Contrary to the MPU in the OLVG, this unit was run by a medical doctor. The median LOS on this unit was 9 days, which is 4 days longer than our findings. This study showed an improvement of 3.8 points on HoNOS from 12.0 at admission to 8.2 at discharge, which was described as a ‘large’ effect (Honig et al., 2014). With a mean HoNOS score of 16.2 at admission, the baseline score was higher in our study. This might be due to the fact that most patients in this study had a primary somatic disorder. In our study the primary disorder was psychiatric and the HoNOS is developed for mental health evaluation. With a more severe population at baseline, probably due to more complex psychiatric disorders, we also label the 4.6 points on the HoNOS as a ‘large’ effect.

Slade et al. (1999) studied two samples of patients reflecting people that most intensively use mental health services. They found the most unmet needs in the domains of daytime activities (28%), company (26%), and intimate relationships (22%). In our study the most unmet needs were in respect of psychological distress (58%), physical health (52%), and psychotic symptoms (42%). This can be explained by the different settings in these studies. MPUs are designed to treat patients with severe medical and psychiatric disorders and hence those with severe mental disorders are often admitted (Kishi and Kathol, 1999).

Finally, Wiersma et al. (2009) conducted a study in four community psychiatric services and found a significant decrease in unmet needs of 0.6 (SD 2.5) (Wiersma et al., 2009). With a decrease of unmet needs of 1.9 (SD 2.8) our study showed a larger fall in unmet needs, indicating that treatment on an MPU was successful for severe patients.

4.2. Strengths & limitations

Our study used an observational prospective design, that was conducted in a single center, was small-scale, and included consecutive patients in a given time period, which reduced generalizability. The study had no control group, which limited the interpretation of the outcomes of the MPU's treatment programme. Also, the interrater coefficient was not calculated which limits the insight in the observer bias. Likewise, the fact that the nurses administered the questionnaires might have resulted in a bias since they also employed the treatment. A limitation of the used method for stratifying severity of illness, based on the HoNOS, is that a patient can rank very severe with only a high score on two item. This might give an over presentation of the severity of the population.

Furthermore, the study only measured HoNOS at admission and discharge so the impact of MPU treatment over time could not be assessed. Notably, we did not administer the questionnaires at the referring ward but in the dedicated environment of the MPU. It is most likely that if the HoNoS and CANSAS instruments were to have been administered at the referral wards, the changes in functional status and unmet needs would have been more marked. It should be noted, however, that the results of our study were comparable to those from the studies that have examined HoNOS and CANSAS in different settings. For instance, in the study of Mulder et al. (2004), they found that patients that were treated clinically had a HoNOS score of 16.1 at admission and this was 11.2 for patients that were treated ambulatory (Mulder et al., 2004). Patients in our study improved from 16.2 to 11.6, considering the study of Mulder et al. (2004) this could indicate a change from patients that are treated clinically to ambulatory treatment.

4.3. Future research

The results of this study showed that during their stays at the MPU patients' functional status improved and the number of unmet needs fell. The total costs of claims were €2.842 and €6.880 per decreased point of the HoNOS and unmet need respectively. The HoNOS and CANSAS include questions on several items. Some of them cannot be addressed on a short MPU admission. Omitting these items would improve the costs of claims per improved point. The questionnaires are developed as a standard set of items. We did not calculate the costs per point for a subset of items as it would distort this standard. In future research, an expert panel might use a Delphi method to select items that are the more important to measure the impact of MPU treatment.

This is the first study that examines the costs of claims in relation to the HoNOS and CANSAS, which makes it hard to compare our results with other costs studies. But this study can be the benchmark for future research. In future research costs of claims should than also be measured. These are not the actual costs for the hospital but the price the health insurance company pays. We do believe this is a useful measure because 1) it represents negotiated prices and therefore reflects the actual costs of a unit; 2) these are the actual costs that are paid by the insurance companies and that are used to calculate the premiums for Dutch inhabitants.

This was one of the first studies that measures health status achieved or attained of a MPU admission. As described in the introduction, these measures are conform the ideas of Porter (Porter, 2010). Based on Porters ideas of value based healthcare, patients and health insurers are demanding more and more insight in the added value of health care treatments. This study shows that on a patient level, HoNOS and CANSAS have proven to be useful instruments to measure treatment outcome in Porters tier 1. But to compare MPU admission with care as usual or other units, simply gathering the data is not enough. The difficulty lies within the heterogeneity of the populations and the capabilities of the units. Future research should therefore focus on comparing units on treatment outcomes and costs. To achieve this, it is important to gather detailed information on the health status of the included patients. Furthermore a thorough insight in the capabilities of existing units is necessary to compare them with each other. The study of Chan et al. (2018) is an example of a study that describes the capabilities of several units (Chan et al., 2018). Considering these units, the OLVG unit can best be compared to the units in the University of Iowa and Long Island Jewish Medical center. When more details of the organization of other units are available, it is possible to perform an analysis that compares the cost-effectiveness between MPUs. We believe it is harder to compare a MPU with care as usual since the included populations will never be homogenous because more complex patients will always be admitted to the MPU. A before and after study might give insights, but because of referrals of the most complex patients to external units, heterogeneity remains an issue.

The HoNOS focuses on mental healthcare status. The improvements in functional status found in this study were therefore independent from improvements on other domains, such as somatic care, which were not measured. We believe the HoNOS is a useful measure for the assessment of the functional status of MPU patients. However, we suggest it should be used in combination with a generic questionnaire that focuses more on the somatic care. An example of such a questionnaire might be the widely used EQ-5D (EuroQol).

Some preliminary costs work was undertaken in our study, and costs could thus be calculated in a purpose-driven way for incorporation into a cost-effectiveness analysis of the MPU approach to patient treatment. But in comparing care facilities like MPUs it is important to take the underlying severity of the medical and psychiatric disorder into account and the complexity of the treatment. In order to perform cost-effectiveness analysis homogeneity of the patients and detailed insights in the treatment abilities of the units are important.

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Declaration of Competing Interest

There were no conflicts of interest for Luc Jansen, Florian Hunnik, Jan van Busschbach and Jeroen Lijmer.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.112526.

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