# A study on the quality of care in psychiatric patients:

# Focused on the effect of continuity of care

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# ABSTRACT

# A study on the quality of care in psychiatric patients:
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**Background:** The socioeconomic burden of mental illness is increasing worldwide, and similar to other developed countries, the burden is expected to increase further in Korea. In addition to the increased burden, Korea has a poorer quality of mental health care than other Organization for Economic Cooperation and Development (OECD) countries, as evidenced by re-admissions and suicides after hospital discharge. To improve the quality of care of persons who are mentally ill, the OECD recommends continuing care after discharging them from the hospital, and in studies conducted outside of Korea, continuity of care has been reported to have positive effects on health outcomes However, this association has not been established in psychiatric studies. There is a lack of research on continuity of post-discharge care in South Korea and improved quality of care. Therefore, this study sought to clarify the relationship between continuity of care after hospitalization for a mental illness and quality of care.

**Methods:** This study used data from the National Health Insurance Service-Cohort Sample from 2002 to 2013. The study's participant was limited to 18,702 psychiatric inpatients. The dependent variables were readmission, all-cause mortality, and suicides within 1 year post-discharge. A nested case-control study design was used because of the immortal time bias that can occur in measuring continuity of ambulatory care, due to the different follow-up times of individuals within the observation period. Thus, all cases consisted of persons with a mental illness who were readmitted to the hospital (n = 8,022), died (n = 355), or committed suicide within 1 year after hospital discharge (n = 108). For readmission cases, up to one control (or ten controls for all-cause mortality or suicide cases), was randomly extracted from the risk set and matched by follow-up time and year of discharge. The index date was defined as the date on which the event occurred. Continuity of psychiatric outpatient care was measured from the time of hospital discharge until readmission or death occurred (or the index date for the control group). Conditional logistic regression was conducted to estimate the odds ratio (OR) for continuity of care, adjusting for sociodemographic, treatment, and hospital factors.

**Results:** Of the 18,702 psychiatric inpatients in the study, 8,022 (42.9%) were readmitted, 355 (1.9%) died, and 108 (0.6%) died by suicide within 1 year after discharge. Compared to the psychiatric inpatients who had a high continuity-of-care score, a significant increase in the risk of readmission within 1 year after hospital discharge was found in those with medium (OR 1.519 95% CI 1.250–1.845) and low (OR 1.769 95% CI 1.425–

2.263) continuity-of-care scores. An increased risk of all-cause mortality within 1 year after hospital discharge was found in the patients in the low continuity group (OR 3.118 95% CI: 1.592–6.106), relative to those in the high-continuity group. The risk of suicide within 1 year after hospital discharge was higher in those with medium (OR 2.709 95% CI: 1.168–6.284) and low continuity of care (OR 3.839 95% CI: 1.351–10.914) than those with high continuity of care.

**Conclusion:** This study found that better continuity of outpatient care after psychiatric hospitalization improved quality of care, as measured by re-admissions, deaths from all causes, and suicides. Therefore, this study's results provide empirical evidence of the importance of continuity of care when designing policies to improve the quality of mental health care.

# I. Introduction

## 1. Background

The burden of mental illness is substantial, worldwide[1,2]. Mental disorders, including schizophrenia, alcohol and drug use disorders, major depressive disorder, bipolar disorders, anxiety disorders, and other mental disorders, accounted for 7.4% of the total disease burden throughout the world in 2010, and it was the fifth leading category of disorders of the global Disability Adjusted Life Years (DALYs)[1]. The burden of depressive disorders is ranked as one of the top 10 disorders of the DALYs in most developed countries[2]. Furthermore, the burden attributable to mental illness increased by 9.7% between 2005 and 2013, with schizophrenia, major depressive disorder, and the bipolar disorders among the major contributors to this growth[2].

In South Korea, the economic burden of mental illness is substantial for both society and the individual[3,4]. In 2005, the overall cost of schizophrenia amounted to $3,174.8 million, which accounted for $418.7 million in direct healthcare costs and $2,635.1 million in indirect costs, including loss of productivity[3]. The estimated total cost of depression in 2005 was $4,049 million, of which $152.6 million and $3,880.5 million represented direct and indirect

healthcare costs, respectively[4]. Morbidity costs due to productivity loss accounted for a large portion of the economic burden of these mental disorders. Moreover, among all diseases, the burden of depressive disorders was ranked eighth in 2007[5]. The burden of these mental disorders in South Korea is expected to increase over time, along with a trend in an increased burden in developed countries.

Given the increasing burden of mental disorders, monitoring and improving mental health care is important to control medical costs and reduce the burden of mental health care, which mostly includes social costs and lost-work productivity[6]. Enhancing mental health care is a policy priority in many countries that seek the most effective and efficient ways to deliver care to patients[6]. Mortality, suicides, and readmission after hospital discharge have been used as quality indicators in many countries to evaluate and improve the quality of mental health care[7]. For instance, the suicide rate after discharge can be a quality indicator because it is well documented that psychiatric patients are particularly vulnerable to suicide immediately after hospital discharge[8-14]. Psychiatric readmission is often used as a proxy for relapse, complications, discharge planning, or quality of the previous hospitalization[15-17]. Unfortunately, South Korea has a high readmission rate for patients diagnosed with schizophrenia, an extremely high mortality rate after hospital discharge, and the highest suicide rate among countries of the Organization for Economic Cooperation and Development (OECD)[18,19].

To improve the quality of mental health care, OECD recommends effective discharge planning and enhanced levels of care immediately following discharge[6]. Indeed, transition from an inpatient to outpatient psychiatric-care setting poses substantial risks of premature disengagement from treatment[20,21]. In two studies, half of the psychiatric inpatients did not receive outpatient care after discharge[20,22], and this lack of timely outpatient care increased their risk of relapse and poor health outcomes[23,24]. In addition to the importance of timely access, continuity of care is one way to enhance the quality of psychiatric care. Continuity of care is defined as the provision of continuous and consistent care by a provider to address the patient's medical needs[25,26]. Haggerty et al.[27] identified three types of continuity of care that are present in every healthcare sector: information (information transmission, including both medical and non-medical information, from one provider to another provider), relationship (ongoing relationship between a patient and a provider characterized by loyalty and trust), and management continuity (consistency in patient care or flexible care for each patient). In mental health, the emphasis is placed on the coordination of services and a stable and trusting relationship between a patient and a provider over time[27].

A considerable number of studies from different fields of research have been conducted on the benefits of continuity of care. There is empirical evidence that better continuity of care is associated with improved communication and trust,

improved patient satisfaction, better medication compliance, increased compliance with treatment plans, decreased medical costs, lower risk for emergency visits, prevention of avoidable hospitalizations or readmission, and reduced mortality[28-31]. However, in South Korea, a limited number of studies on mental health care have been conducted; thus, there is insufficient evidence of the association between continuity of care after hospitalization and quality of care in mental health. The existing literature in mental health care shows little consistency in studies measuring continuity of care, and in the findings of an association between continuity of care and better outcomes.[32,33].

## 2. Objectives

The purpose of this study was to examine whether the continuity of ambulatory care after discharge affects the quality of care of psychiatric inpatients.

The objectives of this study were as follows:

(1) To identify the effects of continuity of ambulatory care on readmission among psychiatric inpatients within 1 year after discharge from the hospital.

(2) To identify the effects of continuity of ambulatory care on all-cause mortality among psychiatric inpatients within 1 year after discharge from the hospital.

(3) To identify the effects of continuity of ambulatory care on suicide among psychiatric inpatients within 1 year after discharge from the hospital.

# II. Literature Review

## 1. Quality of care

## (1) Definition of quality of care

During the last few decades, many researchers and institutes have struggled to formulate a concise, meaningful, and useful definition of quality of care[34]. Lee and Jones[35], in 1933, suggested that "good medical care is the kind of medicine practiced and taught by the recognized leaders of the medical profession at a given time or period of social, cultural, and professional development in a community or population group."

In 1980, Donabedian[36] defined care of high quality as "that kind of care which is expected to maximize an inclusive measure of patient welfare, after one has taken account of the balance of expected gains and losses that attend the process of care in all its parts." Donabedian[36,37] distinguished the following domains of quality of care: technical, interpersonal, and amenities. Technical care refers to using medical knowledge and skills in a way that maximizes the benefits of health without increasing risk. The term interpersonal relations refers to meeting socially defined values and norms that govern the interaction of individuals in general and specific situations. Amenities are a supplementary

aspect of health care, which refers to the comfort or convenience of a facility. In general, healthcare providers place greater emphasis on the technical areas, whereas healthcare users have less knowledge about technical areas, but more knowledge about interpersonal relationships and accommodations.

In 1984, the American Medical Association (AMA)[38] defined high quality care as that "which consistently contributes to the improvement or maintenance of quality and/or duration of life." The AMA's definition emphasized two outcomes: quality of life and longevity. One of the most widely cited definitions formulated by the Institute of Medicine (IOM) in 1990[39,40] holds that quality refers to the "degree to which health services for individuals and populations increase the likelihood of desired health outcomes, and are consistent with current professional knowledge."

The complexity and variability of these and many other definitions of quality can be confusing; however, Donabedian[41,42] suggested that several formulations are both possible and legitimate, depending on where we are located in the system of care and on what the nature and extent of our responsibilities are. Different perspectives and definitions of quality call for different approaches to its measurement and management. Each definition of quality of care has more than one meaning, and each meaning includes a set of properties that must be met to achieve good health outcomes.

## (2) Attributes of quality of care

As defined previously, quality of care consists of multidimensional attributes. According to Lee and Jones[35], there are four important elements involved in developing standards for quality: scientific knowledge, professional values, social and cultural values, and economic values. Myers[43] identified accessibility, quality, continuity, and efficiency as elements of healthcare-service quality. The AMA[38] has recognized specific attributes of care that should be examined in determining its quality, including an emphasis on health promotion and disease prevention, timeliness, informed participation of patients, attention to the scientific basis of medicine, and the efficient use of resources. Donabedian's conception of quality consists of seven attributes: efficacy, effectiveness, efficiency, optimality, acceptability, legitimacy, and equity.[36] The results of a study by Vuori[44] support those of other studies by also recognizing effectiveness, efficiency, and adequacy, and contributing to the list by evaluating quality improvement in scientific-technical competence as properties of measures of quality. The IOM[45] has presented six conditions for ideal health care: safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity. The OECD[46] reviewed the existing literature on the development of conceptual frameworks for measuring the quality of health care among OECD member

countries and identified three components of healthcare performance: accessibility, cost, and quality. The quality factor of healthcare performance includes effectiveness, safety, and responsiveness/patient-centeredness. The attributes of quality care suggested by experts from different perspectives are summarized in Table 1.

Table 1. Dimensions of quality of care

| | Myers[43] | Vouri[44] | Donabedian[36] | IOM[45] | OECD[46] |
|---|---|---|---|---|---|
| Acceptability | | | O | | |
| Accessibility | O | | | | |
| Appropriateness | | O | | | |
| Continuity | O | | | | |
| Efficiency | | O | O | O | |
| Efficacy | | | O | | |
| Effectiveness | O | O | O | O | O |
| Equity | | | O | O | |
| Legitimacy | | | O | | |
| Patient-centeredness /patient focus or responsiveness | | | | O | O |
| Qulity improvement | O | | | | |
| Relevance | | | | | |
| Safe | | | | O | O |
| Scienfic technique | | O | | | |
| Timelines | | | | O | |

## 2. Conceptual framework for measuring quality of care

## (1) Donabedian model

A widely used conceptual approach to quality assessment developed by Donabedian[37,47] advocates a tripartite scheme for evaluating healthcare quality, which includes evaluation of the structure, process, and outcomes of care. *Structure* refers to the stable characteristics of care-provision systems. This includes the available technology, physical resources (facilities, equipment), human resources, and organizational characteristics, such as staff training and payment methods. These factors control how providers and patients in a healthcare system act, and they are measures of the average quality of care within a facility or system. Structure is often easy to observe and measure and it might be the upstream cause of problems identified in the process. *Process* refers to all the actions that comprise healthcare. These actions typically include diagnosis, treatment, preventive care, and patient education. Processes can be further classified as technical processes, which refer to how care is delivered, and interpersonal processes, which encompass the manner in which all care is delivered. In this model, the term *outcome* refers to a favorable or an unfavorable change in the actual or potential health status of individuals and groups who are

current and past recipients of healthcare services. Outcome is defined as a level of health linked with the responsibilities of the healthcare system and its providers.

Based on the Donabedian model, many researchers have developed conceptual frameworks for use by various disciplines. In a 1988 review of quality of care research in mental health, McGlynn et al.[48] presented an analytical framework for designing research on the quality of mental health services. The structure, process, and outcome classifications proposed by Donabedian were adapted by building on principles from efficacy, effectiveness, quality assessment, and quality assurance research (Figure 1). In their framework, the outcomes include clinical symptoms, functioning (physical, cognitive, instrumental, social, vocational, role, and marital/family functioning), mortality, quality of life, and societal costs. It includes four distinct processes: voluntary (or involuntary) hospitalization, diagnostic evaluation (diagnosis, severity, and medical and psychiatric comorbidity), treatment approach/response, and disposition of the patient. The structure of care involves the characteristics of the community, the institutions providing care, the providers delivering care, and the patients potentially benefiting from the care.

Structure → Process → Outcomes

**Community characteristics**
- Mental health system configuration
- Prevalence of disorder
- Demand for services
- Demographics

**Institutional characteristics**
- Ownership
- Facility type
- Organization of services
- Size/occupancy
- Staff/patient ratios
- Sources of payment
- Case mix

**Provider characteristics**
- Demographics
- Specialty/training
- Method of payment

**Patient characteristics**
- Demographics
- Insurance coverage
- Clinical history
- Risk factors
- Protective factors

**Entry status**
- Clinical
- Legal

**Diagnostic evaluation**
- Diagnosis
- Severity
- Comorbidity

**Treatment approach**
- Style of treatment
- Intensity
- Frequency
- Appropriateness

**Treatment response**
- Compliance
- Change in symptoms
- Medication effects
- Complications

**Disposition**
- Clinical
- Legal
- Follow-up/.placement

- Clinical symptoms
- Functions
- Mortality
- Quality of life
- Societal costs

Figure 1. Analytic framework for the quality of mental health[48]

**(2) Holzemer's 3-dimensional expansion of the structure-process-outcome model**

The Outcomes Model for Health Care Research provides a framework for examining the complex nature of health-related outcomes (Figure 2)[49,50]. The horizontal axis consists of measures inputs, processes, and outcomes based on the Donabedian model. Holzemer[50] extended these limited definitions by adding a vertical axis that consists of the three constituents generally involved in a healthcare encounter: the client (e.g., an individual, a family, a school, or an entire community), the provider (e.g., physicians, nurses, and social workers), and the setting (where the delivery of healthcare services takes place). This model extends the Donabedian model by focusing attention on the interactions and associations among the structure, process, and outcomes at the levels of the client, the provider, and setting[49].

|          | Inputs | Processes | Outcomes |
|----------|--------|-----------|----------|
| Client   |        |           |          |
| Provider |        |           |          |
| Setting  |        |           |          |

Figure 2. The Outcomes Model for Health Care Research[49]

### (3) Quality Health Outcomes Model

The Quality Health Outcomes Model developed by Mitchell et al.[51,52] includes Donabedian's classical framework of structure-process-outcomes and Holzemer's 3-dimensional expanded model for multidimensional analysis of the client, provider, and setting (Figure 3). The model was developed as a conceptual guide for healthcare systems researchers using expert panel members' ongoing research, expert opinions, and literature on nursing and health services[52]. In this model, the system includes the structure and process elements of the classic Donabedian model. Clients include not only patients but also families and communities. This model's pathway from intervention to outcome was conceived as being mediated and moderated by characteristics of the care system and the client, which are capable of being understood and measured at multiple levels (individual through population)[52]. The traditional elements of structure are measured as part of the system of care; the processes can be directly measured as specific interventions or as system processes[52]. In studies using the original model, a direct influence of interventions on outcomes was not found, but studies using a modified version of the model found direct effects of the interventions on outcomes.[53-55].
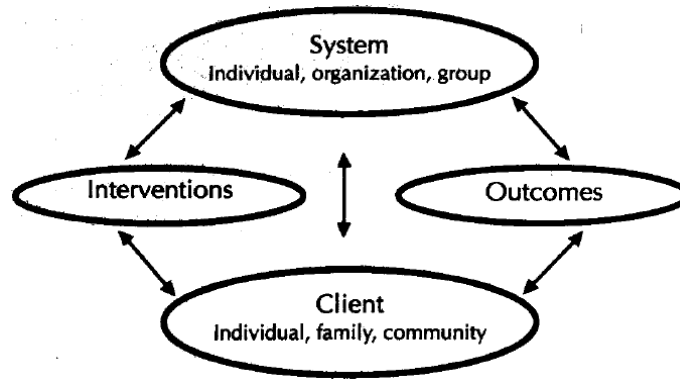
Figure 3. Quality Health Outcomes Model[51]

**(4) Quality indicators of mental health care**

Over the past decades, researchers of quality of care in psychiatry have attempted to conceptualize this variable for research and practice in this specialized area and to develop and suggest measurements (or indicators) from various perspectives. Detailed indicators recommended in previous studies are displayed in Table 2.

As described previously, the analytic framework proposed by McGlynn et al.[48] for designing research focused on quality of mental health adapted the structure, process, and outcome components. On the other hand, McCarthy[56] and McGrath et al.[57] emphasized the importance of the practicality of measurable outcomes rather than process and structure. The reasons for the careful selection of outcome measures is that it is legitimate to substitute measures of structure or process for outcome measures only when a relationship between structure or process and outcome has been established. McGrath et al.[57] suggested five quality indicators of mental health that are commonly assessed in outcomes research, including symptomatology, patient functioning, quality of life, patient satisfaction, and costs.

A Delphi study conducted by Shield et al.[58] identified a generic set of quality indicators with face validity for use in primary care mental health services,

reflecting a multi-stakeholder perspective. They generated 334 indicators divided into twelve aspects of care to measure access, effectiveness, equity, and continuity. Wobrock et al.[15] emphasized two dimensions of quality of care indicators. The first one, face validity, indicates that the measure is meaningful in a logical and clinical sense, based on the clinical rationale[7]. The second one, content validity, addresses whether the measure captures meaningful aspects of quality of care[7]. They focus on process and outcomes because these components are easy to measure with routine data, have a strong evidence base, and are able to describe aspects of quality of care for the entire disease process across all sectors.

A framework for selecting indicators developed by Hermann et al.[7,59] consists of the following criteria: the indicator measures the technical quality provided, not interpersonal or consumer perspectives; the indicator is focused on quality of care, not on costs or healthcare utilization; the indicator is built on a single item, not on a multi-item scale; and the indicator is likely to be useful in quality assessment at the healthcare system level, rather than the provider level. In addition, Hermann et al.[7,59] proposed that selected indicators are assumed to have three dimensions: (1) an impact on health by addressing areas in which there are clear gaps between actual and potential levels of health, (2) important implications for policy, and (3) the ability to be influenced by the healthcare system. They suggested twelve indicators and four dimensions through consensus among

members of a panel of international experts: continuity of care, coordination of care, treatment, and patient outcomes[60].

