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Mental health indicators in the hospitalization process in a Brazilian psychosocial care network

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Abstract

We aim to present the use and viability of mental health indicators at a Brazilian reference psychiatric hospital. We elaborated a Business Process Model and Notation based model of the patients' hospitalization process based on semi-structured interviews with managers and professionals of the hospital. We analyzed the model and selected a set of 6 mental health indicators, based on evidence-based practice from other countries, using information from several Health Information Systems regarding hospitalizations from 2013 to 2017. In Brazil, there is a lack of methods for the manager to measure the actions carried out in mental health. Thus, the method proposed in this article can be used as metrics to assess the impact of public policy implementation and to assist planning and decision-making based on evidence in mental health.

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1. Introduction

The 66th World Health Assembly, composed of 194 Member States, adopted the Comprehensive Mental Health Action Plan of the World Health Organization (WHO) for the period from 2013 to 2020. One of the main objectives presented in this plan was to strengthen Health Information Systems (HIS) evidence and research in mental health. More specifically, this objective proposed that the basic concept in the creation of a HIS was the use of quality indicators that could provide relevant information to estimate improvements in mental health management [1].

One of the ways to carry out such management is mapping and modeling of business processes within hospital services, to identify points, along a process, where raw data can be collected for the subsequent generation of indicators. Business Process Model and Notation (BPMN) is a technique used to illustrate procedure models in a simple and easily understandable way that visually represents the sequence of tasks completed to achieve the organization's goal [2].

Psychiatric hospitalization remains an indispensable therapeutic resource for many patients, especially for those with more severe conditions [3]. In particular, the hospital sector must manage activities of high operational complexity, in which it is necessary to concentrate trained human resources, the latest technology and diversified processes [4]. The use of indicators that contemplate the processes involved in this environment can be of great use for the management of hospital organizations and their stakeholders. These indicators, when addressing both the financial perspective and the clinical evolution of patients, and their flow within the process, can support efficient and effective management, in addition to assisting the development of strategic public policies [5].

Given the above, the objective of this article is to present the result of an analysis on the use of mental health indicators in the hospitalization process at a reference psychiatric hospital. Unlike what can be found in literature, this study involves a robust methodological structure composed of three stages: 1) development of a process model for the hospitalization process; 2) survey of the use of indicators related to the hospitalization in countries that present evidence of their use; and finally 3) the analysis and application of the selected indicators in the context of the proposed hospitalization process model for the Psychosocial Care Network (RAPS in Portuguese) [6].

Thus, we seek to improve decision-making in mental health through the indicators selected objectively from evidence-based practice [7]. Therefore, this study aims to show that, by identifying the models of the hospitalization/treatment processes of patients, through BPMN, carried out by health organizations, the points in the procedure where we may relevant data may be collected and the HIS used for collecting these data, it is possible to produce knowledge for that decision-making improvement.

This study can therefore serve as a practical example on how each health organization will be able to manage and improve their clinical and administrative processes regarding mental health.

2. Method

This work consists of a descriptive study, based on an inquiry about the hospitalization process and a bibliographic and documentary survey on mental health indicators [8].

The RAPS defines the points of attention for the care of people with mental and behavioral disorders, including those who use crack, alcohol or other drugs. Thus, in the RAPS taken as a reference, patients are referred by regulation through an entire geographical zone (in this case, the DRS XIII), which covers 26 municipalities in the Ribeirão Preto region. This zone has a population coverage of 1,452,570 inhabitants, a ratio of 3.32 doctors per 1,000 inhabitants, 129 psychiatrists, 10855 mental health patients [9].

This study refers to patients admitted to the reference psychiatric hospital of this geographical zone, which has 102 beds for patients in acute crisis and 60 beds for resident patients. After hospital discharge, patients are referred to primary, secondary, or mental health care service near their home. The information of the study hospital, regarding the admission, hospitalization and discharge of patients, is managed by the Medical Archive Service (Serviço de Arquivo Médico - SAME in Portuguese) [9].

In the inquiry about the hospitalization process, semi-structured interviews were conducted with the coordinator of the medical team, operational manager and administrative manager of the hospital. A first round of interviews (conducted in September 2019) was necessary for the characterization and modeling of the hospitalization process in the hospital, aiming to gather as much information as possible relevant to the following questions: What activities are

involved in the process; Who carries out each activity; How each activity is carried out in the context of the process; Where each activity is carried out; When each activity is carried out in the context of the process as a whole; Why each activity is carried out in the process in question; and How the HIS available at the hospital are used during each activity [10].

With this information, it was possible to build a model of the patients' hospitalization process, represented by a diagram that allocates indicators for the evaluation of each part of the hospitalization process [5]. Such a diagram was constructed using the Business Process Model and Notation (BPMN) standard [10], a standard for modeling business processes based on graphical notations that portray the main elements of the flows and help to identify and understand the main activities of a process. A second round of interviews was held (in October 2019) with the same professionals to validate the same process model, in search of an accurate representation of the reality of the hospitalization process.

The survey of mental health indicators consisted of searching normative documents (evidence-based practice), for countries that use mental health indicators and present evidence of their effectiveness [7]. Countries selected had to have a universal public health system similar to the Brazilian one, in which a mental health network management structure is maintained. Another fundamental criterion was the possibility of having access to the practice of using mental health indicators in databases, reports or normative documents, with the temporal evolution of the indicator, its results for mental health management and the impact of the indicator on patients' health.

With a set of indicators and the model for the hospitalization process, an analysis of these indicators was implemented with the information available for the reference hospital between the years 2013 and 2017. Such information on hospitalizations at the hospital was obtained through the DRS XIII Mental Health Information System (SISAM 13 in Portuguese) [11]. This system, developed in 2011 in a web environment, allowed the registration, management and monitoring of psychiatric patients' information regarding consultations, hospitalizations, references and against references, in the different units and levels of complexity of mental health in the municipalities of the geographical region in study [12]. Results were made available in a similar manner to the selected countries that use the indicators, with particular reference to their meaning for management [9].

3. Results

3.1. *Process modelling*

We developed representative models of the current state of the process ("AS-IS" model) from diagrams constructed with the BPMN through the performed interviews. The summary view of the "AS-IS" model containing the process representation and a description of the process is in the following paragraphs in BPMN, which describes the hospitalization process of patients at the hospital. It includes the patient's flow, from the request for hospitalization by specialized services to the referral and admission to the hospital. In the wards, doctors are responsible, together with a multidisciplinary team, for registering the code for each diagnosis according to International Statistical Classification of Diseases and Related Health Problems. 10th rev (ICD-10) [12].

All information about the patient's hospitalization process is managed by SAME, and this information is reported to all sectors of the hospital (Figure 1).