Table 2. Quality indicators for mental health care

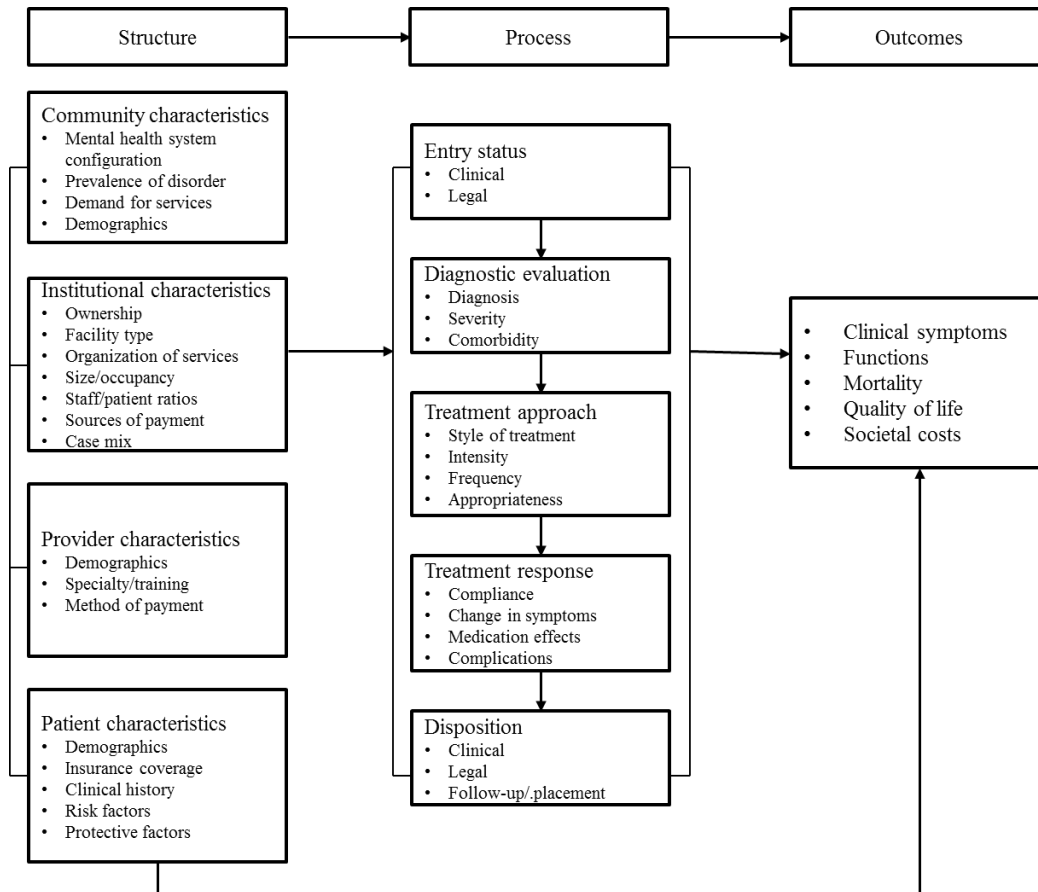| Study | | Recommended Indicators |
|---|---|---|
| MeGlynn et al.[48] (1988) | Structure | The characteristics of the community, the institutions providing care, the providers delivering care, and the patients potentially benefiting from the care |
| | Process | Entry status(voluntary or involuntary), diagnostic evaluation, treatment approach/response |
| | Outcome | Clinical symptoms, functioning, mortality, quality of life, and societal costs |
| McGrath et al.[57] (2003) | Outcome | Symptomatology, patient functioning, quality of life, patient satisfaction, cost |
| Shield et al.[58] (2003) | Structure, Process, Outcome | 21 aspects of care, 11 relating to general practices and 10 relating to health authorities or primary care groups on multi-stakeholder perspective (e.g., professional panels including psychologist, psychiatrist, social worker, commissioners, counselors, carer, patient, voluntary organization) |
| Hermann et al.[7,59] (2002, 2006) | Process | Continuity of Care<br>- Timely ambulatory follow-up after mental health hospitalization<br>- Continuity of visits after hospitalization for dual psychiatric/substance related conditions<br>- Racial/ethnic disparities in mental health follow-up rates<br>- Continuity of visits after mental health-related hospitalization<br>Coordination of Care<br>- Case management for severe psychiatric disorders<br>Treatment<br>- Visits during acute phase treatment of depression<br>- Hospital readmissions for psychiatric patients<br>- Length of treatment for substance-related disorders<br>- Use of anti-cholinergic anti-depressant drugs among elderly patients<br>- Continuous anti-depressant medication treatment in acute phase<br>- Continuous anti-depressant medication treatment in continuation phase |
| | Outcome | Mortality for persons with severe psychiatric disorders |
| Wobrock et al.[15] (2009) | Process | The timely ambulatory follow-up after mental health hospitalization, hospital readmission within 7 days or 30 days after discharge, continuous medication treatment |
| | Outcome | Mortality or suicide of persons with severe psychiatric disorders |
| OECD[61] (2015) | Process, Outcome | Excess mortality for patients with schizophrenia/bipolar disorder<br>Deaths after discharge from suicide among people diagnosed with a mental disorder/schizophrenia/bipolar disorder<br>In-patient suicide among people diagnosed with a mental disorder/a schizophrenia or bipolar disorder<br>Suicide within 30 days and within 1 year of discharge among people diagnosed with a mental disorder<br>Hospital readmissions within 30 days for patients discharged with schizophrenia/bipolar disorder |

## 3. Continuity of care

## (1) Definition of continuity of care

Continuity is a basic element of good medical care[43]. Continuity of care has been defined in various studies as the provision of continuous and consistent care by a provider to address the patient's medical needs[25,26]. Continuity of care is often used interchangeably with continuum of care, coordination of care, discharge planning, case management, service integration, and seamless care[27]. Reid et al.[62] and Haggerty et al.[27] distinguished three types of continuity of care: informational, relational, and management continuity. Each type is distinct, present in all healthcare sectors, and can be viewed from either a person-focused or disease-focused perspective (Figure 4). The importance of each type of continuity varies depending on the provider and the therapeutic context, and every discipline recognizes the need for these features to ensure high quality of care. In a systematic review of the literature, Reid et al.[62] summarized the importance of continuity of care across healthcare sectors (Table 3).

First, *informational continuity* refers to the use of information about past medical history or personal circumstances to provide appropriate care for each individual[27,62]. Specifically, it links data collected over time to avoid fragmented care. The transfer of information focuses on data concerning recorded medical

conditions[27], but knowledge of patients' preferences, values, and the social context is also important for ensuring the appropriateness of care plans, linking segmented care, ensuring that services are responsive to needs, and increasing patients' satisfaction with care[64]. Second, *relational continuity* refers to the ongoing therapeutic relationship with the patient and one or more providers, which bridges past, current, and future care. An ongoing patient-provider relationship is highly valued, particularly in primary care and mental health care. The benefits of long-term relationships are trust, mutual understanding, effective communication, and ongoing responsibility that develops over time[65]. A consistent core of personnel provides patients with a sense of predictability and coherence in their care. For instance, continuity of primary care is facilitated when a patient knows whom to contact in the event of a new health problem[66]. In mental health care, providers take responsibility for maintaining contact with patients to ensure relational and management continuity. Third, *management continuity* is the degree to which coherent or consistent care provided by different providers corresponds with the changing needs of patients, particularly those with chronic diseases or multiple clinical illnesses. Unlike relational continuity, which focuses on the patient as a person, management continuity emphasizes a particular health problem. The flexibility to adapt to patients' changing needs is important, especially in mental health care.

The report by Reid et al.[62] suggests that primary care and mental health care emphasize the person-focused features of continuity, such as ongoing provider-patient relationships and accumulated knowledge about patients. In primary care, continuity of care refers to a strong relationship between a patient and a single provider that extends beyond an episode of a particular disease. It represents a sense of affiliation between the patient and the provider, and it assumes the patient's loyalty and the provider's clinical responsibility. In the mental health field, emphasis is placed on coordination of services and stable and trusting relationships between patients and providers over time; these relationships are typically established with a team rather than a single provider. Mental health patients, in particular, require individualized care pans to allow for changes in patient needs and circumstances. The nursing literature emphasizes the coordination of information delivery and treatment over time, and communication among nurses. Among nurses, it is important to maintain a consistent approach to care and to tailor care to the changing needs of patients. In acute-care settings, management continuity and the transfer of information are emphasized, but relational continuity is irrelevant.
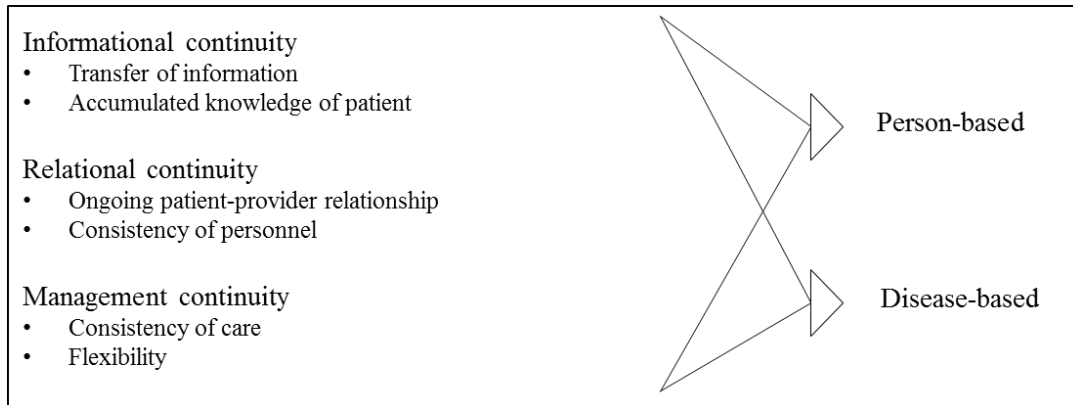
Figure 4. Three types of continuity of care[62]

Saultz et al.[63] examined continuity as a hierarchical concept based on the availability of basic information about a patient's past to complex interpersonal relationships between physicians and patients characterized by trust and accountability. The foundation for the hierarchy of continuity is *information sustainability*. This aspect is the most important characteristic of continuity in preventing medical errors and ensuring patient safety, but by itself, it does not improve access to care or patient satisfaction[63]. *Longitudinal continuity* refers to the degree to which a patient can access and be treated in a familiar environment. Currently, medical facilities, known as medical homes are highly accessible and familiar medical environments[63]. Finally, *interpersonal continuity* implies relationships between individual patients and physicians over time. Patients should know their doctors well and trust their health problems to the care of their

physicians. According to this concept, continuity of care that consists of an ongoing relationship between a patient and the patient's physician reflects interpersonal persistence[63].

Table 3. Relevance and importance of three types of continuity of care across healthcare sectors[62]

| Approaches to measure | Primary care | Mental health care | Specialty and Condition specific care | Cross-Boundary care |
|---|---|---|---|---|
| *Informational continuity* | Very relevant, particularly accumulated knowledge about patient both non-medical and medical conditions beyond a specific disease. | Very relevant, ongoing knowledge of patient and transfer of information from other non-medical agencies. Information transfer and using that information to coordinate care is emphasized. | Very relevant, particularly transfer of information regarding diagnosis and treatment and of problem. | Very relevant, especially transfer of information between settings. |
| *Relational continuity* | Very relevant, person-centered relationship essential attribute of primary care. Particularly, continuity of primary care is facilitated when a patient knows whom to contact in the event of a new health problem. | Very relevant. Relationships between a patients and providers often stress a team approach. Stabile relationships are important because of the difficulty many mental health patients have with forming and keeping relationships | Relationship only extends for duration of problem. Little relevance for short-term problems | Little relevance except in circumstances where same provider delivers care in multiple settings or where other personnel bridge care (e.g., case-managers). |
| *Management continuity* | Relevant, but often hard to operationalize because management continuity is problem specific and primary care is patient-specific. | Very relevant, emphasis on consistent implementation of care plans from one to another, from one shift to another. Flexibility is particularly important because the mental health patients require individualized care plans to allow for changes in patient needs and circumstances. | Very relevant since management continuity is usually oriented around single problem. | Very relevant, especially as care for a particular problem is transferred from providers in one setting to another (e.g., hospital to community nursing). |

**(2) Continuity of care in mental health care**

The importance of continuity in mental health care is just as important as it is in other disciplines, such as primary care, family medicine, and nursing. The first attempt to conceptualize continuity of care was reported in 1967[67]. According to Pugh and McMahon[67], discontinuity over time occurs when consecutive hospitalizations are in different facilities[67], when inpatient and outpatient care are not clearly linked[68], or when patients do not see the same mental health professional consistently[69]. Bass and Windle[69] provide a general definition of continuity of care as "the relatedness between past and present care in conformity with the therapeutic needs of the client", whereas Bachrach[70] defines it as "a process involving the orderly uninterrupted movement of patients among the diverse elements of the service delivery system."

Studies conducted by Johnson et al.[71] and Adair et al.[33] examined the measurement and concept of continuity from the perspective of the mental health field through systematic reviews of the literature. The theoretical definitions of continuity of care are presented in chronological order in Table 4[69,70,72-75]. Continuity of care has focused on case-management approaches to care, such as assertive community treatment, since the late 1970s[76,77], and its emphasis shifted from the individual provider to the team in the 1980s[70,72,78]. Later, the concept of

continuity of care as "the planned coordination of the movement of a patient along the various components of the care delivery system" was added to the earlier concept of "continuity by the same caregiver (or group of caregivers), according to the patient's needs[79]."

Table 4. Theoretical definitions of continuity of care in the mental health field[33,]

| Study | Year | Definition |
|---|---|---|
| Pugh and McMahon[67] | 1967 | Discontinuity over time occurs when consecutive hospitalizations are in different facilities, when inpatient and outpatient are not clearly linked, or when patients did not see consistently the same mental health professional |
| Bass and Windle[69] | 1972 | The relatedness between past and present care in conformity with the therapeutic needs of the client |
| Bachrach[70] | 1981 | A process involving the orderly uninterrupted movement of patients among the diverse elements of the service delivery system |
| Bachrach[72] | 1987 | Continuity of care means that the patient will be able to receive all the different services that he or she needs, even though the service system is fragmented and even though many different service delivery agencies must be involved in his or her treatment |
| Cohen and Sanders[73] | 1997 | A guarantee for ongoing care, regardless of the framework in which that care is offered, as well as a guarantee that this care is implemented and coordinated by one and the same person |
| Sytema et al.[74] | 1997 | The degree to which patients receive over time the care they need. Care needed and care delivered can be expressed in terms of inpatient, day, or outpatient care. Continuity of care exists when the need for care and the care delivered are identical |
| Saarento[75] | 1998 | The degree to which the service system links episodes of treatment into a seamless, uninterrupted whole in conformity with the needs of care of the patients |

**(3) Measurement of continuity of care**

The method of measuring continuity of care depends on the presence or absence of a primary care physician and the family or individual (Table 5)[63]. For example, the Sequential Continuity Index (SECON) or the Continuity of Care Index (COCI) can be used when the respondent is an individual and the primary care physician has not been previously determined. The measure of continuity of care that can be used when the primary care physician is pre-determined is the Usual Provider of Continuity (UPC). Reid et al.[62] recommends the COCI or SECON for measuring informational or relational continuity when using administrative data.

The COCI, developed by Bice and Boxerman[80], shows the distribution of visits to different healthcare providers. Given that the distribution of visits to healthcare providers is constant, the COCI tends to increase as the number of visits increase because the numerator of the formula contains the square of the number of visits to individual providers. The advantage of using the COCI is that it reflects the coordination of care in referrals of patients to other healthcare providers and visits to the re-referenced healthcare provider. However, the calculation of the formula is somewhat complicated and difficult to interpret. If the total number of visits is small, stability is low. The COCI is not affected by the

order in which patients visit different providers. This indicator has a value between 0 and 1, and scores closer to 1 indicate a higher level of continuity of care. A score of 1 indicates a visit to only one provider. The formula is as follows:

$$\text{COCI} = \frac{\sum_{i=1}^{k} n_i^2 - N}{N(N-1)}$$

where $n_i$ is the number of visits to provider $i$, and $N$ is the total number of visits in a defined period.

The SECON is an index designed by Steninwachs[81] to show whether a patient has visited the same medical institution continuously. Unlike the COCI, it emphasizes the order of visits to different providers. This indicator also has a value between 0 and 1, and a score closer to 1 indicates a higher level of continuity of care. The formula is as follows:

$$\text{SECON} = \frac{\emptyset_1 + \cdots + \emptyset_{n-1}}{N-1}$$

where $\emptyset$ is 1 if visits $i$ and $i+1$ are to same provider and 0 if visits are not to the same provider during a defined time interval.

Table 5. Instruments for measuring continuity of care[63]

| Type | Instruments | Study | Year |
|---|---|---|---|
| Measures that do not require an assigned provider | Continuity of Care index | Bice and Boxerman[80] | 1977 |
| | Number of Providers Seen | Eriksson and Mattson[82] | 1983 |
| | Sequential Continuity Index | Steinwachs[81] | 1979 |
| | Likelihood of Continuity Index | Steinwachs[81] | 1979 |
| | Herfindahl Index | | |
| | Modified Continuity Index | Godkin and Rice[83] | 1981 |
| | Modified, Modified Continuity Index | Magill and Senf[84] | 1987 |
| | Index of Concentration | Shortell[25] | 1976 |
| | GINI Index of Concentration | | |
| | K Index | Ejlertsson and Berg[85] | 1984 |
| | FRAC Index | Roos et al.[86] | 1980 |
| Measures that require an assigned provider | Usual Provider Continuity Index | Breslau and Reeb[87] | 1975 |
| | Duration of relationship | Wall[88] | 1981 |
| | Rate of provider turnover | | |
| | Index of Provider Identification | Starfield et al.[89] | 1976 |
| | Most Frequent Provider Continuity | Given et al.[42] | 1985 |
| | Patient survey, interview, or questionnaire | Breslau[90] | 1982 |
| Measure of family continuity | Family Care measure | Murata[91] | 1993 |
| | Family Mean Continuity Index | Godkin and Rice[83] | 1981 |
| | Family Continuity of Care | | |

## 4. Continuity of care and outcomes

Several studies have examined the association between the provision of continuity of care and outcomes among psychiatric patients in various settings. Table 6 summarizes the measures, outcome measures, and results of such studies.

There has been little consistency among the measures used in studies of continuity of care. Some studies have used continuity-of-care indices, including the UPC[92], SECON[92], COCI[92-95], Modified Continuity Index[93,94], Alberta Continuity of Services Scale for Mental Health (ACSS-MH)[96-98], and CONTINUity of care-User Measure[99]. Other studies have used breaks in care[100-102], the first outpatient contact after hospital discharge, and various other methods of measurement[94,100,103-105]. Most of the studies investigating continuity of care from the service provider's perspective, have used contact frequency and regularity or changes in care provider as the measure of continuity, whereas few studies have measured continuity from a patient's perspective by using instruments specifically developed for this purpose[97,99,106]. Adair et al.[97] developed an observer-rated instrument that measures various aspects of continuity. Catty et al.[106] created multiple-item scales of continuity factors through factor analysis and measured those factors to assess outcomes.

Researchers have investigated the association between continuity of care and how various outcomes are related to quality of care. Using the first contact after discharge as the measure of continuity of care, Grinshpoon et al.[104] and Huff[105] found that continuity of care was associated with a reduced risk of hospitalization. Grinshpoon et al.[104] reported reduced rates of readmission among patients who had visited an outpatient clinic within 180 days of their discharge, and Huff[105] found reduced rates of readmission and longer remission times among patients who received any psychotherapy, medication management, or diagnostic evaluation services, relative to no services at all, within the first 30 days after a first psychiatric episode. Huff's study[105] also found that patients who received ambulatory services or had contact with providers above the median total number, had an increased risk of readmission within 30 days and shorter remission times. However, studies conducted by Bindman et al.[102] and Olfson et al.[107] did not find a relationship between continuity of care and readmission. Sytema et al.[100] found no association between the number of readmissions and continuity of care.

Most of the studies have examined whether continuity of care is related to symptom severity and functioning. Brekke et al.[101] found that a larger number of contacts and fewer gaps in care were associated with decreased scores on the Brief Psychiatric Rating Scale (BPRS) 12 months after discharge from a hospital. Olfson et al.[107] found that patients with regular outpatient contacts were more

likely to have lower BPRS scores three months later than patients with no contacts were. On the contrary, Lehman et al.[108] found that symptom-severity scores were lower in the intervention group than in the control group one year later. Catty et al.[106] found that meeting patients' needs was associated with an increase in symptoms during the following year.

Sweeney et al.[99] found that self-reports of better continuity of care were related to better patient-provider relationships. They also found a significant association between self-reports of continuity of care and a greater proportion of patient needs, as measured by the Camberwell Assessment of Needs (CAN)[99]. However, Catty et al.[106] found no association between continuity of care and CAN scores. Chien et al.[92] found a relationship between usual-provider continuity and reduced medical costs, which they attributed to less hospital usage. Mitton et al.[98] found a non-significant trend in total cost savings with better continuity of care. Finally, a large-scale study by Hoertel et al.[95] found an association between continuity of care and lower mortality rates, as measured by the COCI. Desai et al.[109] found that poorer continuity of care with at least two outpatient visits during the first six months after psychiatric discharge decreased the risk of suicide.

Table 6. Summary of studies that examined the association between continuity of care and outcomes among psychiatric patients

| Study | Design | Follow-up (months) | N | Continuity measures | Outcomes | Results |
|---|---|---|---|---|---|---|
| Lehman et al.[108] (1994, US) | Quasi experimental | 12 | 661 | Patient-rated scale, changes in keyworker | Hospitalization, symptom severity, functioning, other (life satisfaction) | Continuity associated with reduced symptom severity; no significant differences found in hospitalization, functioning, or life satisfaction |
| Olfson et al.[107] (1998, US) | Prospective cohort | 3 | 208 | Consultation with outpatient consultant before discharge | Readmission, symptom severity, functioning, medication adherence, employment | Continuity associated with reduced symptom severity; no associations between continuity and other outcomes |
| Brekke et al.[101] (1999, US) | Prospective cohort | 12 | 41 | Contact intensity, breaks in care | Hospitalization, symptom severity, functioning | No association with hospitalization; Greater continuity associated with reduced symptom severity and improved functioning |
| Sytema et al.[100] (1999, Australia and The Netherlands) | Retrospective cohort | 48 | 2,257 | Breaks in care, Time to contact after inpatient discharge | Readmission | No association |
| Appleby et al.[12] (1999, UK) | Case-control | 30 | 298 | Decreases in care at the final contact with services in the community: decreases in frequency of follow-up | Suicide | Decreases in care after discharge from psychiatric inpatient care was strongly associated with suicide |

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Table 6. Summary of studies that examined the association between continuity of care and outcomes among psychiatric patients (continued)

| Study | Design | Follow-up (months) | N | Continuity measures | Outcomes | Results |
|---|---|---|---|---|---|---|
| Bindman et al.[102] (2000, UK) | Prospective cohort | 20 | 100 | Three dimension of continuity<br>- Continuity of service provision<br>- Breaks in services delivery,<br>- The number of community keyworkers | Readmission, symptom severity, functioning | No associations |
| Chien et al.[92] (2000, US) | Retrospective cohort | 12 | 351 | Continuity indices<br>- UPC, SECON, COCI | Medical cost, general life satisfaction, satisfaction with health | Better continuity associated with reduced medical costs and lower hospitalization; continuity not associated with general life satisfaction or satisfaction with health |
| Huff[105] (2000, US) | Retrospective cohort | 1 | 3,755 | Time to contact after discharge, total number of services used | Readmission | Contact within 5 days of discharge related to a reduced risk of readmission; greater service utilization associated with increased risk of hospitalization |
| King et al.[9] (2001, UK) | Case-control | 12 | 665 | -Continuity of contact: the number of days a Patient had been out of contact<br>-Changes in key consultant or outpatient doctor | Suicide | Continuity of contact was associated with a decreased risk of suicide; changes in key professionals was associated with increased risk of suicide |
| Greenberg et al.[110] (2003, US) | Prospective cohort | 4 | 2,357 | Three dimensions<br>- Continuity indices(COCI, MCI),<br>- Contact regularity,<br>- Time to contact after discharge | Symptom severity, substance abuse problems, violent behavior | No associations with symptom severity or substance abuse; better continuity associated with reduced violent behavior |

Table 6. Summary of studies that examined the association between continuity of care and outcomes among psychiatric patients (continued)

| Study | Design | Follow-up (months) | N | Continuity measures | Outcomes | Results |
|-------|--------|--------------------|---|---------------------|----------|---------|
| Greenberg et al.[93] (2004, US) | Retrospective cohort | 8 | 131 | Three dimensions<br>- Continuity indices,<br>- Contact intensity,<br>- Contact regularity | Symptom severity, functioning, and others (therapeutic alliance, life satisfaction, commitment to treatment, substance abuse, violence, employment) | No associations |
| Adair et al.[97] (2005, Canada) | Prospective cohort | 17 | 411 | ACSS-MH<br>- Observer-rated scale<br>- Patient-rated scale | Symptom severity, functioning, service satisfaction, and quality of life | Continuity associated with better functioning, greater service satisfaction lower symptoms severity, and better quality of life |
| Desai et al.[109] (2005, US) | Retrospective cohort | 60 | 121,933 | Continuity of outpatient care after discharge<br>- having at least two outpatient visits in the first 6 months after discharge | Suicide | Poorer continuity of care associated with higher risk of suicide |
| Greenberg & Rosenheck[103] (2005, US) | Retrospective cohort | 3–6 | 181,651 | Three dimensions<br>- Contact intensity,<br>- Contact regularity,<br>- Time to contact after discharge | Functioning | Continuity associated with better functioning; for continuing outpatient group, intensity of contact associated with poorer functioning |
| Mitton et al.[98] (2005, Canada) | Prospective cohort | 17 | 437 | ACSS-MH<br>- Observer-rated scale | Health care costs | No association with total cost; better continuity associated with lower hospital costs and higher community costs |

Table 6. Summary of studies that examined the association between continuity of care and outcomes among psychiatric patients (continued)

| Study | Design | Follow-up (months) | N | Continuity measures | Outcomes | Results |
|-------|--------|--------------------|---|---------------------|----------|---------|
| Vita et al.[111] (2007, Italy) | Retrospective cohort | 18 | 99 | Contact regularity | Medication adherence | Regular continuity (1 visit a month) associated with better medication adherence; greater intensity of contact (more than 1 visit a month) related to poorer medication adherence |
| Heffernan & Husni[112] (2009, UK) | Retrospective cohort | 24 | 26 | The number of changes in keyworker | Length of stay | No association |
| Catty et al.[106] (2011, UK) | Prospective cohort | 24 | 180 | Continuity measures created from factor analysis | Hospitalization, symptom severity, functioning, others (quality of life, therapeutic relationship, care needs met) | Consolidation and care coordination factors associated with reduced hospitalization; regularity associated with a higher risk of being hospitalized; meeting needs associated with an increase in symptoms the previous year |
| Grinshpoon et al.[104] (2010, Israel) | Retrospective cohort | 6 | 908 | Time to first outpatient contact after discharge | Readmission | Better continuity associated with lower risk of readmission |
| Sweeney et al.[99] (2012, UK) | Cross-sectional | None | 167 | Patient-rated scale | therapeutic relationship, health needs, social needs | Higher continuity associated with better therapeutic relationships and more health and social needs met |

Table 6. Summary of studies that examined the association between continuity of care and outcomes among psychiatric patients (continued)

| Study | Design | Follow-up (months) | N | Continuity measures | Outcomes | Results |
|---|---|---|---|---|---|---|
| Hoertel et al.[95] (2014, France) | Retrospective cohort | 36 | 14,515 | COCI | Mortality | Likelihood of death was significantly lower in patients with better continuity |
| Puntis et al.[113] (UK, 2016) | Prospective cohort | 36 | 323 | Changes in care coordinator | Readmission | More changes in care coordinator, more number of different mental health professions see, and more number of psychiatrics associated with less readmission; but changes in care coordinators associated with increased length of stay |
| Van der Lee et al.[114] (2016, The Netheland) | Retrospective cohort | 36 | 7,392 | Continuous care was defined as the number of follow-up years of elective psychiatric care | acute treatment, inpatient care, health care cost | Continuity of psychitric care was associated with less acute treatment, less inpatient care, and less costs of psychiatric care than those without coninuous care |
| Amjad et al.[115] (2016, US) | Cross-sectional | None | 1,416,369 | COCI | Hospitalizations, Emergency department visits, Imaging and laboratory testing, health care spending | Low continuity of ambulatory care among community dwelling older adults with a dementia is associated with higher rates of hospitalization, emergency department visits, laboratory testing, and greater health care spending |
| Sanatinia et al.[116] (2016, UK) | Cross-sectional | None | 3,379 | Changes in key workers or psychiatrists over the past 12 months | Self-reported satisfaction | Those reporting multiple changes were associated with less satisfied with treatment |

# III. Study Methods

## 1. Conceptual framework for this study

This study's conceptual framework is based on the conceptual frameworks of quality of care, quality indicators for psychiatry, and continuity-of-care measures reviewed in this study. This study's conceptual framework is shown in Figure 5. In the original model, the interventions did not directly influence outcomes, but other studies have applied the model to their areas of clinical practice (e.g., obstetrical care, particularly second-stage labor) and concluded that outcomes of interventions in the clinical settings require more attention, thereby supporting the use of this framework[53,54]. Therefore, the modified Quality Health Outcomes Model was used as the conceptual framework for this study[51,52].
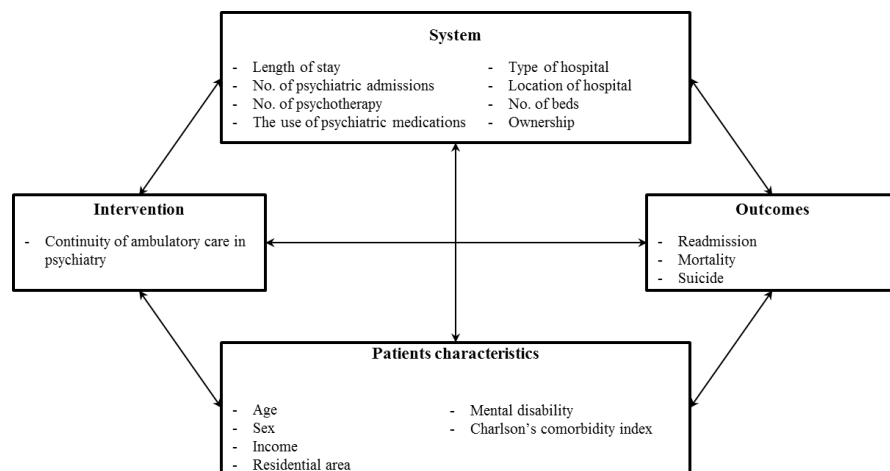


Figure 5. Conceptual framework for this study

## 2. Data source

Data were obtained from the National Health Insurance Service-National Sample Cohort (NHIS-NSC), and included 1,025,340 representative participants (2.2% of the whole population) who were randomly stratified and selected based on age, sex, insurance type, income, residential region, and total individual medical costs. As all Korean citizens are obligated to enroll in the single-payer national health insurance and medical aid program administered by the National Health Insurance Corporation, this sample cohort is representative of the general population of Korea. The NHIS-NSC database includes information regarding patients' unique de-identification numbers, age, sex, insurance type, diagnosis according to the International Classification of Diseases (ICD-10), medical costs, and prescribed medication/treatments. In addition, the de-identification numbers are linked to mortality data from the Korean National Statistical Office (KNSO). By law, all causes of death must be reported to the KNSO within 1 month of their occurrence. Details of the NHIS-NSC database have been provided in a previous report[117].

## 3. Study sample

To identify psychiatric inpatients for this study, we needed to understand some aspects of using national health insurance (NHI) claims data. Claims for medical insurance are submitted by medical institutions to the NHI to request payment for a portion of the medical expenses of the patient covered by the NHI. The NHI claims data are filed at least once a month regardless of the period of hospitalization and outpatient care provided to the patient. Medical expenses are classified and stored in this database. For example, if a patient is admitted to the hospital for three months, three claims are submitted, with a month separating each claim. A new claim is filed if a patient is transferred to another hospital. Therefore, it is possible to track the time of first medical treatment, the length of hospital stay, and the date of discharge from a specific illness episode, which can be recorded as one episode of care. Three types of episodes are considered when using the NHI database[118,119]: (1) healthcare provider episode refers to the inpatient care that a patient receives during their stay at the same healthcare institution; (2) patient episode refers to the care, including inpatient services, that a patient receives from different healthcare providers to treat a particular condition; and (3) care episode refers to the inpatient and outpatient care that a

patient receives to treat a particular condition within a specified period. For this study, the patient episode was used to identify psychiatric inpatients.

To select study participants, all inpatient claims between January 1, 2002 and December 31, 2013 (n = 1,936,343) were identified. Of these, 1,373,136 were inpatient episodes, except for 77,254 inpatient claims during daytime, using the definition of patient episode. Of the 1,373,136 inpatient episodes, this study extracted inpatients with psychiatric diagnoses based on the ICD-10 code (n = 24,006). The disorders consisted of substance use disorder (code: F1), schizophrenia disorder (codes: F2), bipolar disorder (code: F31), depressive disorders (code: F32, F33), and other mental disorders (code: F4, F5, F6, F9). The primary diagnoses are listed in Appendix Table 2. This study did not include inpatients who were diagnosed with dementia (codes: F0) because those patients were transferred from the hospital to a long-term care facility after the introduction of long-term care insurance in 2008. The NHIS-NSC database did not have information about long-term care services.

Of the 24,006 psychiatric inpatients, this study excluded those without information about inpatient days (n = 158), those who were discharged or admitted in 2013 to allow for at least a 1-year follow-up period (n = 2,685), those who died in the hospital (n = 73), and those with medical aid (n = 2,388). Overall,

this study included 18,702 inpatients. The flow chart for selecting the study participants is displayed in Figure 6.

Death certificates for in-hospital mortalities included only the month and year of the deaths; therefore, this study operationalized in-hospital mortality as follows: after matching the year and month of the discharges and deaths, this study defined the in-hospital mortalities as patients who did not utilize any healthcare services after their hospital discharge date. This study also excluded inpatients with medical aid beneficiaries because of incomplete data for medical aid before 2008 and different payment systems. Incomplete data can lead to underestimations of healthcare services, rather than actual utilization. Additionally, the psychiatric patients with NHS were covered by fee for service, whereas those with medical aid received per diem coverage. The low reimbursement for the medical-aid psychiatric patients limited treatment in outpatient settings and longer hospitalizations. Accordingly, the gap between the psychiatric patients covered by medical aid and national health insurance might have led to biased results.