3.2. *Selecting and measuring mental health indicators*

Based on the inclusion/exclusion criteria, the countries selected for this study were: Canada, Australia and England. A set of 180 indicators was found: 15 from Australia, 55 from Canada and 110 from England [13-15], all related to mental health in general. We excluded specific social assistance indicators, indicators without a calculation method, indicators that were not part of the hospitalization context. From this set, 18 indicators related to hospital administration were selected. After analysing these 18 indicators, 12 were excluded because they are not exclusive to the hospitalization process or because they are indicators for other hospitalization processes more specialized in children and adolescents. The process model "AS-IS" also includes the points where data are collected (highlighted in green color in Figure 1) to generate relevant indicators.
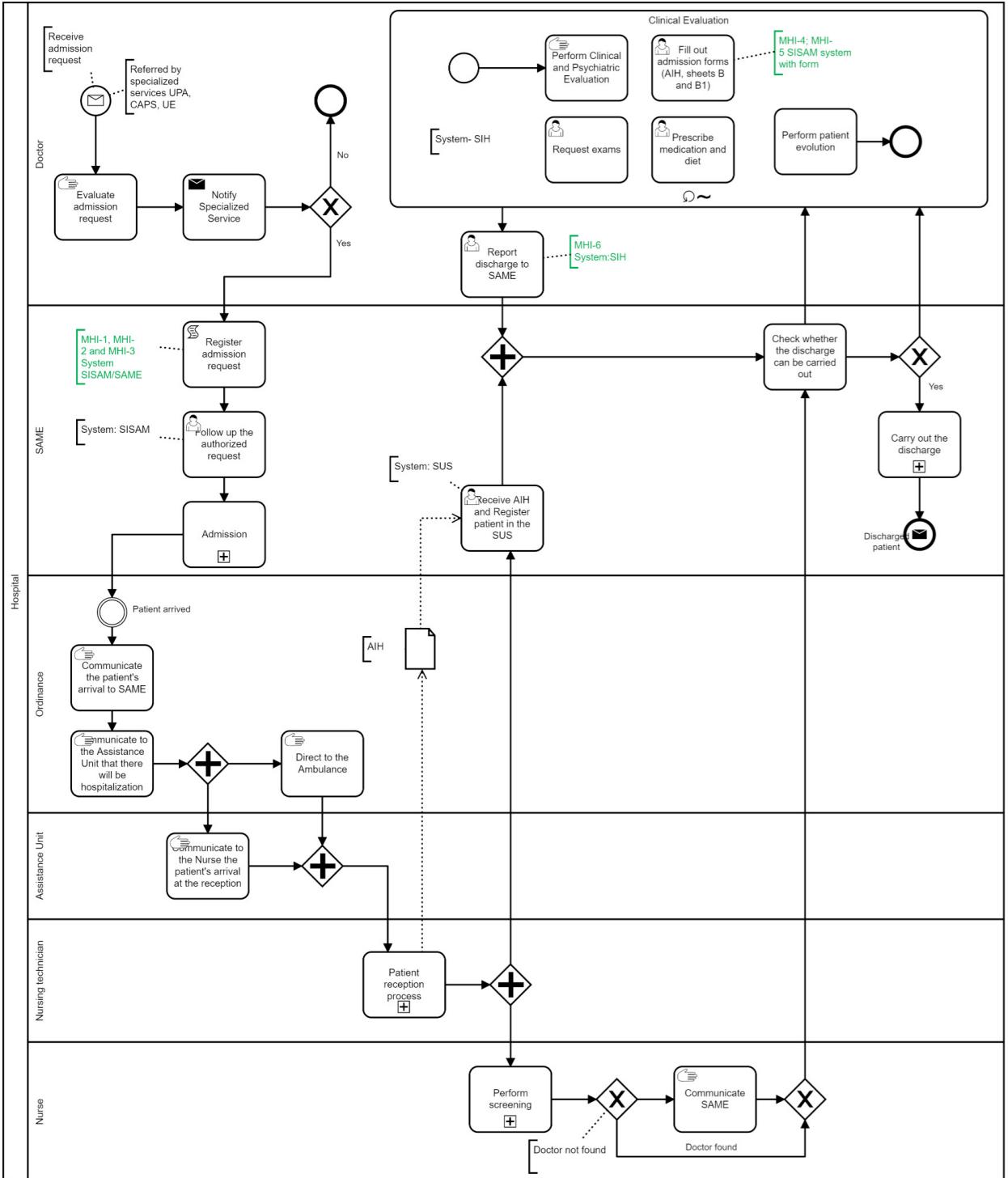
Figure 1 – BPMN process model for the hospitalization ("AS-IS" model). Data obtained: DRS XIII- 13th Regional Health Department of the State of São Paulo / SISAM: Mental Health Information System; SAME: Medical Archive Service; AIH: Hospitalization Authorization; CAPS: Psychosocial Care Center; UPA: Emergency Care Unit; EU: Emergency Unit. MHI: Mental health indicators 1,2 3,4,5,6; SUS: Health Unic System.

Finally, 6 Mental Health Indicators (MHI) were selected. The next subsections include their rationale and concrete

results obtained in this study, namely:

3.2.1. MHI-1: Proportion of individuals hospitalized for mental illness who spent a total of 30 days or more in the hospital

This indicator is used effectively in Canada and Australia [13,15], with only a difference in the number of days (Canada: 30 days, Australia: 28 days).

Table 1. Patients hospitalized for 30 days or more in a year, in the period from 2013 to 2017.

Year	Total number of patients	Patients hospitalized for more than 30 days a year	Percentage
2013	686	347	50.58%
2014	587	362	61.67%
2015	617	388	62.88%
2016	594	337	56.73%
2017	460	295	64.13%

In Canada, this indicator is presented as an average of 22.6%, for the period from 2006 to 2013. Using data from SISAM 13, the rates of individuals hospitalized for mental illness that passed 30 days in the reference hospital, in the selected period, averaged 59.19% [11]. This value suggests that most hospitalizations are long-term. Another possibility is the difficulty of discharge from psychiatric patients who often do not have a family environment or socioeconomic conditions outside the hospital that guarantee discharge. Thus, the comparison of the absolute values of this indicator between the reference hospital and other countries, and even hospitals, is slightly compromised if other characteristics of the hospital and health region are not considered.