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┌─────────────────────────────────────────────────┐
│ Inpatient claims during 2002-2013               │
│ n =1,936,343                                    │
└─────────────────────────────────────────────────┘
        │
        │──────────────►┌─────────────────────────────────────────────────┐
        │               │ Excluded inpatient claims during daytime (n = 77,254) │
        ▼               └─────────────────────────────────────────────────┘
┌─────────────────────────────────────────────────┐
│ Inpatient claims during 2002-2013               │
│ n = 1,859,089                                   │
└─────────────────────────────────────────────────┘
        │
        ▼
┌─────────────────────────────────────────────────┐
│ Episode of inpatients                           │
│ n = 1,373,136                                   │
└─────────────────────────────────────────────────┘
        │
        ▼
┌─────────────────────────────────────────────────┐
│ Extracted psychiatric inpatients (ICD-10 : F1-F9) │
│ n = 24,006                                      │
└─────────────────────────────────────────────────┘
        │
        │──────────────►┌─────────────────────────────────────────────────┐
        │               │ Excluded no information about inpatients days (n = 158) │
        │               │ Excluded those who discharged or admitted in 2013 │
        │               │ to allow for at least minimum 1 year follow-up (n = 2,685) │
        │               │ Excluded those who died in hospital (n = 73)    │
        │               │ Excluded medical aid beneficiaries  (n = 2,388) │
        ▼               └─────────────────────────────────────────────────┘
┌─────────────────────────────────────────────────┐
│         n = 18,702                              │
└─────────────────────────────────────────────────┘
```

Figure 6. Flow chart of selection of the study participants

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## 4. Study design

This study used a nested case-control design in a cohort to investigate the association between the continuity of psychiatric ambulatory care and readmission, mortality, and suicide within 1 year after hospital discharge. A nested case-control design was used because of the immortal time bias that can occur when measuring the continuity of ambulatory care due to the different follow-up times of each person within the observation period. In this nested case-control study, which used a risk-set sampling method, cases consisted of psychiatric inpatients who had been readmitted to the hospital within 1 year, died within 1 year, or died by suicide within 1 year after hospital discharge between 2002 and 2012. The control patients were selected from the cohort of psychiatric inpatients at risk of readmission with 1 year, mortality within 1 year, and suicide within 1 year at the time the case developed. For readmission cases, up to one control (or ten controls for mortality or suicide cases) was randomly extracted from the risk set, which was matched by follow-up time and year of discharge. The index date was defined as the date on which the event occurred.

## 5. Study variables

### (1) Quality of care outcomes

This study examined the association between continuity of care and quality of care. This study used 1-year readmission, 1-year mortality, and suicide as indicators of quality of psychiatric care. To investigate the association between continuity of care and quality of care, the outcome variables for this study were readmission, all-cause mortality, and suicide (ICD-10 code X64-80) within 1 year of hospital discharge. All participants were observed from the time of their hospital discharge to follow-up loss, death (by suicide or any other cause), or 1 year after discharge, whichever occurred first.

### (2) Continuity of care

This study used the most popular method of measurement, which can be analyzed by using the claims data. The patient-based measurement method can be used in situations in which a physician has not been determined. Given the situation in Korea where patients may choose any hospital, the patient-based measurement method was used in this study. Therefore, continuity of psychiatric outpatient care was measured from the time of hospital discharge until

readmission or death occurred (or the index date for the control group) using the following indices: the COCI and the SECON.

Both the COCI and SECON have values between 0 and 1, and values closer to 1 indicate better continuity of care. A perfect score of 1 indicates that patients have visited only one provider. A minimum of three psychiatric outpatient visits is mandatory for a valid COCI score for a particular time frame, because continuity is invalid with a limited number of visits[120]. Likewise, the SECON does not have extreme values unless the minimum number of visits is two[81]. This study included patients with 0, 1, and 2 psychiatric outpatient visits as a separate group. Excluding them would have biased the results because this group exhibited unique characteristics. Moreover, because they represented the largest group in this sample, excluding these individuals from the analysis would have been inappropriate. Therefore, this study classified scores on the COCI and SECON into five categories: Low (< 0.4), Medium (< 0.75), High (0.75–1), total visits = 1–2 (total visits = 1 for SECON), and total visits = 0.

**(3) Covariates**

Sociodemographic, treatment, and hospital characteristics were used as covariates. This study classified the primary diagnoses into five categories: substance use disorders, schizophrenias, bipolar disorders, depressive disorders,

and other disorders. Sociodemographic factors included age, sex, household income, i.e., Q1 (low) to Q5 (high), and residential area, which was categorized into two groups: urban (Seoul, Daejeon, Daegu, Busan, Incheon, Kwangju, and Ulsan) or rural (everywhere else). To account for patients' severity of illness, we included their level of mental disability (an exam was conducted by a disabled persons welfare law), which was assessed using the Global Assessment of Functioning (GAF). The GAF levels were classified as follows: none, moderate (GAF score = 51–60), or severe (GAF score < 50). The Charlson's Comorbidity Index (CCI) was included to assess patients' medical comorbidities during their hospital admission[121]. The CCI scores were categorized into 4 groups: 0, 1, 2, and 3 or more. The number of previous hospitalizations due to a psychiatric disorder was also included (1, 2, 3, and 4 or more). Treatment included length of stay and the number of psychotherapy sessions during hospitalization (0, 1–2, 3–4, 5–6, and 7 or more per week). Medication use during hospitalization was included in this study: antidepressants, antipsychotics, anxiolytics, and stabilizer (Appendix Table 1). Hospital characteristics included: the type of hospital (general hospital, hospital, or clinic); location of the hospital (rural or urban); number of beds (< 30, 30–299, 300–1000, and 1,000 or more); and ownership (public, corporate, and private). Table 7 presents the definitions of the variables that were analyzed in this study.

Table 7. Definitions of the variables analyzed in this study

| Variables | Definition |
|---|---|
| **Dependent variables** | |
| Readmission | 1 year after hospital discharge |
| All-cause mortality | 1 year after hospital discharge |
| Suicide | 1 year after hospital discharge |
| **Independent variables** | |
| **Continuity of care** | |
| COCI | Total visits : 0, Total visits : 1-2, Low(<0.4), Medium(<0.75), High(0.75-1) |
| SECON | Total visits : 0, Total visits : 1, Low(<0.4), Medium(<0.75), High(0.75-1) |
| **Individual** | |
| Sex | Male female |
| Age | -29, 30-39, 40-49, 50-59, 60-69, 70- |
| Household income | Q1(Low), Q2, Q3, Q4, Q5(High) |
| Residential area | Rural, urban |
| Mental disability | Normal, Moderate, Severe |
| Charlson's comorbidity index | 0, 1, 2, ≥3 |
| Length of stay* | ≤23 days, >23 days |
| Primary diagnosis | Substance use disorder, Schizophrenia, Bipolar disorder, Depressive disorder, Other mental disorder |
| No. of psychiatric admissions | 1, 2, 3, or ≥4 |
| No. of psychotherapy | 0, 1-2, 3-4, 5-6, 7 or more per week |
| Antidepressants | Yes, No |
| Antipsychotics | Yes, No |
| Anxiolytics | Yes, No |
| Stabilizer | Yes, No |
| **Hospital** | |
| Type of hospital | General hospital, Hospital, Clinic |
| Location of hospital | Rural, Urban |
| No. of beds | <30, <300, <1000, ≥1000 |
| Ownership | Public, corporate, private |

*The criterion was the median length of stay.

## 6. Statistical analyses

Descriptive statistics were used to calculate patient characteristics and treatments during hospitalization and hospital characteristics for the case (readmission, mortality, and suicide within 1 year of hospital discharge) and the control groups. As the groups were matched according to follow-up time and year of discharge, these measures did not differ significantly. Conditional logistic regression was conducted to estimate the odds ratios (OR) and 95% confidence intervals (CI) to assess the association between continuity of ambulatory care after discharge and readmission, mortality, and suicide risk.

Several sensitivity analyses were performed. First, the association was tested between continuity of ambulatory care and readmission, mortality, and suicide within 1 year after discharge using the SECON. Second, this study examined the association between continuity of care, which was categorized as perfect (continuity 1) versus imperfect (continuity < 1), and outcomes. A value of $P < 0.05$ was considered statistically significant. All statistical analyses were conducted using the SAS software package (ver. 9.4; SAS Institute, Cary, NC, USA).

## 7. Ethics statement

This study was reviewed and approved by the Ethical Review Board at Yonsei University [IRB number Y-2017-0008].

# IV. Results

## 1. Continuity of care and readmission

### (1) Characteristics of the study participants

The general characteristics of the study participants by readmission within 1 year after discharge (between 2002 and 2012) are shown in Appendix Table 3. Of the 18,702 psychiatric inpatients, 8,022 (42.9%) were readmitted within 1 year of hospital discharge (Appendix Table 3). Of these psychiatric inpatients, 5,880 (31.4%), 4,918 (26.3%), 1,592 (8.2%), 3,135 (16.8%), and 3177 (17.0%), respectively, had a primary diagnosis of a substance use disorder, schizophrenia, bipolar disorder, depressive disorder, and other psychiatric disorder. Patients diagnosed with a substance use disorder had the highest readmission rate within 1 year after discharge, followed by patients with schizophrenia, bipolar disorder, depressive disorder, and other mental disorder (53.7%, 50.3%, 38.4%, 30.5%, and 26.0%, respectively).

Table 8 displays the general characteristics of the readmission and control groups. The total case-control sample included 16,044 patients who were discharged with psychiatric disorders between 2002 and 2012. Each control participant (n = 8,022) was matched with 1 individual who had been readmitted

within 1 year after discharge (n = 8,022). The matching variables, including follow-up time and year of discharge, were distributed evenly between the study groups. The mean number of follow-up days did not differ between the readmitted (83.4; SD 95.4) and control (83.4; SD 95.4) groups.

As measured by the COCI, the percentage of patients readmitted within 1 year after discharge from the hospital was higher relative to the control group (3.7% vs. 2.4% for low continuity and 4.8% vs. 3.8% for medium continuity, respectively), whereas the proportion of patients in the readmission group with high continuity of care (16.6%) was lower relative to that of the control group (18.7%). The proportion of readmission within 1 year after discharge was higher for patients who were male, younger, in the lower income group, living in urban areas, diagnosed with more severe mental disorders, exceeded the median length of stay, had more hospitalizations, had more psychotherapy sessions, took antipsychotics, and were admitted to smaller hospitals, compared to that of the control group.

Table 8. Characteristics of the study participants matched on follow-up time and year of discharge, by readmission within 1 year after hospital discharge

| Variable | n | % | Case (readmission) | | Control | |
|---|---|---|---|---|---|---|
| | | | N | % | N | % |
| *Individual level* | 16044 | | 8022 | 50.0 | 8022 | 50.0 |
| **Continuity of care index**∗ | | | | | | |
| Total visits : 0 | 7478 | 46.6 | 3937 | 49.1 | 3541 | 44.1 |
| Total visits : 1-2 | 4551 | 28.4 | 2069 | 25.8 | 2482 | 30.9 |
| Low | 496 | 3.1 | 300 | 3.7 | 196 | 2.4 |
| Medium | 692 | 4.3 | 388 | 4.8 | 304 | 3.8 |
| High | 2827 | 17.6 | 1328 | 16.6 | 1499 | 18.7 |
| **Sex** | | | | | | |
| Male | 8976 | 55.9 | 4876 | 60.8 | 4100 | 51.1 |
| Female | 7068 | 44.1 | 3146 | 39.2 | 3922 | 48.9 |
| **Age** | | | | | | |
| -29 | 2527 | 15.8 | 1209 | 15.1 | 1318 | 16.4 |
| 30-39 | 3478 | 21.7 | 1921 | 23.9 | 1557 | 19.4 |
| 40-49 | 3892 | 24.3 | 2005 | 25.0 | 1887 | 23.5 |
| 50-59 | 3370 | 21.0 | 1761 | 22.0 | 1609 | 20.1 |
| 60-69 | 1739 | 10.8 | 777 | 9.7 | 962 | 12.0 |
| 70- | 1038 | 6.5 | 349 | 4.4 | 689 | 8.6 |
| **Income** | | | | | | |
| Q1(Low) | 2843 | 17.7 | 1450 | 18.1 | 1393 | 17.4 |
| Q2 | 2479 | 15.5 | 1273 | 15.9 | 1206 | 15.0 |
| Q3 | 3005 | 18.7 | 1523 | 19.0 | 1482 | 18.5 |
| Q4 | 3241 | 20.2 | 1547 | 19.3 | 1694 | 21.1 |
| Q5(High) | 4476 | 27.9 | 2229 | 27.8 | 2247 | 28.0 |
| **Residential area** | | | | | | |
| Rural | 5322 | 33.2 | 2577 | 32.1 | 2745 | 34.2 |
| Urban | 10722 | 66.8 | 5445 | 67.9 | 5277 | 65.8 |
| **Mental disability** | | | | | | |
| Normal | 14612 | 91.1 | 7010 | 87.4 | 7602 | 94.8 |
| Moderate | 522 | 3.3 | 363 | 4.5 | 159 | 2.0 |
| Severe | 910 | 5.7 | 649 | 8.1 | 261 | 3.3 |
| **Charlson's comorbidity index** | | | | | | |
| 0 | 13110 | 81.7 | 6623 | 82.6 | 6487 | 80.9 |
| 1 | 2212 | 13.8 | 1070 | 13.3 | 1142 | 14.2 |
| 2 | 491 | 3.1 | 224 | 2.8 | 267 | 3.3 |
| ≥3 | 231 | 1.4 | 105 | 1.3 | 126 | 1.6 |
| **Primary diagnosis** | | | | | | |
| Substance use disorder | 5518 | 34.4 | 3158 | 39.4 | 2360 | 29.4 |
| Schizophrenia | 4416 | 27.5 | 2473 | 30.8 | 1943 | 24.2 |
| Bipolar disorder | 1305 | 8.1 | 611 | 7.6 | 694 | 8.7 |
| Depressive disorder | 2431 | 15.2 | 955 | 11.9 | 1476 | 18.4 |
| Other mental disorder | 2374 | 14.8 | 825 | 10.3 | 1549 | 19.3 |

∗ Low (< 0.4), Medium (< 0.75), High (0.75–1) indicates at least three outpatient visits.

Table 8. Characteristics of the study participants matched on follow-up time and year of discharge, by readmission within 1 year after hospital discharge (continued)

| Variable | N | % | Case (readmission) | | Control | |
|---|---|---|---|---|---|---|
| | | | N | % | N | % |
| **Length of stay** | | | | | | |
| ≤23 days | 8501 | 53.0 | 4240 | 52.9 | 4261 | 53.1 |
| >23 days | 7543 | 47.0 | 3782 | 47.1 | 3761 | 46.9 |
| **No. of psychiatric admissions** | | | | | | |
| 1 | 6676 | 41.6 | 2014 | 25.1 | 4662 | 58.1 |
| 2 | 2611 | 16.3 | 1234 | 15.4 | 1377 | 17.2 |
| 3 | 1549 | 9.7 | 877 | 10.9 | 672 | 8.4 |
| ≥4 | 5208 | 32.5 | 3897 | 48.6 | 1311 | 16.3 |
| **Psychotherapy** | | | | | | |
| 0 per week | 1422 | 8.9 | 398 | 5.0 | 1024 | 12.8 |
| 1-2 per week | 760 | 4.7 | 310 | 3.9 | 450 | 5.6 |
| 3-4 per week | 2165 | 13.5 | 1078 | 13.4 | 1087 | 13.6 |
| 5-6 per week | 4838 | 30.2 | 2515 | 31.4 | 2323 | 29.0 |
| above 7 per week | 6859 | 42.8 | 3721 | 46.4 | 3138 | 39.1 |
| **Antidepressants** | | | | | | |
| No | 8414 | 52.4 | 4304 | 53.7 | 4110 | 51.2 |
| Yes | 7630 | 47.6 | 3718 | 46.3 | 3912 | 48.8 |
| **Antipsychotics** | | | | | | |
| No | 6423 | 40.0 | 2904 | 36.2 | 3519 | 43.9 |
| Yes | 9621 | 60.0 | 5118 | 63.8 | 4503 | 56.1 |
| **Anxiolytics** | | | | | | |
| No | 1764 | 11.0 | 1021 | 12.7 | 743 | 9.3 |
| Yes | 14280 | 89.0 | 7001 | 87.3 | 7279 | 90.7 |
| **Stabilizer** | | | | | | |
| No | 11503 | 71.7 | 5678 | 70.8 | 5825 | 72.6 |
| Yes | 4541 | 28.3 | 2344 | 29.2 | 2197 | 27.4 |
| *Hospital level* | | | | | | |
| **Type of hospital** | | | | | | |
| General hospital | 4986 | 31.1 | 1797 | 22.4 | 3189 | 39.8 |
| Hospital | 8306 | 51.8 | 4503 | 56.1 | 3803 | 47.4 |
| Clinic | 2752 | 17.2 | 1722 | 21.5 | 1030 | 12.8 |
| **Location of hospital** | | | | | | |
| Rural | 4888 | 30.5 | 2406 | 30.0 | 2482 | 30.9 |
| Urban | 11156 | 69.5 | 5616 | 70.0 | 5540 | 69.1 |
| **No. of beds** | | | | | | |
| <30 | 410 | 2.6 | 288 | 3.6 | 122 | 1.5 |
| <300 | 6909 | 43.1 | 3771 | 47.0 | 3138 | 39.1 |
| <1000 | 6720 | 41.9 | 3232 | 40.3 | 3488 | 43.5 |
| ≥1000 | 2005 | 12.5 | 731 | 9.1 | 1274 | 15.9 |
| **Ownership** | | | | | | |
| Public | 1055 | 6.6 | 540 | 6.7 | 515 | 6.4 |
| Corporate | 8147 | 50.8 | 3589 | 44.7 | 4558 | 56.8 |
| Private | 6842 | 42.6 | 3893 | 48.5 | 2949 | 36.8 |

**(2) Association between continuity of care and readmission within 1 year of hospital discharge**

Table 9 shows the results of both the crude and adjusted conditional logistic regression analyses of the association between continuity of psychiatric ambulatory care and readmission within 1 year after discharge. The adjusted odds ratio (AOR) for risk of readmission within 1 year after discharge among patients with medium- (AOR 1.519 95% CI 1.250–1.845) and low- continuity of care (AOR 1.769 95% CI 1.425–2.263) were significantly higher relative to patients with high continuity of care.

Higher risk for readmission within 1 year after discharge was associated with being male, younger, having a more severe mental disability, having multiple psychiatric admissions, participating in multiple psychotherapy sessions during hospitalization, taking medications, such as antipsychotics and antidepressants, and being discharged from a clinic. Lower readmission risk within 1 year after discharge was associated with exceeding the median length of stay.

Table 9. Association between continuity of care and readmission within 1 year after hospital discharge

| Variable | Readmission | | | | | | |
|---|---|---|---|---|---|---|---|
| | COR | 95% CI | | p-value | AOR | 95% CI | | p-value |
| *Individual level* | | | | | | | | |
| **Continuity of care index**\* | | | | | | | | |
| Total visits : 0 | 1.293 | 1.165 | 1.435 | <.0001 | 1.116 | 0.975 | 1.278 | 0.112 |
| Total visits : 1-2 | 0.947 | 0.850 | 1.054 | 0.318 | 1.019 | 0.895 | 1.160 | 0.778 |
| Low | **1.748** | **1.435** | **2.129** | **<.0001** | **1.796** | **1.425** | **2.263** | **<.0001** |
| Medium | **1.432** | **1.214** | **1.690** | **<.0001** | **1.519** | **1.250** | **1.845** | **<.0001** |
| High | 1.000 | | | | 1.000 | | | |
| **Sex** | | | | | | | | |
| Male | 1.479 | 1.389 | 1.575 | <.0001 | 1.095 | 1.005 | 1.194 | 0.038 |
| Female | 1.000 | | | | 1.000 | | | |
| **Age** | | | | | | | | |
| -29 | 1.000 | | | | 1.000 | | | |
| 30-39 | 1.357 | 1.221 | 1.507 | <.0001 | 0.933 | 0.820 | 1.062 | 0.294 |
| 40-49 | 1.171 | 1.057 | 1.297 | 0.003 | 0.828 | 0.726 | 0.944 | 0.005 |
| 50-59 | 1.190 | 1.071 | 1.321 | 0.001 | 0.840 | 0.733 | 0.963 | 0.012 |
| 60-69 | 0.885 | 0.782 | 1.002 | 0.055 | 0.796 | 0.679 | 0.933 | 0.005 |
| 70- | 0.556 | 0.477 | 0.647 | <.0001 | 0.651 | 0.538 | 0.788 | <.0001 |
| **Income** | | | | | | | | |
| Q1(Low) | 1.051 | 0.956 | 1.155 | 0.305 | 0.873 | 0.775 | 0.984 | 0.026 |
| Q2 | 1.063 | 0.964 | 1.173 | 0.222 | 0.980 | 0.867 | 1.107 | 0.740 |
| Q3 | 1.036 | 0.945 | 1.137 | 0.448 | 0.939 | 0.837 | 1.053 | 0.280 |
| Q4 | 0.919 | 0.839 | 1.007 | 0.070 | 0.934 | 0.835 | 1.045 | 0.235 |
| Q5(High) | 1.000 | | | | 1.000 | | | |
| **Residential area** | | | | | | | | |
| Rural | 1.000 | | | | 1.000 | | | |
| Urban | 1.099 | 1.029 | 1.174 | 0.005 | 1.036 | 0.930 | 1.153 | 0.525 |
| **Mental disability** | | | | | | | | |
| Normal | 1.000 | | | | 1.000 | | | |
| Moderate | 2.548 | 2.100 | 3.092 | <.0001 | 1.436 | 1.138 | 1.811 | 0.002 |
| Severe | 2.723 | 2.345 | 3.163 | <.0001 | 1.506 | 1.244 | 1.822 | <.0001 |
| **Charlson's comorbidity index** | | | | | | | | |
| 0 | 1.000 | | | | 1.000 | | | |
| 1 | 0.918 | 0.839 | 1.004 | 0.062 | 1.051 | 0.938 | 1.178 | 0.389 |
| 2 | 0.824 | 0.688 | 0.986 | 0.035 | 1.061 | 0.851 | 1.322 | 0.599 |
| ≥3 | 0.815 | 0.626 | 1.060 | 0.127 | 0.955 | 0.700 | 1.303 | 0.773 |
| **Primary diagnosis** | | | | | | | | |
| Substance use disorder | 2.464 | 2.226 | 2.728 | <.0001 | 1.531 | 1.333 | 1.760 | <.0001 |
| Schizophrenia | 2.344 | 2.110 | 2.604 | <.0001 | 1.244 | 1.071 | 1.444 | 0.004 |