3.2.2. MHI-2: Percentage of people aged 18 or over readmitted to the hospital within 30 days after hospital discharge due to problems related to a mental disorder

Among the three selected countries, this indicator is used and calculated in this way only in Canada. In a Report presented in 2015, for the period from 2009 to 2013, the average of readmissions was 11.5% [13]. Analysing the data from SISAM 13, we observed an average of 3.03% of readmission over the 5 years in study. The downtrend over these years reveals a possible evolution in the efficiency of the services of this Brazilian hospital in the studied period, but the elucidation of the reasons for the decrease in the number of readmissions can be considered a motto for future investigations.

Table 2. Percentage of people aged 18 or over readmitted to the hospital within 30 days after hospital discharge due to problems related to a mental disorder.

Year	Patients hospitalized aged 18 or over	Readmitted to the hospital within 30 days after discharge	Percentage
2013	605	25	4.13%
2014	542	22	4.06%
2015	577	15	2.60%
2016	518	19	3.67%
2017	416	3	0.72%

3.2.3. MHI-3: Percentage of people aged 18 or over with at least three hospitalizations related to mental illness, among those who had at least one hospitalization for mental illness in one year

Data from SISAM 13 showed an average of 2.99% of patients, aged 18 years or older, who had at least three hospitalizations related to mental illnesses in one year [11]. This indicator is used and calculated in this way only in Canada, where it is possible to observe that the average number of patients with more than 3 hospitalizations was 11.0% over a period of 5 years (2008 to 2012) [11].

Table 3. Patients aged 18 years or older with at least three hospitalizations related to mental illnesses in one year.

Year	Patients hospitalized aged 18 or over	With 3 or more hospitalizations in a year	Percentage
2013	605	32	5.29%
2014	542	16	2.95%
2015	577	15	2.60%
2016	518	14	2.70%
2017	416	6	1.44%

We can also observe an important downward trend in the number of these patients in the analysed period, given that in 2013 a percentage of 5.29% of readmissions was registered, while in 2017 this value was 1.4%. This phenomenon can show that there was a possible evolution in the performance of the service and support network between the years 2013 to 2017, as we can see in Table 3.

3.2.4. MHI-4: Admission due to acute mental illness in adults, per 100,000 inhabitants among people over 18 years old

This indicator is used in England and Australia, however, in England it is presented and broken down into 5 domains of mental health indicators. Through data from SISAM 13, for the reference hospital, we observed a significant decrease in hospitalizations in 2017. MHI-4, in the hospital, presented an average annual rate of 65.36 hospitalizations per 100 thousand inhabitants diagnosed as mental disorders [11] (Table 4).

Table 4. Admission rate, per 100,000 inhabitants, for people aged 18 years or older, related to the diagnoses of mental disorders. Population data obtained from IBGE sense 2010 [17]. Numerator / denominator multiplied by 100,000 inhabitants.

	2013	2014	2015	2016	2017	Average
Total admissions	77.47	65.42	70.28	65.42	48.20	65.36

3.2.5. MHI-5: Number of acute hospitalizations in a Psychiatric Hospital for adults of working age, during one year, due to the use of psychoactive substances, expressed as a rate per 100,000 inhabitants over 18 years of age

This indicator is also used in England and Australia, however, in England it is used in a similar way to MHI-4 indicator. The data obtained through SISAM 13 are shown in Table 4 below, showing the distribution of hospitalizations for mental disorders due to the use of psychoactive substances during the study period [12,14]. It presented an average annual rate of 17.56 hospitalizations, per 100,000 inhabitants, in the period between 2013 and 2017 [9]. In addition, there was a downward trend in the annual rate during the period, given that the rate started with 23.69 admissions per 100 thousand inhabitants in 2013 and decreased to 8.40 in 2017 [12].

Table 5. Admission rate, per 100,000 inhabitants, for people aged 18 years or older, related to the use of psychoactive substances. Population data obtained from IBGE sense 2010 [16]. Numerator / denominator multiplied by 100,000 inhabitants.