| Bipolar disorder | 1.644 | 1.429 | 1.891 | <.0001 | 1.118 | 0.926 | 1.349 | 0.247 |
| Depressive disorder | 1.214 | 1.078 | 1.368 | 0.001 | 1.087 | 0.940 | 1.257 | 0.259 |
| Other mental disorder | 1.000 | | | | 1.000 | | | |

\* Low (< 0.4), Medium (< 0.75), High (0.75–1) indicates at least three outpatient visits.

Table 9. Association between continuity of care and readmission within 1 year after hospital discharge (continued)

| Variable | Readmission | | | | | | |
|---|---|---|---|---|---|---|---|
| | COR | 95% CI | | p-value | AOR | 95% CI | | p-value |
| **Length of stay** | | | | | | | | |
| ≤23 days | 1.000 | | | | 1.000 | | | |
| >23 days | 1.011 | 0.950 | 1.075 | 0.740 | 0.814 | 0.748 | 0.886 | <.0001 |
| **No. of psychiatric admissions** | | | | | | | | |
| 1 | 1.000 | | | | 1.000 | | | |
| 2 | 2.201 | 1.985 | 2.441 | <.0001 | 1.964 | 1.762 | 2.189 | <.0001 |
| 3 | 3.338 | 2.938 | 3.794 | <.0001 | 2.836 | 2.480 | 3.242 | <.0001 |
| ≥4 | 8.165 | 7.382 | 9.032 | <.0001 | 6.035 | 5.421 | 6.719 | <.0001 |
| **Psychotherapy** | | | | | | | | |
| 0 per week | 1.000 | | | | 1.000 | | | |
| 1-2 per week | 1.781 | 1.476 | 2.151 | <.0001 | 1.262 | 1.002 | 1.589 | 0.048 |
| 3-4 per week | 2.550 | 2.206 | 2.948 | <.0001 | 1.538 | 1.281 | 1.847 | <.0001 |
| 5-6 per week | 2.811 | 2.464 | 3.207 | <.0001 | 1.670 | 1.409 | 1.979 | <.0001 |
| above 7 per week | 3.051 | 2.685 | 3.468 | <.0001 | 1.619 | 1.368 | 1.916 | <.0001 |
| **Antidepressants** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 0.907 | 0.852 | 0.965 | 0.002 | 1.165 | 1.068 | 1.272 | 0.001 |
| **Antipsychotics** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 1.375 | 1.290 | 1.465 | <.0001 | 1.178 | 1.067 | 1.300 | 0.001 |
| **Anxiolytics** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 0.700 | 0.633 | 0.774 | <.0001 | 0.823 | 0.717 | 0.945 | 0.006 |
| **Stabilizer** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 1.093 | 1.021 | 1.171 | 0.011 | 0.982 | 0.891 | 1.082 | 0.713 |
| *Hospital level* | | | | | | | | |
| **Type of hospital** | | | | | | | | |
| General hospital | 1.000 | | | | 1.000 | | | |
| Hospital | 2.146 | 1.990 | 2.315 | <.0001 | 1.289 | 1.143 | 1.453 | <.0001 |
| Clinic | 3.060 | 2.765 | 3.386 | <.0001 | 1.686 | 1.409 | 2.018 | <.0001 |
| **Location of hospital** | | | | | | | | |
| Rural | 1.000 | | | | 1.000 | | | |
| Urban | 1.046 | 0.978 | 1.119 | 0.192 | 0.967 | 0.863 | 1.083 | 0.557 |
| **No. of beds** | | | | | | | | |
| <30 | 1.000 | | | | 1.000 | | | |
| <300 | 0.517 | 0.415 | 0.644 | <.0001 | 0.867 | 0.659 | 1.141 | 0.308 |
| <1000 | 0.394 | 0.316 | 0.490 | <.0001 | 0.923 | 0.687 | 1.242 | 0.597 |
| ≥1000 | 0.243 | 0.193 | 0.307 | <.0001 | 0.710 | 0.515 | 0.979 | 0.037 |
| **Ownership** | | | | | | | | |
| Public | 1.000 | | | | 1.000 | | | |
| Corporate | 0.756 | 0.664 | 0.860 | <.0001 | 1.121 | 0.946 | 1.329 | 0.187 |
| Private | 1.283 | 1.124 | 1.464 | 0.000 | 1.192 | 0.992 | 1.433 | 0.061 |

## 2. Continuity of care and all-cause mortality

### (1) Characteristics of the study participants

Table 10 displays the general characteristics of the participants on all-cause mortality in the case and control groups. The total case-control sample included 3,905 patients who were discharged with psychiatric disorders between 2002 and 2012. Each control participant (n = 3550) was matched with up to 10 individuals who died within 1 year after discharge (n = 355). The matching variables, including follow-up time and year of discharge, were distributed evenly between the groups. The mean number of follow-up days did not differ between the case (128.3; SD 95.4) and control (128.3; SD 95.4) groups. The proportion of all-cause mortality within 1 year after discharge was higher for participants who were male, older, had a lower income, had higher Carlson's comorbidity scores, had more severe mental disorders, and exceeded the median length of stay.

Table 10. Characteristics of the study participants matched on follow-up time and year of discharge, by all-cause mortality within 1 year after hospital discharge

| Variable | n | % | Case (Mortality) N | Case (Mortality) % | Control N | Control % |
|---|---|---|---|---|---|---|
| *Individual level* | 3905 | | 355 | 9.1 | 3550 | 90.9 |
| **Continuity of care index*** | | | | | | |
| Total visits : 0 | 1352 | 34.6 | 170 | 47.9 | 1182 | 33.3 |
| Total visits : 1-2 | 1010 | 25.9 | 85 | 23.9 | 925 | 26.1 |
| Low | 111 | 2.8 | 13 | 3.7 | 98 | 2.8 |
| Medium | 246 | 6.3 | 21 | 5.9 | 225 | 6.3 |
| High | 1186 | 30.4 | 66 | 18.6 | 1120 | 31.5 |
| **Sex** | | | | | | |
| Male | 1991 | 51.0 | 251 | 70.7 | 1740 | 49.0 |
| Female | 1914 | 49.0 | 104 | 29.3 | 1810 | 51.0 |
| **Age** | | | | | | |
| -29 | 636 | 16.3 | 27 | 7.6 | 609 | 17.2 |
| 30-39 | 716 | 18.3 | 39 | 11.0 | 677 | 19.1 |
| 40-49 | 906 | 23.2 | 77 | 21.7 | 829 | 23.4 |
| 50-59 | 748 | 19.2 | 81 | 22.8 | 667 | 18.8 |
| 60-69 | 504 | 12.9 | 64 | 18.0 | 440 | 12.4 |
| 70- | 395 | 10.1 | 67 | 18.9 | 328 | 9.2 |
| **Income** | | | | | | |
| Q1(Low) | 613 | 15.7 | 59 | 16.6 | 554 | 15.6 |
| Q2 | 605 | 15.5 | 62 | 17.5 | 543 | 15.3 |
| Q3 | 688 | 17.6 | 59 | 16.6 | 629 | 17.7 |
| Q4 | 855 | 21.9 | 79 | 22.3 | 776 | 21.9 |
| Q5(High) | 1144 | 29.3 | 96 | 27.0 | 1048 | 29.5 |
| **Residential area** | | | | | | |
| Rural | 1293 | 33.1 | 110 | 31.0 | 1183 | 33.3 |
| Urban | 2612 | 66.9 | 245 | 69.0 | 2367 | 66.7 |
| **Mental disability** | | | | | | |
| Normal | 3735 | 95.6 | 343 | 96.6 | 3392 | 95.5 |
| Moderate | 71 | 1.8 | 6 | 1.7 | 65 | 1.8 |
| Severe | 99 | 2.5 | 6 | 1.7 | 93 | 2.6 |
| **Charlson's comorbidity index** | | | | | | |
| 0 | 3081 | 78.9 | 213 | 60.0 | 2868 | 80.8 |
| 1 | 571 | 14.6 | 85 | 23.9 | 486 | 13.7 |
| 2 | 162 | 4.1 | 25 | 7.0 | 137 | 3.9 |
| ≥3 | 91 | 2.3 | 32 | 9.0 | 59 | 1.7 |
| **Primary diagnosis** | | | | | | |
| Substance use disorder | 1142 | 29.2 | 168 | 47.3 | 974 | 27.4 |
| Schizophrenia | 908 | 23.3 | 60 | 16.9 | 848 | 23.9 |
| Bipolar disorder | 343 | 8.8 | 18 | 5.1 | 325 | 9.2 |
| Depressive disorder | 720 | 18.4 | 64 | 18.0 | 656 | 18.5 |
| Other mental disorder | 792 | 20.3 | 45 | 12.7 | 747 | 21.0 |

* Low (< 0.4), Medium (< 0.75), High (0.75–1) indicates at least three outpatient visits.

Table 10. Characteristics of the study participants matched on follow-up time and year of discharge, by all-cause mortality within 1 year after hospital discharge (continued)

| Variable | N | % | Case (Mortality) | | Control | |
|---|---|---|---|---|---|---|
| | | | N | % | n | % |
| **Length of stay** | | | | | | |
| ≤23 days | 2126 | 54.4 | 151 | 42.5 | 1975 | 55.6 |
| >23 days | 1779 | 45.6 | 204 | 57.5 | 1575 | 44.4 |
| **No. of psychiatric admissions** | | | | | | |
| 1 | 2348 | 60.1 | 176 | 49.6 | 2172 | 61.2 |
| 2 | 690 | 17.7 | 69 | 19.4 | 621 | 17.5 |
| 3 | 297 | 7.6 | 32 | 9.0 | 265 | 7.5 |
| ≥4 | 570 | 14.6 | 78 | 22.0 | 492 | 13.9 |
| **Psychotherapy** | | | | | | |
| 0 per week | 521 | 13.3 | 47 | 13.2 | 474 | 13.4 |
| 1-2 per week | 227 | 5.8 | 31 | 8.7 | 196 | 5.5 |
| 3-4 per week | 519 | 13.3 | 38 | 10.7 | 481 | 13.5 |
| 5-6 per week | 1128 | 28.9 | 103 | 29.0 | 1025 | 28.9 |
| above 7 per week | 1510 | 38.7 | 136 | 38.3 | 1374 | 38.7 |
| **Antidepressants** | | | | | | |
| No | 1972 | 50.5 | 171 | 48.2 | 1801 | 50.7 |
| Yes | 1933 | 49.5 | 184 | 51.8 | 1749 | 49.3 |
| **Antipsychotics** | | | | | | |
| No | 1735 | 44.4 | 157 | 44.2 | 1578 | 44.5 |
| Yes | 2170 | 55.6 | 198 | 55.8 | 1972 | 55.5 |
| **Anxiolytics** | | | | | | |
| No | 401 | 10.3 | 34 | 9.6 | 367 | 10.3 |
| Yes | 3504 | 89.7 | 321 | 90.4 | 3183 | 89.7 |
| **Stabilizer** | | | | | | |
| No | 2866 | 73.4 | 284 | 80.0 | 2582 | 72.7 |
| Yes | 1039 | 26.6 | 71 | 20.0 | 968 | 27.3 |
| *Hospital level* | | | | | | |
| **Type of hospital** | | | | | | |
| General hospital | 1600 | 41.0 | 102 | 28.7 | 1498 | 42.2 |
| Hospital | 1825 | 46.7 | 209 | 58.9 | 1616 | 45.5 |
| Clinic | 480 | 12.3 | 44 | 12.4 | 436 | 12.3 |
| **Location of hospital** | | | | | | |
| Rural | 1207 | 30.9 | 122 | 34.4 | 1085 | 30.6 |
| Urban | 2698 | 69.1 | 233 | 65.6 | 2465 | 69.4 |
| **No. of beds** | | | | | | |
| <30 | 55 | 1.4 | 5 | 1.4 | 50 | 1.4 |
| <300 | 1461 | 37.4 | 157 | 44.2 | 1304 | 36.7 |
| <1000 | 1789 | 45.8 | 153 | 43.1 | 1636 | 46.1 |
| ≥1000 | 600 | 15.4 | 40 | 11.3 | 560 | 15.8 |
| **Ownership** | | | | | | |
| Public | 256 | 6.6 | 29 | 8.2 | 227 | 6.4 |
| Corporate | 2297 | 58.8 | 175 | 49.3 | 2122 | 59.8 |
| Private | 1352 | 34.6 | 151 | 42.5 | 1201 | 33.8 |

**(2) Association between continuity of care and all-cause mortality within 1 year of hospital discharge**

Table 11 shows the results of the adjusted conditional logistic regression analyses of the association between continuity of care and all cause-mortality within 1 year after discharge. Compared with the patients who had high continuity of care, the all-cause mortality within 1 year after discharge among patients who had low continuity (AOR 3.118 95% CI: 1.592–6.106), 1 or 2 psychiatric outpatients visits (AOR 1.532 95% CI: 1.046–2.243), and no visits (AOR 1.774 95% CI: 1.220–2.579) was significantly higher. The AORs for all-cause mortality risk within 1 year after discharge were significantly higher for psychiatric inpatients who were male, age 70 years and older, exceeded the median length of stay, had a higher comorbidity score, and had multiple psychiatric admissions.

Table 11. Association between continuity of care and all-cause mortality within 1 year after hospital discharge

| Variable | COR | 95% CI | | p-value | AOR | 95% CI | | p-value |
|---|---|---|---|---|---|---|---|---|
| *Individual level* | | | | | | | | |
| **Continuity of care index**\* | | | | | | | | |
| Total visits : 0 | 2.615 | 1.925 | 3.553 | <.0001 | 1.774 | 1.220 | 2.579 | 0.003 |
| Total visits : 1-2 | 1.696 | 1.193 | 2.410 | 0.003 | 1.532 | 1.046 | 2.243 | 0.029 |
| Low | **2.340** | **1.240** | **4.414** | **0.009** | **3.118** | **1.592** | **6.106** | **0.001** |
| Medium | 1.547 | 0.927 | 2.583 | 0.095 | 1.697 | 0.984 | 2.927 | 0.057 |
| High | 1.000 | | | | 1.000 | | | |
| **Sex** | | | | | | | | |
| Male | 2.507 | 1.976 | 3.181 | <.0001 | 1.768 | 1.333 | 2.346 | <.0001 |
| Female | 1.000 | | | | 1.000 | | | |
| **Age** | | | | | | | | |
| -29 | 1.000 | | | | 1.000 | | | |
| 30-39 | 1.283 | 0.777 | 2.120 | 0.330 | 0.930 | 0.547 | 1.581 | 0.788 |
| 40-49 | 2.070 | 1.320 | 3.246 | 0.002 | 1.263 | 0.773 | 2.064 | 0.352 |
| 50-59 | 2.748 | 1.750 | 4.313 | <.0001 | 1.532 | 0.929 | 2.528 | 0.095 |
| 60-69 | 3.256 | 2.047 | 5.180 | <.0001 | 1.645 | 0.981 | 2.756 | 0.059 |
| 70- | 4.561 | 2.863 | 7.267 | <.0001 | 3.597 | 2.128 | 6.082 | <.0001 |
| **Income** | | | | | | | | |
| Q1(Low) | 1.162 | 0.826 | 1.635 | 0.387 | 1.210 | 0.833 | 1.758 | 0.317 |
| Q2 | 1.243 | 0.890 | 1.737 | 0.202 | 1.293 | 0.897 | 1.865 | 0.168 |
| Q3 | 1.025 | 0.729 | 1.442 | 0.887 | 1.022 | 0.709 | 1.474 | 0.908 |
| Q4 | 1.111 | 0.813 | 1.519 | 0.508 | 1.099 | 0.782 | 1.545 | 0.586 |
| Q5(High) | 1.000 | | | | 1.000 | | | |
| **Residential area** | | | | | | | | |
| Rural | 1.000 | | | | 1.000 | | | |
| Urban | 1.114 | 0.879 | 1.412 | 0.370 | 1.393 | 1.002 | 1.936 | 0.049 |
| **Mental disability** | | | | | | | | |
| Normal | 1.000 | | | | 1.000 | | | |
| Moderate | 0.912 | 0.394 | 2.112 | 0.830 | 1.198 | 0.490 | 2.924 | 0.692 |
| Severe | 0.634 | 0.274 | 1.465 | 0.286 | 0.473 | 0.186 | 1.203 | 0.116 |
| **Charlson's comorbidity index** | | | | | | | | |
| 0 | 1.000 | | | | 1.000 | | | |
| 1 | 2.373 | 1.811 | 3.110 | <.0001 | 1.745 | 1.301 | 2.342 | 0.000 |
| 2 | 2.468 | 1.575 | 3.867 | <.0001 | 1.601 | 0.985 | 2.603 | 0.058 |
| ≥3 | 7.327 | 4.653 | 11.538 | <.0001 | 5.378 | 3.264 | 8.861 | <.0001 |
| **Primary diagnosis** | | | | | | | | |
| Substance use disorder | 2.855 | 2.027 | 4.021 | <.0001 | 1.453 | 0.948 | 2.226 | 0.087 |
| Schizophrenia | 1.178 | 0.790 | 1.756 | 0.422 | 1.101 | 0.665 | 1.823 | 0.709 |
| Bipolar disorder | 0.932 | 0.531 | 1.635 | 0.807 | 1.159 | 0.596 | 2.252 | 0.664 |
| Depressive disorder | 1.622 | 1.091 | 2.410 | 0.017 | 1.568 | 0.997 | 2.465 | 0.052 |
| Other mental disorder | 1.000 | | | | 1.000 | | | |

\* Low (< 0.4), Medium (< 0.75), High (0.75-1) indicates at least three outpatient visits.

Table 11. Association between continuity of care and all-cause mortality within 1 year after hospital discharge (continued)

| Variable | COR | 95% CI | | p-value | AOR | 95% CI | | p-value |
|---|---|---|---|---|---|---|---|---|
| **Length of stay** | | | | | | | | |
| ≤23 days | 1.000 | | | | 1.000 | | | |
| >23 days | 1.701 | 1.363 | 2.122 | <.0001 | 1.598 | 1.221 | 2.090 | 0.001 |
| **No. of psychiatric admissions** | | | | | | | | |
| 1 | 1.000 | | | | 1.000 | | | |
| 2 | 1.390 | 1.036 | 1.863 | 0.028 | 1.614 | 1.172 | 2.222 | 0.003 |
| 3 | 1.530 | 1.025 | 2.283 | 0.037 | 1.882 | 1.219 | 2.904 | 0.004 |
| ≥4 | 2.046 | 1.524 | 2.746 | <.0001 | 2.255 | 1.619 | 3.141 | <.0001 |
| **Psychotherapy** | | | | | | | | |
| 0 per week | 1.000 | | | | 1.000 | | | |
| 1-2 per week | 1.578 | 0.978 | 2.545 | 0.061 | 0.985 | 0.552 | 1.759 | 0.960 |
| 3-4 per week | 0.797 | 0.511 | 1.243 | 0.317 | 0.565 | 0.329 | 0.972 | 0.039 |
| 5-6 per week | 1.008 | 0.702 | 1.447 | 0.965 | 0.734 | 0.455 | 1.185 | 0.206 |
| above 7 per week | 0.995 | 0.702 | 1.411 | 0.978 | 0.696 | 0.433 | 1.117 | 0.133 |
| **Antidepressants** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 1.109 | 0.891 | 1.381 | 0.355 | 1.059 | 0.810 | 1.384 | 0.675 |
| **Antipsychotics** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 1.009 | 0.811 | 1.256 | 0.935 | 1.312 | 0.981 | 1.754 | 0.067 |
| **Anxiolytics** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 1.088 | 0.753 | 1.572 | 0.654 | 0.884 | 0.578 | 1.353 | 0.571 |
| **Stabilizer** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 0.669 | 0.511 | 0.876 | 0.003 | 0.734 | 0.532 | 1.012 | 0.059 |
| *Hospital level* | | | | | | | | |
| **Type of hospital** | | | | | | | | |
| General hospital | 1.000 | | | | 1.000 | | | |
| Hospital | 1.921 | 1.497 | 2.464 | <.0001 | 1.272 | 0.891 | 1.816 | 0.185 |
| Clinic | 1.476 | 1.018 | 2.139 | 0.040 | 1.169 | 0.675 | 2.024 | 0.578 |
| **Location of hospital** | | | | | | | | |
| Rural | 1.000 | | | | 1.000 | | | |
| Urban | 0.839 | 0.666 | 1.058 | 0.138 | 0.765 | 0.544 | 1.076 | 0.123 |
| **No. of beds** | | | | | | | | |
| <30 | 1.000 | | | | 1.000 | | | |
| <300 | 1.211 | 0.476 | 3.084 | 0.688 | 0.934 | 0.337 | 2.593 | 0.896 |
| <1000 | 0.941 | 0.369 | 2.397 | 0.899 | 0.908 | 0.310 | 2.664 | 0.861 |
| ≥1000 | 0.717 | 0.271 | 1.897 | 0.503 | 1.209 | 0.386 | 3.784 | 0.745 |
| **Ownership** | | | | | | | | |
| Public | 1.000 | | | | 1.000 | | | |
| Corporate | 0.643 | 0.423 | 0.979 | 0.039 | 0.659 | 0.409 | 1.060 | 0.086 |
| Private | 0.987 | 0.644 | 1.511 | 0.952 | 0.862 | 0.508 | 1.465 | 0.583 |

The header spans: COR | 95% CI | p-value | AOR | 95% CI | p-value, all under "All-cause mortality".

## 3. Continuity of care and suicide

### (1) Characteristics of the study participants

Table 12 displays the general characteristics of all-cause mortality in the control group. The total case-control sample included 1,188 patients who were discharged with psychiatric disorders between 2002 and 2012. Each control participant (n = 1,080) was matched with up to 10 individuals who died by suicide within 1 year of discharge (n = 108). The matching variables, including follow-up time and year of discharge, were distributed evenly between the groups. The mean number of follow-up days did not differ between the case (151.6; SD 103.2) and control (151.6; SD 103.2) groups. The proportion of patients who died by suicide within 1 year after discharge was higher among males, those with a primary diagnosis of depressive disorder, and those who were taking antidepressants or antipsychotics.

Table 12. Characteristics of the study participants, matched on follow-up time and year of discharge, by suicide within 1 year after discharge

| Variable | n | % | Case (Suicide) | | Control | |
|---|---|---|---|---|---|---|
| | | | N | % | n | % |
| *Individual level* | 1188 | | 108 | 9.1 | 1080 | 90.9 |
| **Continuity of care index**\* | | | | | | |
| Total visits : 0 | 417 | 35.1 | 28 | 25.9 | 389 | 36.0 |
| Total visits : 1-2 | 312 | 26.3 | 32 | 29.6 | 280 | 25.9 |
| Low | 35 | 2.9 | 7 | 6.5 | 28 | 2.6 |
| Medium | 66 | 5.6 | 11 | 10.2 | 55 | 5.1 |
| High | 358 | 30.1 | 30 | 27.8 | 328 | 30.4 |
| **Sex** | | | | | | |
| Male | 609 | 51.3 | 63 | 58.3 | 546 | 50.6 |
| Female | 579 | 48.7 | 45 | 41.7 | 534 | 49.4 |
| **Age** | | | | | | |
| -29 | 196 | 16.5 | 15 | 13.9 | 181 | 16.8 |
| 30-39 | 213 | 17.9 | 24 | 22.2 | 189 | 17.5 |
| 40-49 | 296 | 24.9 | 25 | 23.1 | 271 | 25.1 |
| 50-59 | 233 | 19.6 | 24 | 22.2 | 209 | 19.4 |
| 60-69 | 136 | 11.4 | 10 | 9.3 | 126 | 11.7 |
| 70- | 114 | 9.6 | 10 | 9.3 | 104 | 9.6 |
| **Income** | | | | | | |
| Q1(Low) | 195 | 16.4 | 10 | 9.3 | 185 | 17.1 |
| Q2 | 175 | 14.7 | 19 | 17.6 | 156 | 14.4 |
| Q3 | 216 | 18.2 | 19 | 17.6 | 197 | 18.2 |
| Q4 | 253 | 21.3 | 32 | 29.6 | 221 | 20.5 |
| Q5(High) | 349 | 29.4 | 28 | 25.9 | 321 | 29.7 |
| **Residential area** | | | | | | |
| Rural | 388 | 32.7 | 32 | 29.6 | 356 | 33.0 |
| Urban | 800 | 67.3 | 76 | 70.4 | 724 | 67.0 |
| **Mental disability** | | | | | | |
| Normal | 1130 | 95.1 | 105 | 97.2 | 1025 | 94.9 |
| Moderate | 23 | 1.9 | 2 | 1.9 | 21 | 1.9 |
| Severe | 35 | 2.9 | 1 | 0.9 | 34 | 3.1 |
| **Charlson's comorbidity index** | | | | | | |
| 0 | 942 | 79.3 | 84 | 77.8 | 858 | 79.4 |
| 1 | 182 | 15.3 | 18 | 16.7 | 164 | 15.2 |
| 2 | 43 | 3.6 | 3 | 2.8 | 40 | 3.7 |
| ≥3 | 21 | 1.8 | 3 | 2.8 | 18 | 1.7 |
| **Primary diagnosis** | | | | | | |
| Substance use disorder | 334 | 28.1 | 29 | 26.9 | 305 | 28.2 |
| Schizophrenia | 290 | 24.4 | 26 | 24.1 | 264 | 24.4 |
| Bipolar disorder | 116 | 9.8 | 11 | 10.2 | 105 | 9.7 |
| Depressive disorder | 229 | 19.3 | 28 | 25.9 | 201 | 18.6 |
| Other mental disorder | 219 | 18.4 | 14 | 13.0 | 205 | 19.0 |

\* Low (< 0.4), Medium (< 0.75), High (0.75-1) indicates at least three outpatient visits.

Table 12. Characteristics of the study participants matched on follow-up time and year of discharge, by suicide within 1 year after hospital discharge (continued)

| Variable | N | % | Case (Suicide) | | Control | |
|---|---|---|---|---|---|---|
| | | | N | % | n | % |
| **Length of stay** | | | | | | |
| ≤23 days | 607 | 51.1 | 49 | 45.4 | 558 | 51.7 |
| >23 days | 581 | 48.9 | 59 | 54.6 | 522 | 48.3 |
| **No. of psychiatric admissions** | | | | | | |
| 1 | 687 | 57.8 | 44 | 40.7 | 643 | 59.5 |
| 2 | 247 | 20.8 | 31 | 28.7 | 216 | 20.0 |
| 3 | 90 | 7.6 | 11 | 10.2 | 79 | 7.3 |
| ≥4 | 164 | 13.8 | 22 | 20.4 | 142 | 13.1 |
| **Psychotherapy** | | | | | | |
| 0 per week | 138 | 11.6 | 6 | 5.6 | 132 | 12.2 |
| 1-2 per week | 61 | 5.1 | 7 | 6.5 | 54 | 5.0 |
| 3-4 per week | 166 | 14.0 | 10 | 9.3 | 156 | 14.4 |
| 5-6 per week | 330 | 27.8 | 36 | 33.3 | 294 | 27.2 |
| above 7 per week | 493 | 41.5 | 49 | 45.4 | 444 | 41.1 |
| **Antidepressants** | | | | | | |
| No | 607 | 51.1 | 48 | 44.4 | 559 | 51.8 |
| Yes | 581 | 48.9 | 60 | 55.6 | 521 | 48.2 |
| **Antipsychotics** | | | | | | |
| No | 479 | 40.3 | 34 | 31.5 | 445 | 41.2 |
| Yes | 709 | 59.7 | 74 | 68.5 | 635 | 58.8 |
| **Anxiolytics** | | | | | | |
| No | 105 | 8.8 | 9 | 8.3 | 96 | 8.9 |
| Yes | 1083 | 91.2 | 99 | 91.7 | 984 | 91.1 |
| **Stabilizer** | | | | | | |
| No | 856 | 72.1 | 74 | 68.5 | 782 | 72.4 |
| Yes | 332 | 27.9 | 34 | 31.5 | 298 | 27.6 |
| *Hospital level* | | | | | | |
| **Type of hospital** | | | | | | |
| General hospital | 465 | 39.1 | 39 | 36.1 | 426 | 39.4 |
| Hospital | 584 | 49.2 | 61 | 56.5 | 523 | 48.4 |
| Clinic | 139 | 11.7 | 8 | 7.4 | 131 | 12.1 |
| **Location of hospital** | | | | | | |
| Rural | 357 | 30.1 | 33 | 30.6 | 324 | 30.0 |
| Urban | 831 | 69.9 | 75 | 69.4 | 756 | 70.0 |
| **No. of beds** | | | | | | |
| <30 | 14 | 1.2 | 1 | 0.9 | 13 | 1.2 |
| <300 | 472 | 39.7 | 38 | 35.2 | 434 | 40.2 |
| <1000 | 511 | 43.0 | 50 | 46.3 | 461 | 42.7 |
| ≥1000 | 191 | 16.1 | 19 | 17.6 | 172 | 15.9 |
| **Ownership** | | | | | | |
| Public | 75 | 6.3 | 9 | 8.3 | 66 | 6.1 |
| Coporate | 695 | 58.5 | 61 | 56.5 | 634 | 58.7 |
| Private | 418 | 35.2 | 38 | 35.2 | 380 | 35.2 |

**(2) Association between continuity of care and suicide within 1 year of hospital discharge**

Table 13 shows the results of the adjusted conditional logistic regression analyses of the association between continuity of care and death by suicide 1 year after discharge. Compared to those who had high continuity of care, those with medium (AOR 2.709 95% CI: 1.168–6.284) and low continuity (AOR 3.839 95% CI: 1.351–10.914) had an increased risk of suicide within 1 year after hospital discharge. The AORs for suicide risk within 1 year after discharge were significantly higher among the psychiatric inpatients who were male, and had multiple psychiatric admissions.

Table 13. Association between continuity of care and suicide within 1 year after hospital discharge

| Variable | Suicide | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | COR | 95% CI | | p-value | AOR | 95% CI | | p-value |
| ***Individual level*** | | | | | | | | |
| **Continuity of care index**\* | | | | | | | | |
| Total visits : 0 | 0.767 | 0.431 | 1.365 | 0.367 | 0.916 | 0.461 | 1.821 | 0.803 |
| Total visits : 1-2 | 1.225 | 0.677 | 2.218 | 0.503 | 1.607 | 0.835 | 3.092 | 0.156 |
| Low | **2.718** | **1.078** | **6.855** | **0.034** | **3.839** | **1.351** | **10.914** | **0.012** |
| Medium | **2.205** | **1.033** | **4.705** | **0.041** | **2.709** | **1.168** | **6.284** | **0.020** |
| High | 1.000 | | | | 1.000 | | | |
| **Sex** | | | | | | | | |
| Male | 1.363 | 0.915 | 2.030 | 0.127 | 1.804 | 1.112 | 2.927 | 0.017 |
| Female | 1.000 | | | | 1.000 | | | |
| **Age** | | | | | | | | |
| -29 | 1.000 | | | | 1.000 | | | |
| 30-39 | 1.542 | 0.780 | 3.049 | 0.213 | 1.418 | 0.672 | 2.991 | 0.359 |
| 40-49 | 1.125 | 0.574 | 2.203 | 0.732 | 1.262 | 0.593 | 2.687 | 0.546 |
| 50-59 | 1.390 | 0.708 | 2.729 | 0.339 | 1.342 | 0.627 | 2.874 | 0.449 |
| 60-69 | 0.966 | 0.422 | 2.212 | 0.935 | 0.863 | 0.346 | 2.153 | 0.752 |
| 70- | 1.166 | 0.506 | 2.691 | 0.718 | 1.824 | 0.698 | 4.763 | 0.220 |
| **Income** | | | | | | | | |
| Q1(Low) | 0.613 | 0.290 | 1.297 | 0.201 | 0.786 | 0.350 | 1.766 | 0.560 |
| Q2 | 1.380 | 0.745 | 2.556 | 0.306 | 1.559 | 0.791 | 3.072 | 0.199 |
| Q3 | 1.109 | 0.602 | 2.044 | 0.740 | 1.269 | 0.655 | 2.456 | 0.480 |
| Q4 | 1.679 | 0.980 | 2.878 | 0.059 | 2.002 | 1.096 | 3.656 | 0.024 |
| Q5(High) | 1.000 | | | | 1.000 | | | |
| **Residential area** | | | | | | | | |
| Rural | 1.000 | | | | 1.000 | | | |
| Urban | 1.172 | 0.757 | 1.814 | 0.476 | 1.245 | 0.681 | 2.274 | 0.477 |
| **Mental disability** | | | | | | | | |
| Normal | 1.000 | | | | 1.000 | | | |
| Moderate | 0.932 | 0.214 | 4.059 | 0.925 | 0.481 | 0.097 | 2.376 | 0.369 |
| Severe | 0.289 | 0.039 | 2.125 | 0.223 | 0.154 | 0.019 | 1.266 | 0.082 |
| **Charlson's comorbidity index** | | | | | | | | |
| 0 | 1.000 | | | | 1.000 | | | |
| 1 | 1.126 | 0.658 | 1.926 | 0.666 | 1.169 | 0.656 | 2.082 | 0.597 |
| 2 | 0.767 | 0.234 | 2.515 | 0.661 | 0.737 | 0.199 | 2.733 | 0.648 |
| ≥3 | 1.706 | 0.495 | 5.875 | 0.398 | 1.979 | 0.491 | 7.983 | 0.338 |
| **Primary diagnosis** | | | | | | | | |
| Substance use disorder | 1.377 | 0.711 | 2.666 | 0.343 | 0.728 | 0.323 | 1.641 | 0.444 |
| Schizophrenia | 1.429 | 0.731 | 2.790 | 0.296 | 0.908 | 0.398 | 2.071 | 0.819 |
| Bipolar disorder | 1.532 | 0.669 | 3.506 | 0.313 | 0.787 | 0.290 | 2.135 | 0.639 |
| Depressive disorder | 2.029 | 1.041 | 3.954 | 0.038 | 1.739 | 0.831 | 3.641 | 0.142 |
| Other mental disorder | 1.000 | | | | 1.000 | | | |

\* Low (< 0.4), Medium (< 0.75), High (0.75-1) indicates at least three outpatient visits.

Table 13. Association between continuity of care and suicide within 1 year after hospital discharge (continued)

| Variable | Suicide | | | | | | |
|---|---|---|---|---|---|---|---|
| | COR | 95% CI | | p-value | AOR | 95% CI | | p-value |
| **Length of stay** | | | | | | | | |
| ≤23 days | 1.000 | | | | 1.000 | | | |
| >23 days | 1.294 | 0.866 | 1.933 | 0.209 | 1.123 | 0.694 | 1.819 | 0.636 |
| **No. of psychiatric admissions** | | | | | | | | |
| 1 | 1.000 | | | | 1.000 | | | |
| 2 | 2.096 | 1.289 | 3.410 | 0.003 | 2.239 | 1.313 | 3.816 | 0.003 |
| 3 | 2.082 | 1.027 | 4.221 | 0.042 | 1.978 | 0.916 | 4.274 | 0.083 |
| ≥4 | 2.314 | 1.335 | 4.012 | 0.003 | 2.536 | 1.339 | 4.804 | 0.004 |
| **Psychotherapy** | | | | | | | | |
| 0 per week | 1.000 | | | | 1.000 | | | |
| 1-2 per week | 2.852 | 0.917 | 8.872 | 0.070 | 1.277 | 0.360 | 4.524 | 0.705 |
| 3-4 per week | 1.397 | 0.494 | 3.950 | 0.528 | 0.783 | 0.250 | 2.457 | 0.675 |
| 5-6 per week | 2.669 | 1.103 | 6.461 | 0.030 | 1.501 | 0.551 | 4.089 | 0.427 |
| above 7 per week | 2.436 | 1.018 | 5.829 | 0.045 | 1.468 | 0.545 | 3.953 | 0.448 |
| **Antidepressants** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 1.339 | 0.900 | 1.991 | 0.150 | 1.274 | 0.768 | 2.113 | 0.348 |
| **Antipsychotics** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 1.521 | 0.997 | 2.322 | 0.052 | 1.298 | 0.747 | 2.256 | 0.354 |
| **Anxiolytics** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 1.074 | 0.525 | 2.198 | 0.846 | 0.614 | 0.265 | 1.418 | 0.253 |
| **Stabilizer** | | | | | | | | |
| No | 1.000 | | | | 1.000 | | | |
| Yes | 1.205 | 0.786 | 1.845 | 0.392 | 1.161 | 0.676 | 1.994 | 0.589 |
| *Hospital level* | | | | | | | | |
| **Type of hospital** | | | | | | | | |
| General hospital | 1.000 | | | | 1.000 | | | |
| Hospital | 1.289 | 0.840 | 1.979 | 0.245 | 1.400 | 0.717 | 2.735 | 0.324 |
| Clinic | 0.666 | 0.304 | 1.460 | 0.310 | 0.533 | 0.169 | 1.684 | 0.284 |
| **Location of hospital** | | | | | | | | |
| Rural | 1.000 | | | | 1.000 | | | |
| Urban | 0.974 | 0.635 | 1.495 | 0.904 | 0.827 | 0.443 | 1.546 | 0.552 |
| **No. of beds** | | | | | | | | |
| <30 | 1.000 | | | | 1.000 | | | |
| <300 | 1.114 | 0.141 | 8.810 | 0.918 | 1.820 | 0.169 | 19.627 | 0.622 |
| <1000 | 1.389 | 0.179 | 10.815 | 0.753 | 2.520 | 0.218 | 29.071 | 0.459 |
| ≥1000 | 1.418 | 0.175 | 11.507 | 0.744 | 3.535 | 0.278 | 44.971 | 0.331 |
| **Ownership** | | | | | | | | |
| Public | 1.000 | | | | 1.000 | | | |
| Corporate | 0.708 | 0.338 | 1.483 | 0.360 | 0.619 | 0.264 | 1.451 | 0.270 |
| Private | 0.735 | 0.340 | 1.589 | 0.433 | 0.939 | 0.354 | 2.492 | 0.900 |

# V. Discussion

## 1. Discussion of the study methods

This study analyzed data obtained from the NHIS-NSC, which included 1,025,340 representative participants (2.2% of the entire population) who were randomly stratified and selected based on age, sex, insurance type, income, residential region, and total individual medical costs, based on data from 2002.

### (1) Selection of the study participants

There were several considerations related to the selection of the study participants. First, this study used the psychiatric inpatient episode, which refers to the care that a patient received, including inpatient services, for the treatment of a particular condition from different healthcare providers. Second, this study did not include inpatients who were diagnosed with dementia (code: F0) because they were transferred from hospitals to long-term care facilities after the introduction of long-term care insurance in 2008, and the NHIS-NSC database did not have information about long-term care services. Third, this study excluded medical aid beneficiaries because of incomplete data for this group up to 2008, and because of different payment systems for the beneficiaries of the national health insurance.

Psychiatric patients with medical aid received per diem coverage; therefore, the low reimbursement for medical aid psychiatric patients limited treatment in outpatient settings, and longer hospitalizations. Accordingly, the medical aid patients had coverage for a limited number of treatments, and it was difficult to determine the correct numbers of admissions, readmission, and treatments. Fourth, this study excluded in-hospital mortality in order to measure the continuity of care after hospital discharge and to investigate the effects of continuity of care after hospital discharge on readmission and mortality. As no exact date of death was available, the operational definition of in-hospital deaths was as follows: if the month of discharge was the same as the month of death, and at the same time, there was no record of the provision of medical care after the date of discharge, an in-hospital death occurred.

## (2) Study design

This study used a nested-case control design to minimize the likelihood of immortal time bias due to the measurement of continuity of care during patients' different follow-up periods. For example, patients with shorter durations of events were not expected to be affected by the level of continuity, although events might have occurred because of a shorter follow-up period. However, there were still

concerns about information bias in measuring the continuity of care during the given follow-up time. Although the follow-up times of the case and control groups were matched, measuring continuity of care in outpatient settings over a shorter period was still problematic. On the other hand, the cases and matched control groups with long follow-up times were relatively robust for measures of continuity of care. In this study, there were no interventions by the investigator in measuring continuity of care; thus, misclassifications of continuity of care might make it impossible to detect differences between the cases and controls.

## (3) Continuity of care measurements

This study used continuity of care indices to measure and capture the multidimensional concepts of continuity (i.e., informational, relational, and management continuity) using administrative data. The existing literature recommends the use of available measures of continuity, such as the SECON, COCI, UPC, or other tools when using administrative data, based on the type of continuity (informational, relational, or management) measured across healthcare sectors.

However, it is questionable whether the indices used in this and other studies measured all the concepts related to continuity at various levels.

Continuity of information does not simply include the medication taken by the patient or the patient's history that can be obtained through an electronic record or a physician's memory, but it also includes non-medical information (e.g., the patient's values and preferences). In addition, a strong relationship between a doctor and patient might be more important in terms of its quality rather than its quantitative aspects (e.g., number of visits). These might be concepts requiring assessment beyond the quantitative measures of centralization, order, or patterns of healthcare services measured by the tools used in this study.

Even if continuity of information had been measured using an index, such as sequential continuity with emphasis on information transfer, it would not have been known whether the patient's information had been actually transmitted. Although many studies have attempted to identify the relationship between quantitative measures of continuity and outcomes based on continuity theory, there is still a need for new measures to incorporate key components of continuity to ensure accurate measurements.

## (4) Limitations of the study

Several limitations should be considered when interpreting the results of this study. First, there are some issues with the use of administrative claims data.

The reliance on the ICD-10 codes for the psychiatric diagnoses might have yielded some misclassifications due to the unavoidable characteristics of claims data, including miscoding of data by the original coder, whether it was intended or not. However, a thorough examination by both the government and the hospitals showed that nearly 70% of the primary, secondary, and tertiary diagnostic codes from the claims records corresponded with those from the medical records in the hospitals[122].

Second, as with other studies that have used administrative claims data, there were potential key covariates that we were unable to identify, such as family history of suicide attempts, family structure, marital status, employment status, and participants' previous suicide attempts. Patients' histories of self-harm, including drug overdose, poisoning, nonsuicidal self-injury (cutting), and non-fatal suicide attempts prior to entry into the study, were unknown. The study might have been subject to certain inherent limitations caused by the use of administrative data, which lack information on schizophrenia and subtypes of other psychiatric disorders. Third, similar to observational studies, our results are subject to confounding by unmeasured variables. Despite our attempts identify and account for potential confounders, some may be present, as such efforts are inherently imperfect.

The literature on mental health care emphasizes the importance of relationships with teams that include multiple professionals and are usually coordinated through a common goal and plan, rather than a single provider[123]. Coordination is often extended to social services, such as case managers who are assigned to facilitate access to health and social services[71,124]; however, this study did not consider that. In addition, this study did not assess the importance of continuity of care provided by the nurses and the other healthcare professionals.

When countries assess the quality of their mental health care, the focus is generally on psychiatric inpatients and the changes in their conditions after discharge using indicators, such as readmissions or suicide[7,17]. These indicators are used as a measure of the quality of the mental health care provided and are considered to be valid indicators[7,60]. However, in Korean society, hospital admissions of mentally ill persons might not be determined solely by an individual's condition or symptoms. They can be influenced by other factors, such as involuntary admissions. Indeed, involuntary hospitalization of patients with a mental illness accounts for approximately 80% of all admissions, which is higher than that of other developed countries[6]. The Mental Health Act states that if a psychiatrist decides that hospital admission is necessary for an individual with psychiatric symptoms, the person in charge of psychiatric hospitals may admit the individual with the consent of two other responsible persons[125]. A psychiatrist's

judgment of the need for involuntary psychiatric admission is required, but this law does not prescribe clear legal or medical grounds for the psychiatrist's judgment[125]. As of May 2017, the Mental Health Act is expected to enforce enhanced involuntary hospitalization; for patients whose data were analyzed in this study, factors such as involuntary admission might have been used as factors in determining the need for admission or readmission. Therefore, the results of this study should be interpreted with caution because the lack of awareness of and the inability to control for variables that might have been affected by other factors.

Despite these limitations, the strengths of this study are its population-based design and the acquisition of data from the NHIS-NSC, which is representative of the entire country. In addition, the follow up was robust because the unique personal identification numbers for the Korean residents were linked to the national mortality database. Recall bias was not an issue, as we used data from prescriptions for antipsychotic medication, which were recorded prior to the occurrence of the outcomes.

## 2. Discussion of the study results

This study examined the association between continuity of ambulatory care after hospital discharge and readmission, mortality, and suicide within 1 year after discharge among psychiatric patients who were admitted between 2002 and 2012, using a nested case-control study approach.

This study yielded three major findings using the COCI. First, this study found a high risk of readmission within 1 year of hospital discharge among the patients with medium and low continuity of care, compared to those with the high continuity, especially, among those diagnosed with schizophrenia. Second, this study suggested that the risk of all-cause mortality within 1 of hospital discharge was highest among patients who had received low continuity of care. Third, the suicide risk of the patients who had medium and low continuity of care was greater relative to that of the patients who received high continuity of care. The sensitivity analysis of the trends in the associations between continuity of care and all three outcomes were similar when using the SECON as a measure of continuity of care, which emphasizes the order of patients' visits. Moreover, the results are similar to the study's findings that poor continuity ($< 1$) was associated with more readmission and increased risk of all-cause mortality and suicides, compared to perfect continuity.

In a previous study on readmission, Grinshpoon et al.[104] found decreased readmission rates within 6 months of psychiatric hospital discharge using the first outpatient contact after discharge as the measure of continuity of care. Similarly, Huff found a reduced risk of readmission after 30 days among patients who had outpatient visits within five days of discharge. Huff's study[105] also found that those who had contact with more providers and a larger number of service contacts also had an increased risk of readmission. However, studies conducted by Bindman et al.[102], Olfson et al.[107], and Sytema et al.[100] did not show a relationship between continuity of care and readmission. Puntis et al.[113] found that changes in care coordinators and contacts with a larger number of different mental health professionals were associated with fewer readmission. The existing literature provides empirical support for the effect of continuity of care on psychiatric readmission, but the results of previous studies on readmission of psychiatric patients have been mixed. The reasons for these different findings from previous studies might be related to inconsistencies in the methods of measuring continuity of care, differences in study designs, and their sample sizes. In addition, the length of time for measuring continuity of care in some studies, might have led to biased results.

Compared with previous studies that have identified the relationship between continuity of care and mortality (or suicide), a large-scale study by

Hoertel et al.[95] found an association between continuity of care and a lower mortality rate. They suggested that improving longitudinal continuity of care should reduce all-cause mortality among patients with mental illness, particularly in those with bipolar disorder, major depressive disorder, and schizophrenia[95]. Although they were not able to determine the cause of death, their findings suggest that the reduced mortality decreased the suicide rate[95]. The association between longitudinal continuity of care and the likelihood of death was stronger among patients with a higher suicide risk (i.e., patients with bipolar disorder, major depressive disorder, and schizophrenia compared to those with other mental disorders[126]). Thus, individuals at greater risk of suicide might be more vulnerable to it if they do not have an ongoing therapeutic relationships compared to those with a lower risk of suicide for whom an ongoing therapeutic relationship might be of less importance from a mortality perspective.

A study conducted by Desai et al.[109], that defined continuity as having at least two outpatient visits within the first six months of psychiatric discharge, found that better continuity of care decreased the risk of suicide. King et al.[9] found that an increase in the number of days a patient had been out of contact with providers or changes in key consultants or outpatient doctors, was associated with an increased risk of suicide. Appleby et al.[12] also found that a decrease in care after discharge from a psychiatric inpatient setting was strongly associated with

suicide risk. However, it might be difficult to make direct comparisons of the results of previous studies with those of this study because the methods used to measure continuity of care in these studies were different, although the studies were similar in the context of continuity of outpatient visits after discharge.

The results of this study can be explained based on the theories of continuity of care suggested in the previous literature [62,127]. Theories of continuity of care have evolved through the accumulation of empirical evidence related to primary care, certain chronic diseases, and mental illnesses[62]. Continuity of care should promote a stronger and more trusting relationship between a patient and a provider, thereby resulting in accumulated medical and non-medical information about patients. This information should promote doctors' understanding of their patients' health needs, and thus, provide more appropriate care to meet their patients' needs.