	2013	2014	2015	2016	2017	Average
Total admissions due to substance use	23.69	18.33	22.98	14.38	8.40	17.56

3.2.6. MHI-6: Average time (in days) spent in hospital, in one year, in a mental health service for patients hospitalized in the state or territory

This indicator is used and calculated in this way in Australia, however, this is a universal indicator and used in Brazil and other countries within hospital management. From the analysis of the annual data of this indicator, it was not possible to verify whether there is a tendency for a decrease or an increase in the average time in the period. However, a joint analysis of MHI-1 and MHI-6 confirms the characteristic of the hospital as a long-term hospitalization centre, a role played in accordance with the characteristics of the health region that already has an

urgency and emergency hospital for psychiatric care.

Table 6. Average time (in days) spent in hospital, in one year, in a mental health service for patients hospitalized in the state or territory.

	2013	2014	2015	2016	2017
Average time spent in hospital	41.69	50.96	44.73	42.75	48.10

4. Discussion

Among the findings of this study, it stands out initially, the modeling of the patient's hospitalization process coupled with the selection of 6 indicators for such process, extracted from the evidence-based practice of countries that use indicators for the psychiatric hospitalization process, and which obtain results relevant to the public health of their localities from them [13-15]. We've identified also in the process model, the points where data could be collected within the hospitalization process, to generate the values for the selected indicators.

The BPM life cycle provides for processes to be modeled, configured, executed and evaluated routinely [10]. In the evaluation stage, if indicators with unsatisfactory values are identified, this can impact the control flow and, consequently, the Health Information Systems (HIS) that support the process activities. On the other hand, if there are no records of values necessary to produce the indicators at a given time, it is possible to use the historic ones so that information systems can make estimates of the population's health demand based on this information [17].

The hospital readmission indicators (MHI-2 and MHI-3) are relevant to clinical practice and service management, since the occurrence of hospital readmissions within 30 days after discharge often reflects negative clinical consequences for patients with mental disorders, which can occur due to factors such as inadequate access to subsequent care, lack of adherence to medications, lack of self-care and failure in the follow-up service network [18-19]. In the case of a high number of readmissions, one of the reasons may be related to not attending primary care services.

We can also state that indicators that show psychiatric hospitalization for mental disorders and rates for the use of psychoactive substances (MHI-4 and MHI-5) aim at the efficient management of psychiatric diseases throughout their treatments and the reduction of hospitalizations for avoidable reasons. Through these data, it is possible to plan properly, for example, the increase in the patient's follow-up time in extra-hospital services [19]. These rates show that the use of psychoactive substances represents a considerable number of psychiatric hospitalizations, which reveals the need for more effective action by the public power, through public information and prevention programs related to the use of these substances [20].

The length of stay (MHI-1 and MHI-6) presented by the indicators is determined by several factors, since the particular characteristics of each disease and the lack of support service structures can determine a prolonged length of stay [20]. Adequate clinical treatment to practice is not necessarily reflected in a shorter hospital stay. In the context of the length of stay indicator, we suggest the use of additional indicators to reveal the existing correlations, such as the quantity and quality of care provided by psychiatrists, psychologists, occupational therapists and available nurses [21, 22].

The limitations show that there is a significant lack of official indicators for the mental health area in Brazil. Furthermore, it was not performing the sub-processes of the hospitalization process, such as the cost of a psychiatric bed or the quality of hospitalization. However, through the modeling, it was identified where the mental health indicators are positioned in the process and investigating how they can be used in practice, suggesting adaptation or improvement of procedures and services.

As future work, we can mention using this methodology to elucidate relevant indicators that can be generated in various hospital processes, pointing to when it is possible to collect raw data for this processing. So, this information can be used to increase the completeness of data from mental health information systems. These indicators also serve as a basis for building knowledge-based tools such as ontologies, decision support systems, and mental health observatories.

5. Conclusions

In this article, we presented the results of a BPM-based method to collect data for mental health indicators in a reference hospital in Brazil. The method includes modeling a hospitalization process using BPMN, pointing out the places and the HIS that support this collecting, and describing the results obtained for selected mental health indicators. These show important information that can be used to improve decision-making, not only from the clinical perspective, but also from the management, organizational and technological ones. Results and discussion already provide some valuable insights on the collected data, and point out possible areas of improvement. The method proposed can be applied to other health indicators, to comply with practices long observed in developed countries. Mapping these indicators to existing processes and HIS proven also to be a non-intrusive way of collecting these relevant data.

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