Indeed, the importance of continuity has been supported by qualitative studies through in-depth interviews with psychiatric patients, including those with schizophrenia, depression, bipolar disorder, and other psychiatric disorders[128,129]. One study reported that patients wanted to build an ongoing relationship with one person over time, and they expressed a need to repeat their accounts of their previous health problems and treatments, regardless of their specific psychiatric condition[128]. This finding is similar to that of another qualitative study, in which

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general practitioners and mental health patients were interviewed[129]. Most of the patients preferred their own general practitioners to listen to their stories, rather than be referred to a different general practitioner with specialized knowledge of mental health [129].

In addition, patients with schizophrenia, depression, and bipolar disorder should be treated in a flexible manner, depending on the patient's condition, progression, phase (acute, chronic), and subtype of disorder. However, if patients continue to visit other medical institutions, and detailed information about the patient's care is not communicated among providers, the provider might not be able to provide consistent and individualized care. In particular, personal psychotherapy for patients with schizophrenia entails the process of serving as a consultant for the patient's overall problem and solving many problems as they are encountered. Given the finding that continuity of care increases the accumulation of knowledge about patients, empathy between the doctor and the patient should develop. A doctor should be able to help a patient understand his/her experiences, thoughts and feelings and to correct the patient's distorted thoughts based on an empathic relationship.

## 3. Implications of the study

First, South Korea's rate of psychiatric readmission is higher than that of the other OECD countries, it has the highest suicide rate among the OECD countries, and most mental illnesses are related to suicide. Given the nation's alarming mental health statistics, advanced efforts should be focused on improving the continuity of ambulatory care after discharge of psychiatric inpatients to reduce readmission, mortality, and suicides. Several approaches to meeting these goals have been suggested, including increasing patient awareness of the importance of continuity and implementation of policies to promote continuity.

Second, this study provides empirical evidence supporting South Korea's recent announcement regarding comprehensive countermeasures for mental health. This initiative includes arrangements with psychiatrists in the regional mental health centers and strengthening the coordination of care between hospitals and regional mental health centers with the goals of early detection of mental illness, suicide prevention, and quick recovery and return to society. This study provides empirical evidence supporting the importance of continuity in terms of care coordination to improve quality of care. Although this study focused on the effects of continuity of ambulatory care of psychiatric outpatients following

discharge from a hospital, the research findings have relevance in the context of

improving system linkage of patients with appropriate treatment for mental illness.

# VI. Conclusion

This study investigated the association of continuity of psychiatric ambulatory care after hospital discharge with readmission, all-cause mortality, and suicide among psychiatric inpatients. This study showed that continuity of ambulatory care after discharge was associated with readmission, mortality, and suicide. Thus, initiatives that improve continuity of care have the potential to improve quality of care while reducing the burden of mental disorders. This study's results should encourage the promotion of continuity of ambulatory care after hospital discharge of psychiatric inpatients. The results suggest that continuity is an important consideration when designing approaches to reduce readmission, mortality, and suicide.

# References

1.  Whiteford HA, Degenhardt L, Rehm J, Baxter AJ, Ferrari AJ, Erskine HE, et al. Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. The Lancet 2013;382:1575-86.

2.  Murray CJ, Barber RM, Foreman KJ, Ozgoren AA, Abd-Allah F, Abera SF, et al. Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990–2013: quantifying the epidemiological transition. The Lancet 2015;386:2145-91.

3.  Chang SM, Cho S-J, Jeon HJ, Hahm B-J, Lee HJ, Park J-I, et al. Economic burden of schizophrenia in South Korea. Journal of Korean medical science 2008;23:167-75.

4.  Chang SM, Hong J-P, Cho MJ. Economic burden of depression in South Korea. Social psychiatry and psychiatric epidemiology 2012;47:683-9.

5.  Oh I-H, Yoon S-J, Kim E-J. The burden of disease in Korea. Journal of the Korean Medical Association/Taehan Uisa Hyophoe Chi 2011;54.

6.  Hewlett E, Moran V. Making mental health count: the social and economic costs of neglecting mental health care: OECD; 2014.

7.  Hermann RC, Mattke S, Somekh D, Silfverhielm H, Goldner E, Glover G, et al. Quality indicators for international benchmarking of mental health care. International Journal for Quality in Health Care 2006;18:31-8.

8.  Qin P, Nordentoft M. Suicide risk in relation to psychiatric hospitalization: evidence based on longitudinal registers. Archives of general psychiatry 2005;62:427-32.

9.  King EA, Baldwin DS, Sinclair JM, Baker NG, CAMPBELL M, Thompson C. The Wessex recent in-patient suicide study, 1. The British Journal of Psychiatry 2001;178:531-6.

10. Meehan J, Kapur N, Hunt IM, Turnbull P, Robinson J, Bickley H, et al. Suicide in mental health in-patients and within 3 months of discharge. The

British Journal of Psychiatry 2006;188:129-34.

11. Ho T-P. The suicide risk of discharged psychiatric patients. The Journal of clinical psychiatry 2003;64:702-7.

12. Appleby L, Dennehy JA, Thomas CS, Faragher EB, Lewis G. Aftercare and clinical characteristics of people with mental illness who commit suicide: a case-control study. The Lancet 1999;353:1397-400.

13. Goldacre M, Seagroatt V, Hawton K. Suicide after discharge from psychiatric inpatient care. The Lancet 1993;342:283-6.

14. Hunt IM, Kapur N, Webb R, Robinson J, Burns J, Shaw J, et al. Suicide in recently discharged psychiatric patients: a case-control study. Psychological medicine 2009;39:443-9.

15. Wobrock T, Weinmann S, Falkai P, Gaebel W. Quality assurance in psychiatry: quality indicators and guideline implementation. European archives of psychiatry and clinical neuroscience 2009;259:219-26.

16. Perlman CM, Hirdes JP, Vigod S. Psychiatric Rehospitalization: Development of a Person-Level Indicator for Care Planning and Quality Assurance. The primary care companion for CNS disorders 2015;17.

17. Byrne SL, Hooke GR, Page AC. Readmission: a useful indicator of the quality of inpatient psychiatric care. Journal of affective disorders 2010;126:206-13.

18. OECD. Health at a Glance 2013: OECD Indicators. OECD Publishing, Paris 2013(Available from: http://dx.doi.org/10.1787/health_glance-2013-en).

19. OECD. Health at a Glance 2015: OECD Indicators. OECD Publishing, Paris 2015(Available from: http://dx.doi.org/10.1787/health_glance-2015-en).

20. Stein BD, Kogan JN, Sorbero MJ, Thompson W, Hutchinson SL. Predictors of timely follow-up care among Medicaid-enrolled adults after psychiatric hospitalization. Psychiatric Services 2007;58:1563-9.

21. Compton MT, Rudisch BE, Craw J, Thompson T, Owens DA. Predictors of missed first appointments at community mental health centers after

psychiatric hospitalization. Psychiatric Services 2006;57:531-7.

22. Olfson M, Marcus SC, Doshi JA. Continuity of care after inpatient discharge of patients with schizophrenia in the Medicaid program: a retrospective longitudinal cohort analysis. The Journal of clinical psychiatry 2010;71:831-8.

23. Nelson EA, Maruish ME, Axler JL. Effects of discharge planning and compliance with outpatient appointments on readmission rates. Psychiatric Services 2000;51:885-9.

24. Lin H-C, Lee H-C. The association between timely outpatient visits and the likelihood of rehospitalization for schizophrenia patients. American Journal of Orthopsychiatry 2008;78:494.

25. Shortell SM. Continuity of medical care: conceptualization and measurement. Medical care 1976:377-91.

26. Citro R, Ghosh S, Churgin PG. A fundamental metric for continuity of care: modeling and performance evaluation. IEEE transactions on information technology in biomedicine 1997;1:189-204.

27. Haggerty JL, Reid RJ, Freeman GK, Starfield BH, Adair CE, McKendry R. Continuity of care: a multidisciplinary review. British Medical Journal 2003;327:1219.

28. Van Servellen G, Fongwa M, Mockus D'Errico E. Continuity of care and quality care outcomes for people experiencing chronic conditions: A literature review. Nursing & health sciences 2006;8:185-95.

29. Van Walraven C, Oake N, Jennings A, Forster AJ. The association between continuity of care and outcomes: a systematic and critical review. Journal of evaluation in clinical practice 2010;16:947-56.

30. Rogers J, Curtis P. The concept and measurement of continuity in primary care. American journal of public health 1980;70:122-7.

31. Saultz JW, Albedaiwi W. Interpersonal continuity of care and patient satisfaction: a critical review. The Annals of Family Medicine 2004;2:445-51.

32. Puntis S, Rugkåsa J, Forrest A, Mitchell A, Burns T. Associations between

continuity of care and patient outcomes in mental health care: a systematic review. Psychiatric Services 2015;66:354-63.

33. Adair CE, McDougall GM, Beckie A, Joyce A, Mitton C, Wild CT, et al. History and measurement of continuity of care in mental health services and evidence of its role in outcomes. Psychiatric Services 2003;54:1351-6.

34. Palmer RH. Considerations in defining quality of health care. Striving for Quality in Health Care 1991:1-54.

35. Lee RI, Jones LW. The fundamentals of good medical care. Publications of the Committee on the Costs of Medical Care 1933;22.

36. Donabedian A. Explorations in Quality Assessment and Monitoring: The definition of quality and approaches to its assessment. Ann Arbor, Health Administration Press 1980.

37. Donabedian A. The definition of quality and approaches to its assesment: Health Administration Press; 1980.

38. Griffin N. Quality of care. JAMA 1986;256:1032-4.

39. Lohr KN. Medicare: a strategy for quality assurance: National Academies Press; 1990.

40. Lohr KN, Donaldson MS, Harris-Wehling J. Medicare: A Strategy for Quality Assurance, V: Quality of Care in a Changing Health Care Environment. Quality Review Bulletin 1992;18:120-6.

41. Donabedian A. The quality of care: how can it be assessed? JAMA 1988;260:1743-8.

42. Given CW, Branson M, Zemach R. Evaluation and application of continuity measures in primary care settings. Journal of community health 1985;10:22-41.

43. Myers BA. A guide to medical care administration: concepts and principles: American Public Health Association; 1969.

44. Vuori HV. Quality Assurance of Health Services. Concepts and Methodology. Public Health in Europe 16: ERIC; 1982.

45. Richardson WC, Berwick DM, Bisgard J, Bristow L, Buck C, Cassel C. Crossing the quality chasm: a new health system for the 21st century. Institute of Medicine, National Academy Press Washington, DC; 2001.

46. Arah OA, Westert GP, Hurst J, Klazinga NS. A conceptual framework for the OECD health care quality indicators project. International Journal for Quality in Health Care 2006;18:5-13.

47. Donabedian A. An introduction to quality assurance in health care: Oxford University Press; 2002.

48. McGlynn EA, Norquist GS, Wells KB, Sullivan G, Liberman RP. Quality-of-care research in mental health: Responding to the challenge. Inquiry 1988:157-70.

49. Holzemer WL, Reilly CA. Variables, variability, and variations research: implications for medical informatics. Journal of the American Medical Informatics Association 1995;2:183-90.

50. Holzemer WL. The impact of nursing care in Latin America and the Carihbean: a focus on outcomes. Journal of advanced nursing 1994;20:5-12.

51. Mitchell PH, Ferketich S, Jennings BM. Quality health outcomes model. Journal of Nursing Scholarship 1998;30:43-6.

52. Mitchell PH, Lang NM. Framing the problem of measuring and improving healthcare quality: has the Quality Health Outcomes Model been useful? Medical care 2004;42:II-4-II-11.

53. Mayberry LJ, Gennaro S. A quality of health outcomes model for guiding obstetrical practice. Journal of Nursing Scholarship 2001;33:141-6.

54. Lee SH. Identification of factors related to quality of service in Longterm care hospitals using multilevel analysis. Yonsei University Doctoral dissertation 2008.

55. Thompson GN, McClement SE, Menec VH, Chochinov HM. Understanding bereaved family members' dissatisfaction with end-of-life care in nursing homes. Journal of gerontological nursing 2012;38:49-60.

56. McCarthy PR, Gelber S, Dugger DE. Outcome measurement to outcome

management: The critical step. Administration and Policy in Mental Health and Mental Health Services Research 1993;21:59-68.

57. McGrath BM, Tempier RP. Implementing quality management in psychiatry: from theory to practice—shifting focus from process to outcome. The Canadian Journal of Psychiatry 2003;48:467-74.

58. Shield T, Campbell S, Rogers A, Worrall A, Chew-Graham C, Gask L. Quality indicators for primary care mental health services. Quality and Safety in Health Care 2003;12:100-6.

59. Hermann RC, Palmer RH. Common ground: a framework for selecting core quality measures for mental health and substance abuse care. Psychiatric Services 2002;53:281-7.

60. Hermann R, Mattke S. Selecting indicators for the quality of mental health care at the health systems level in OECD countries. 2004.

61. Carinci F, Van Gool K, Mainz J, Veillard J, Pichora E, Januel J, et al. Towards actionable international comparisons of health system performance: expert revision of the OECD framework and quality indicators. International Journal for Quality in Health Care 2015;27:137-46.

62. Reid RJ, McKendry R, Haggerty J. Defusing the Confusion: Concepts and Measures of Continuity of Health Care: Final Report: Canadian Health Services Research Foundation= Fondation canadienne de la recherche sur les Services de santé; 2002.

63. Saultz JW. Defining and measuring interpersonal continuity of care. The Annals of Family Medicine 2003;1:134-43.

64. Hjortdahl P. The influence of general practitioners' knowledge about their patients on the clinical decision-making process. Scandinavian journal of primary health care 1992;10:290-4.

65. Banahan Jr B, Banahan 3rd B. Continuity as an attitudinal contract. The Journal of family practice 1981;12:767.

66. Starfield B. Primary care: balancing health needs, services, and technology: Oxford University Press, USA; 1998.

67. Pugh TF, MacMahon B. Measurement of discontinuity of psychiatric inpatient care. Public health reports 1967;82:533.

68. May PR. Adopting new models for continuity of care: what are the needs? Psychiatric Services 1975;26:599-601.

69. Bass RD, Windle C. Continuity of care: an approach to measurement. American Journal of Psychiatry 1972;129:196-201.

70. Bachrach LL. Continuity of care for chronic mental patients: a conceptual analysis. The American Journal of Psychiatry 1981.

71. Johnson S, Prosser D, Bindman J, Szmukler G. Continuity of care for the severely mentally ill: concepts and measures. Social psychiatry and psychiatric epidemiology 1997;32:137-42.

72. Bachrach L. Continuity of care. Leona Bachrach speaks: selected speeches and lectures. New Directions for Mental Health 1987;35:63-73.

73. Cohen D, Sanders H. Day-program-based treatment in the Amsterdam city center. International journal of social psychiatry 1995;41:120-31.

74. Sytema S, Micciolo R, Tansella M. Continuity of care for patients with schizophrenia and related disorders: a comparative South-Verona and Groningen case-register study. Psychological medicine 1997;27:1355-62.

75. Saarento O, Ø iesvold T, Sytema S, Göstas G, Kastrup M, Lönnerberg O, et al. The Nordic Comparative Study on Sectorized Psychiatry: continuity of care related to characteristics of the psychiatric services and the patients. Social psychiatry and psychiatric epidemiology 1998;33:521-7.

76. Test MA. Continuity of care in community treatment. New directions for mental health services 1979;1979:15-23.

77. Test MA, Stein LI. Practical guidelines for the community treatment of markedly impaired patients. Community Mental Health Journal 1976;12:72-82.

78. Tessler RC, Willis G, Gubman GD. Defining and measuring continuity of care. Psychosocial Rehabilitation Journal 1986;10:27.

79. Perris C, Rodhe K, Palm A, Abelson M, Hellgren S, Lilja C, et al. Fully

integrated in-and outpatient services in a psychiatric sector: Implementation of a new model for the care of psychiatric patients favoring continuity of care. Cognitive therapy: Applications in psychiatric and medical settings 1987:117-31.

80. Bice TW, Boxerman SB. A quantitative measure of continuity of care. Medical care 1977;15:347-9.

81. Steinwachs DM. Measuring provider continuity in ambulatory care: an assessment of alternative approaches. Medical care 1979:551-65.

82. Eriksson EA, Mattsson L-G. Quantitative measurement of continuity of care: measures in use and an alternative approach. Medical care 1983:858-75.

83. Godkin M, Rice C. Relationship of physician continuity to type of health problems in primary care. The Journal of family practice 1981;12:99-102.

84. Magill MK, Senf J. A new method for measuring continuity of care in family practice residencies. The Journal of family practice 1987;24:165-8.

85. Ejlertsson G, Berg S. Continuity-of-care measures: an analytic and empirical comparison. Medical care 1984;22:231-9.

86. Roos LL, Roos NP, Gilbert P, Nicol JP. Continuity of care: does it contribute to quality of care? Medical care 1980;18:174-84.

87. Breslau N, Reeb KG. Continuity of care in a university-based practice. Academic Medicine 1975;50:965-9.

88. Wall E. Continuity of care and family medicine: definition, determinants, and relationship to outcome. The Journal of family practice 1981;13:655-64.

89. Starfield BH, Simborg DW, Horn SD, Yourtee SA. Continuity and coordination in primary care: their achievement and utility. Medical care 1976;14:625-36.

90. Breslau N. Continuity reexamined: differential impact on satisfaction with medical care for disabled and normal children. Medical care 1982;20:347-60.

91.    Murata PJ. A visit-based quantitative measure of family care. Journal of family practice 1993;36:39-45.

92.    Chien CF, Steinwachs DM, Lehman A, Fahey M, Skinner EA. Provider continuity and outcomes of care for persons with schizophrenia. Mental Health Services Research 2000;2:201-11.

93.    Greenberg GA, Fontana A, Rosenheck RA. Continuity and intensity of care among women receiving outpatient care for PTSD. Psychiatric quarterly 2004;75:165-81.

94.    Greenberg GA, Rosenheck RA, Fontana A. Continuity of care and clinical effectiveness: treatment of posttraumatic stress disorder in the Department of Veterans Affairs. The Journal of Behavioral Health Services and Research 2003;30:202-14.

95.    Hoertel N, Limosin F, Leleu H. Poor longitudinal continuity of care is associated with an increased mortality rate among patients with mental disorders: results from the French National Health Insurance Reimbursement Database. European psychiatry 2014;29:358-64.

96.    Adair C, Wild T, Joyce A, McDougall G, Gordon A, Costigan N, et al. Development of a measure of perceived continuity of care for persons with severe mental illness.  American journal of epidemiology: OXFORD UNIV PRESS INC JOURNALS DEPT, 2001 EVANS RD, CARY, NC 27513 USA; 2001. p.S101-S.

97.    Adair CE, McDougall GM, Mitton CR, Joyce AS, Wild TC, Gordon A, et al. Continuity of care and health outcomes among persons with severe mental illness. Psychiatric Services 2005;56:1061-9.

98.    Mitton CR, Adair CE, McDougall GM, Marcoux G. Continuity of care and health care costs among persons with severe mental illness. Psychiatric Services 2005;56:1070-6.

99.    Sweeney A, Rose D, Clement S, Jichi F, Jones IR, Burns T, et al. Understanding service user-defined continuity of care and its relationship to health and social measures: a cross-sectional study. BMC Health Services Research 2012;12:145.

100.    Sytema S, Burgess P. Continuity of care and readmission in two service

systems: a comparative Victorian and Groningen case-register study. Acta Psychiatrica Scandinavica 1999;100:212-9.

101. Brekke JS, Ansel M, Long J, Slade E, Weinstein M. Intensity and continuity of services and functional outcomes in the rehabilitation of persons with schizophrenia. Psychiatric Services 1999;50:248-56.

102. Bindman J, Johnson S, Szmukler G, Wright S, Kuipers E, Thornicroft G, et al. Continuity of care and clinical outcome: a prospective cohort study. Social Psychiatry and Psychiatric Epidemiology 2000;35:242-7.

103. Greenberg GA, Rosenheck RA. Special section on the GAF: continuity of care and clinical outcomes in a national health system. Psychiatric Services 2005;56:427-33.

104. Grinshpoon A, Lerner Y, Hornik-Lurie T, Zilber N, Ponizovsky AM. Post-discharge contact with mental health clinics and psychiatric readmission: a 6-month follow-up study. The Israel journal of psychiatry and related sciences 2010;48:262-7.

105. Huff ED. Outpatient Utilization Patterns and Quality Outcomes after First Acute Episode of Mental Health Hospitalization Is Some Better than None, and is More Service Associated with Better Outcomes? Evaluation & the Health Professions 2000;23:441-56.

106. Catty J, White S, Clement S, Cowan N, Geyer C, Harvey K, et al. Continuity of care for people with psychotic illness: Its relationship to clinical and social functioning. International Journal of Social Psychiatry 2013;59:5-17.

107. Olfson M, Mechanic D, Boyer CA, Hansell S. Linking inpatients with schizophrenia to outpatient care. Psychiatric Services 1998;49:911-7.

108. Lehman AF, Postrado LT, Roth D, McNary SW, Goldman HH. Continuity of care and client outcomes in the Robert Wood Johnson Foundation program on chronic mental illness. The Milbank Quarterly 1994:105-22.

109. Desai RA, Dausey DJ, Rosenheck RA. Mental health service delivery and suicide risk: the role of individual patient and facility factors. American Journal of Psychiatry 2005;162:311-8.

110. Simon GE, Ludman E, Unützer J, Bauer MS. Design and implementation of a randomized trial evaluating systematic care for bipolar disorder. Bipolar Disorders 2002;4:226-36.

111. Vita A, Corsini P, Bonomi S, Cesana BM, Sacchetti E. Factors affecting antipsychotic drug discontinuation in the treatment of schizophrenia: evidence from a naturalistic, retrospective, 18-month follow-up study. Schizophrenia research 2008;104:302-4.

112. Heffernan JF, Husni M. Continuity of care coordination, health needs and social deprivation. The Psychiatrist 2009;33:132-4.

113. Puntis SR, Rugkåsa J, Burns T. The association between continuity of care and readmission to hospital in patients with severe psychosis. Social Psychiatry and Psychiatric Epidemiology 2016;51:1633-43.

114. van der Lee A, de Haan L, Beekman A. Schizophrenia in the Netherlands: Continuity of Care with Better Quality of Care for Less Medical Costs. PloS one 2016;11:e0157150.

115. Amjad H, Carmichael D, Austin AM, Chang C-H, Bynum JP. Continuity of care and health care utilization in older adults with dementia in fee-for-service Medicare. JAMA Internal Medicine 2016;176:1371-8.

116. Sanatinia R, Cowan V, Barnicot K, Zalewska K, Shiers D, Cooper SJ, et al. Loss of relational continuity of care in schizophrenia: associations with patient satisfaction and quality of care. British Journal of Psychiatry Open 2016;2:318-22.

117. Lee J, Lee JS, Park S-H, Shin SA, Kim K. Cohort profile: The national health insurance service–national sample cohort (NHIS-NSC), South Korea. International journal of epidemiology 2016:dyv319.

118. Kim L, Sakong J, Kim Y, Kim S, Kim S, Tchoe B, et al. Developing the inpatient sample for the National Health Insurance claims data. Health Policy and Management 2013;23:152-61.

119. Kim J, Kim H, Im J. Development of risk adjustment and prediction methods for care episodes using National Health Insurance Database. Seoul: Health Insurance Review & Assessment Service 2007.

120. Hsu C-H, Chou Y-J, Pu C. The Effect of Continuity of Care on Emergency Room Use for Diabetic Patients Varies by Disease Severity. Journal of epidemiology 2016;26:413-9.

121. Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi J-C, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Medical care 2005:1130-9.

122. JY K. Strategies to enhance the use of National Health Insurance claims database in generating health statistics. Technical report by Health Insurance Review and Assessment Services. Korea: Health Insurance Review and Assessment Services; 2005.

123. Gubman GD, Tessler R, Willis G. Living with the mentally ill: factors affecting household complaints. Schizophrenia Bulletin 1987;13:727.

124. Bachrach LL. Continuity of care and approaches to case management for long-term mentally ill patients. Psychiatric Services 1993;44:465-8.

125. Kim AM. Why do psychiatric patients in Korea stay longer in hospital? International Journal of Mental Health Systems 2017;11:2.

126. Harris EC, Barraclough B. Suicide as an outcome for mental disorders. A meta-analysis. The British Journal of Psychiatry 1997;170:205-28.

127. Gray DP, Evans P, Sweeney K, Lings P, Seamark D, Seamark C, et al. Towards a theory of continuity of care. Journal of the Royal Society of Medicine 2003;96:160-6.

128. Kai J, Crosland A. Perspectives of people with enduring mental ill health from a community-based qualitative study. Br J Gen Pract 2001;51:730-6.

129. Lester H, Tritter JQ, Sorohan H. Patients' and health professionals' views on primary care for people with serious mental illness: focus group study. British medical journal 2005;330:1122.

# Appendix

Appendix Table 1. Type of medications in this study

| Type of drugs | Ingredients |
|---|---|
| Antidepressants | amitriptyline, amoxapine, clomipramine, doxepin, imipramine, quinupramine, fluoxetine, fluvoxamine, paroxetine, sertraline, citalopram, escitalopram, moclobemide, medifoxamine, mianserine, mirtazapine, nefazodone, sodium tianeptine, trazodone, venlafaxine, milnacipran, bupropion, duloxetine, nortryptiline, and phenelzine |
| Antipsychotics | olanzapine, risperidone, clozapine, quetiapine, aripiprazol, haloperidol, ziprasidone, amisulpride, chlorpromazine, levomepromazine, perphenazine, trifluoperazine, thioridazine, mesoridazine besylate, bromperidol, droperidol, flupentixol, zuclopenthixol, chlorprothixene, pimozide, loxapine, sulpiride, paliperidone, zotepin, molindone, nemonapride, blonanserin, tiapride, and fluphenthixol |
| Anxiolytics, Sedatives&Hypnotics | alprazolam, bromazepam, brotizolam, chlordiazepoxide, clobazam, clonazepam, clorazepate, clotiazepam, diazepam, fludiazepam, estazolam, loflazepate, etizolam, flunitrazepam, flurazepam, lorazepam, midazolam, nordazepam, pinazepam, tofisopam, triazolam, oxazepam, quazepam, temazepam, zolpidem, zopiclone, amobarbital, barbital, phenobarbital, and secobarbital sodium |
| Stabilizer | carbamazepine, divalproex/valproate/valproic acid, lamotrigine, lithium carbonate, topiramate, buspirone, and gabapentin |

Appendix Table 2. Diagnostic codes of the mental disorders analyzed in this study

| Primary diagnosis | ICD-10 code | Explanation |
|---|---|---|
| Substance use disorder | F10 | Mental and behavioral disorders due to psychoactive substance use |
| | F11 | Mental and behavioral disorders due to use of opioids |
| | F12 | Mental and behavioral disorders due to use of cannabinoids |
| | F13 | Mental and behavioral disorders due to use of cannabinoids |
| | F14 | Mental and behavioral disorders due to use of cannabinoids |
| | F15 | Mental and behavioral disorders due to use of other stimulants, including caffeine |
| | F16 | Mental and behavioral disorders due to use of hallucinogens |
| | F17 | Mental and behavioral disorders due to use of tobacco |
| | F18 | Mental and behavioral disorders due to use of volatile solvents |
| | F19 | Mental and behavioral disorders due to multiple drug use and use of other psychoactive substances |
| Schizophrenia | F20 | Schizophrenia |
| | F21 | Borderline schizophrenia |
| | F22 | Persistent delusional disorders |
| | F23 | Acute and transient psychotic disorders |
| | F24 | Induced delusional disorder |
| | F25 | Schizoaffective disorders |
| | F28 | Other nonorganic psychotic disorders |
| | F29 | Unspecified nonorganic psychosis |
| Bipolar disorder | F31 | Bipolar affective disorder |
| Depressive disorder | F32 | Major depressive disorder |
| | F33 | Major depressive disorder, recurrent |
| Other mental disorders | F30 | Manic episode |
| | F34 | Persistent mood [affective] disorders |
| | F38 | Other mood [affective] disorders |
| | F39 | Unspecified mood [affective] disorder |
| | F40 | Phobic anxiety disorders |
| | F41 | Other anxiety disorders |
| | F42 | Obsessive-compulsive disorder |
| | F43 | Reaction to severe stress, and adjustment disorders |
| | F44 | Dissociative [conversion] disorders |
| | F45 | Somatoform disorders |
| | F48 | Other neurotic disorders |
| | F50 | Eating disorders |
| | F51 | Nonorganic sleep disorders |
| | F52 | Sexual dysfunction, not caused by organic disorder or disease |
| | F53 | Mental and behavioral disorders associated with the puerperium, NEC |
| | F54 | Psychological and behavioral factors associated with disorders or diseases classified elsewhere |
| | F55 | Abuse of non-dependence-producing substances |
| | F59 | Unspecified behavioral syndromes associated with physiological disturbances and physical factors |
| | F60 | Specific personality disorders |
| | F61 | Mixed and other personality disorders |
| | F62 | Enduring personality changes, not attributable to brain damage and disease |
| | F63 | Habit and impulse disorders |
| | F64 | Gender identity disorders |
| | F65 | Disorders of sexual preference |
| | F66 | Psychological and behavioral disorders associated with sexual development and orientation |
| | F68 | Other disorders of adult personality and behavior |
| | F69 | Unspecified disorder of adult personality and behavior |
| | F90 | Hyperkinetic disorders |
| | F91 | Conduct disorders |
| | F92 | Mixed disorders of conduct and emotions |
| | F93 | Emotional disorders with onset specific to childhood |
| | F94 | Disorders of social functioning with onset specific to childhood and adolescence |
| | F95 | Tic disorders |
| | F98 | Other behavioral and emotional disorders with onset usually occurring in childhood and adolescence |

Appendix Table 3. Characteristics of the study participants by readmission, mortality, and suicide within 1 year after hospital discharge

| Variable | Total | | Readmission | | All-cause mortality | | Suicide | |
|---|---|---|---|---|---|---|---|---|
| | N | Col % | n | Row % | n | Row % | n | Row % |
| *Individual level* | 18702 | | 8022 | 42.9 | 355 | 1.9 | 108 | 0.6 |
| **Continuity of care index** | | | | | | | | |
| Total visits : 0 | 6954 | 37.2 | 3937 | 56.6 | 170 | 2.4 | 28 | 0.4 |
| Total visits : 1-2 | 3674 | 19.6 | 2066 | 56.2 | 84 | 2.3 | 32 | 0.9 |
| Low | 648 | 3.5 | 301 | 46.5 | 13 | 2.0 | 7 | 1.1 |
| Medium | 1501 | 8.0 | 388 | 25.8 | 21 | 1.4 | 11 | 0.7 |
| High | 5925 | 31.7 | 1330 | 22.4 | 67 | 1.1 | 30 | 0.5 |
| **Sex** | | | | | | | | |
| Male | 10117 | 54.1 | 4876 | 48.2 | 251 | 2.5 | 63 | 0.6 |
| Female | 8585 | 45.9 | 3146 | 36.6 | 104 | 1.2 | 45 | 0.5 |
| **Age** | | | | | | | | |
| -29 | 3061 | 16.4 | 1209 | 39.5 | 27 | 0.9 | 15 | 0.5 |
| 30-39 | 3830 | 20.5 | 1921 | 50.2 | 39 | 1.0 | 24 | 0.6 |
| 40-49 | 4477 | 23.9 | 2005 | 44.8 | 77 | 1.7 | 25 | 0.6 |
| 50-59 | 3815 | 20.4 | 1761 | 46.2 | 81 | 2.1 | 24 | 0.6 |
| 60-69 | 2150 | 11.5 | 777 | 36.1 | 64 | 3.0 | 10 | 0.5 |
| 70- | 1369 | 7.3 | 349 | 25.5 | 67 | 4.9 | 10 | 0.7 |
| **Income** | | | | | | | | |
| Q1(Low) | 3191 | 17.1 | 1450 | 45.4 | 59 | 1.8 | 10 | 0.3 |
| Q2 | 2917 | 15.6 | 1273 | 43.6 | 62 | 2.1 | 19 | 0.7 |
| Q3 | 3469 | 18.5 | 1523 | 43.9 | 59 | 1.7 | 19 | 0.5 |
| Q4 | 3816 | 20.4 | 1547 | 40.5 | 79 | 2.1 | 32 | 0.8 |
| Q5(High) | 5309 | 28.4 | 2229 | 42.0 | 96 | 1.8 | 28 | 0.5 |
| **Residential area** | | | | | | | | |
| Rural | 6175 | 33.0 | 2577 | 41.7 | 110 | 1.8 | 32 | 0.5 |
| Urban | 12527 | 67.0 | 5445 | 43.5 | 245 | 2.0 | 76 | 0.6 |
| **Mental disability** | | | | | | | | |
| Normal | 17296 | 92.5 | 7010 | 40.5 | 343 | 2.0 | 105 | 0.6 |
| Moderate | 515 | 2.8 | 363 | 70.5 | 6 | 1.2 | 2 | 0.4 |
| Severe | 891 | 4.8 | 649 | 72.8 | 6 | 0.7 | 1 | 0.1 |

Appendix Table 3. Characteristics of the study participants by readmission, mortality, and suicides within 1 year after hospital discharge (continued)

| Variable | Total | | Readmission | | All-cause mortality | | Suicide | |
|---|---|---|---|---|---|---|---|---|
| | n | Col % | n | Row % | n | Row % | n | Row % |
| **Charlson's comorbidity index** | | | | | | | | |
| 0 | 15189 | 81.2 | 6623 | 43.6 | 213 | 1.4 | 84 | 0.6 |
| 1 | 2626 | 14.0 | 1070 | 40.7 | 85 | 3.2 | 18 | 0.7 |
| 2 | 601 | 3.2 | 224 | 37.3 | 25 | 4.2 | 3 | 0.5 |
| ≥3 | 286 | 1.5 | 105 | 36.7 | 32 | 11.2 | 3 | 1.0 |
| **Primary diagnosis** | | | | | | | | |
| Substance use disorder | 5880 | 31.4 | 3158 | 53.7 | 168 | 2.9 | 29 | 0.5 |
| Schizophrenia | 4918 | 26.3 | 2473 | 50.3 | 60 | 1.2 | 26 | 0.5 |
| Bipolar disorder | 1592 | 8.5 | 611 | 38.4 | 18 | 1.1 | 11 | 0.7 |
| Depressive disorder | 3135 | 16.8 | 955 | 30.5 | 64 | 2.0 | 28 | 0.9 |
| Other mental disorder | 3177 | 17.0 | 825 | 26.0 | 45 | 1.4 | 14 | 0.4 |
| **Length of stay** | | | | | | | | |
| ≤23 days | 10797 | 50.3 | 4240 | 39.3 | 151 | 1.4 | 49 | 0.5 |
| >23 days | 10653 | 49.7 | 3782 | 35.5 | 204 | 1.9 | 59 | 0.6 |
| **No. of psychiatric admissions** | | | | | | | | |
| 1 | 9022 | 48.2 | 2014 | 22.3 | 176 | 2.0 | 44 | 0.5 |
| 2 | 3078 | 16.5 | 1234 | 40.1 | 69 | 2.2 | 31 | 1.0 |
| 3 | 1633 | 8.7 | 877 | 53.7 | 32 | 2.0 | 11 | 0.7 |
| ≥4 | 4969 | 26.6 | 3897 | 78.4 | 78 | 1.6 | 22 | 0.4 |
| **Psychotherapy** | | | | | | | | |
| 0 per week | 2027 | 10.8 | 398 | 19.6 | 47 | 2.3 | 6 | 0.3 |
| 1-2 per week | 933 | 5.0 | 310 | 33.2 | 31 | 3.3 | 7 | 0.8 |
| 3-4 per week | 2495 | 13.3 | 1078 | 43.2 | 38 | 1.5 | 10 | 0.4 |
| 5-6 per week | 5479 | 29.3 | 2515 | 45.9 | 103 | 1.9 | 36 | 0.7 |
| above 7 per week | 7768 | 41.5 | 3721 | 47.9 | 136 | 1.8 | 49 | 0.6 |
| **Antidepressants** | | | | | | | | |
| No | 9682 | 51.8 | 4304 | 44.5 | 171 | 1.8 | 48 | 0.5 |
| Yes | 9020 | 48.2 | 3718 | 41.2 | 184 | 2.0 | 60 | 0.7 |

Appendix Table 3. Characteristics of the study participants by readmission, mortality, and suicide within 1 year after hospital discharge (continued)
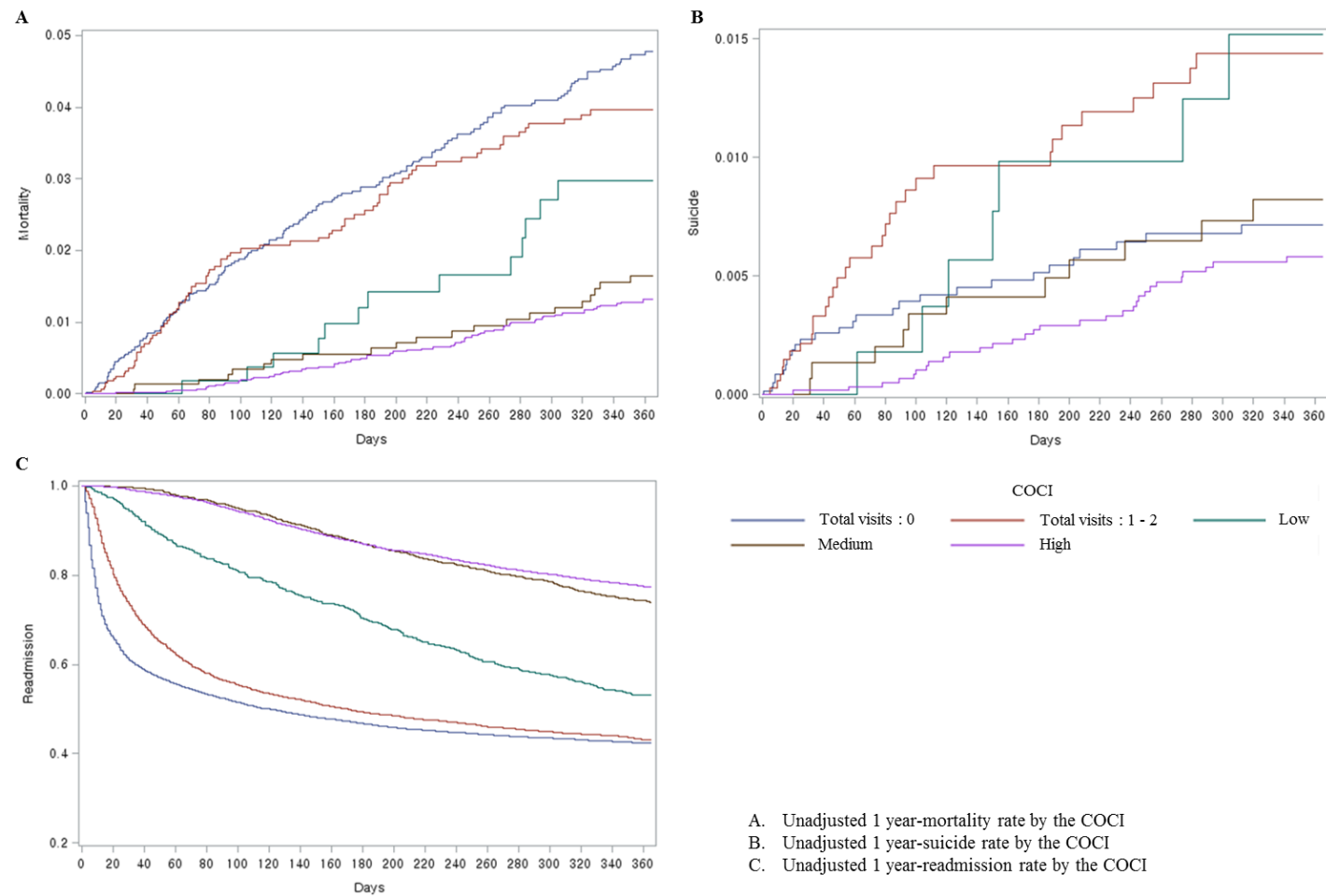
| Variable | Total | | Readmission | | All-cause mortality | | Suicide | |
|---|---|---|---|---|---|---|---|---|
| | n | Col % | N | Row % | n | Row % | n | Row % |
| **Antipsychotics** | | | | | | | | |
| No | 7773 | 41.6 | 2904 | 37.4 | 157 | 2.0 | 34 | 0.4 |
| Yes | 10929 | 58.4 | 5118 | 46.8 | 198 | 1.8 | 74 | 0.7 |
| **Anxiolytics** | | | | | | | | |
| No | 2091 | 11.2 | 1021 | 48.8 | 34 | 1.6 | 9 | 0.4 |
| Yes | 16611 | 88.8 | 7001 | 42.1 | 321 | 1.9 | 99 | 0.6 |
| **Stabilizer** | | | | | | | | |
| No | 13452 | 71.9 | 5678 | 42.2 | 284 | 2.1 | 74 | 0.6 |
| Yes | 5250 | 28.1 | 2344 | 44.6 | 71 | 1.4 | 34 | 0.6 |
| *Hospital level* | | | | | | | | |
| **Type of hospital** | | | | | | | | |
| General hospital | 6554 | 35.0 | 1797 | 27.4 | 102 | 1.6 | 39 | 0.6 |
| Hospital | 9099 | 48.7 | 4503 | 49.5 | 209 | 2.3 | 61 | 0.7 |
| Clinic | 3049 | 16.3 | 1722 | 56.5 | 44 | 1.4 | 8 | 0.3 |
| **Location** | | | | | | | | |
| Rural | 5657 | 30.2 | 2406 | 42.5 | 122 | 2.2 | 33 | 0.6 |
| Urban | 13045 | 69.8 | 5616 | 43.1 | 233 | 1.8 | 75 | 0.6 |
| **No. of beds** | | | | | | | | |
| <30 | 480 | 2.6 | 288 | 60.0 | 5 | 1.0 | 1 | 0.2 |
| <300 | 7743 | 41.4 | 3771 | 48.7 | 157 | 2.0 | 38 | 0.5 |
| <1000 | 7916 | 42.3 | 3232 | 40.8 | 153 | 1.9 | 50 | 0.6 |
| ≥1000 | 2563 | 13.7 | 731 | 28.5 | 40 | 1.6 | 19 | 0.7 |
| **Ownership** | | | | | | | | |
| Public | 1182 | 6.3 | 540 | 45.7 | 29 | 2.5 | 9 | 0.8 |
| Coporate | 9978 | 53.4 | 3589 | 36.0 | 175 | 1.8 | 61 | 0.6 |
| Private | 7542 | 40.3 | 3893 | 51.6 | 151 | 2.0 | 38 | 0.5 |

Appendix Figure 1. Unadjusted 1-year-mortality, suicide, and readmission rates using the COCI

Appendix Table 4. Results of the Cox proportional hazards model for readmission, all-cause mortality, and suicide within 1 year after hospital discharge

| Variable | Readmission | | | | All-cause mortality | | | | Suicide | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AHR | 95% CI | | p-value | AHR | 95% CI | | p-value | AHR | 95% CI | | p-value |
| *Individual level* | | | | | | | | | | | | |
| **Continuity of care index** | | | | | | | | | | | | |
| Total visits : 0 | 5.830 | 5.265 | 6.456 | <.0001 | 3.582 | 2.541 | 5.050 | <.0001 | 2.250 | 1.233 | 4.105 | 0.008 |
| Total visits : 1-2 | 4.583 | 4.218 | 4.979 | <.0001 | 3.325 | 2.338 | 4.729 | <.0001 | 3.679 | 2.182 | 6.204 | <.0001 |
| Low | 2.568 | 2.254 | 2.927 | <.0001 | 2.383 | 1.298 | 4.375 | 0.005 | 2.776 | 1.182 | 6.522 | 0.019 |
| Medium | 1.218 | 1.085 | 1.367 | 0.001 | 1.266 | 0.770 | 2.081 | 0.352 | 1.510 | 0.750 | 3.042 | 0.249 |
| High | 1.000 | | | | 1.000 | | | | 1.000 | | | |
| **Sex** | | | | | | | | | | | | |
| Male | 0.983 | 0.907 | 1.065 | 0.675 | 1.740 | 1.326 | 2.282 | <.0001 | 1.426 | 0.901 | 2.259 | 0.130 |
| Female | 1.000 | | | | 1.000 | | | | 1.000 | | | |
| **Age** | | | | | | | | | | | | |
| -29 | 1.000 | | | | 1.000 | | | | 1.000 | | | |
| 30-39 | 1.030 | 0.928 | 1.144 | 0.574 | 0.928 | 0.561 | 1.535 | 0.772 | 0.703 | 0.363 | 1.364 | 0.298 |
| 40-49 | 0.889 | 0.792 | 0.997 | 0.045 | 1.289 | 0.876 | 1.897 | 0.198 | 0.891 | 0.505 | 1.574 | 0.691 |
| 50-59 | 0.843 | 0.736 | 0.965 | 0.013 | 1.339 | 0.903 | 1.985 | 0.146 | 0.950 | 0.526 | 1.716 | 0.865 |
| 60-69 | 0.799 | 0.680 | 0.939 | 0.007 | 1.734 | 1.149 | 2.617 | 0.009 | 0.606 | 0.280 | 1.309 | 0.202 |
| 70- | 0.664 | 0.556 | 0.792 | <.0001 | 3.144 | 2.080 | 4.752 | <.0001 | 1.046 | 0.485 | 2.257 | 0.908 |
| **Income** | | | | | | | | | | | | |
| Q1(Low) | 0.848 | 0.763 | 0.942 | 0.002 | 0.985 | 0.705 | 1.377 | 0.932 | 0.636 | 0.312 | 1.298 | 0.214 |
| Q2 | 0.898 | 0.814 | 0.992 | 0.034 | 1.167 | 0.843 | 1.615 | 0.353 | 1.274 | 0.709 | 2.288 | 0.418 |
| Q3 | 0.950 | 0.849 | 1.062 | 0.367 | 0.991 | 0.713 | 1.378 | 0.959 | 1.103 | 0.605 | 2.012 | 0.748 |
| Q4 | 0.880 | 0.807 | 0.961 | 0.004 | 1.076 | 0.794 | 1.459 | 0.636 | 1.587 | 0.946 | 2.661 | 0.080 |
| Q5(High) | 1.000 | | | | 1.000 | | | | 1.000 | | | |
| **Residential area** | | | | | | | | | | | | |
| Rural | 1.000 | | | | 1.000 | | | | 1.000 | | | |
| Urban | 0.983 | 0.891 | 1.084 | 0.729 | 1.408 | 1.031 | 1.924 | 0.032 | 1.405 | 0.790 | 2.499 | 0.247 |
| **Mental disability** | | | | | | | | | | | | |
| Normal | 1.000 | | | | 1.000 | | | | 1.000 | | | |
| Moderate | 1.623 | 1.237 | 2.129 | 0.001 | 1.397 | 0.603 | 3.239 | 0.435 | 0.839 | 0.208 | 3.381 | 0.805 |
| Severe | 1.729 | 1.469 | 2.036 | <.0001 | 0.647 | 0.278 | 1.503 | 0.311 | 0.232 | 0.030 | 1.798 | 0.162 |

Appendix Table 4. Results of the Cox proportional hazards model for readmission, all-cause mortality, and suicide within 1 year after hospital discharge (continued)

| Variable | Readmission | | | All-cause mortality | | | Suicide | | |
|---|---|---|---|---|---|---|---|---|---|
| | AHR | 95% CI | p-value | AHR | 95% CI | p-value | AHR | 95% CI | p-value |
| **Charlson's comorbidity index** | | | | | | | | | |
| 0 | 1.000 | | | 1.000 | | | 1.000 | | |
| 1 | 0.984 | 0.903 1.073 | 0.719 | 1.617 | 1.243 2.104 | 0.000 | 1.220 | 0.693 2.146 | 0.491 |
| 2 | 0.878 | 0.748 1.031 | 0.111 | 1.760 | 1.142 2.714 | 0.011 | 0.825 | 0.255 2.664 | 0.747 |
| ≥3 | 0.903 | 0.731 1.116 | 0.345 | 4.703 | 3.141 7.041 | <.0001 | 1.769 | 0.516 6.068 | 0.364 |
| **Primary diagnosis** | | | | | | | | | |
| Substance use disorder | 1.078 | 0.929 1.250 | 0.325 | 1.168 | 0.786 1.737 | 0.442 | 0.574 | 0.259 1.274 | 0.173 |
| Schizophrenia | 1.494 | 1.261 1.769 | <.0001 | 1.222 | 0.762 1.957 | 0.406 | 0.899 | 0.390 2.071 | 0.803 |
| Bipolar disorder | 1.322 | 1.097 1.594 | 0.003 | 1.200 | 0.633 2.275 | 0.575 | 0.994 | 0.366 2.700 | 0.991 |
| Depressive disorder | 1.200 | 1.019 1.413 | 0.029 | 1.501 | 1.007 2.238 | 0.046 | 1.630 | 0.815 3.260 | 0.167 |
| Other mental disorder | 1.000 | | | 1.000 | | | 1.000 | | |
| **Length of stay** | | | | | | | | | |
| ≤23 days | 1.000 | | | 1.000 | | | 1.000 | | |
| >23 days | 0.918 | 0.846 0.982 | 0.015 | 1.430 | 1.113 1.837 | 0.005 | 1.179 | 0.753 1.845 | 0.471 |
| **No. of psychiatric admissions** | | | | | | | | | |
| 1 | 1.000 | | | 1.000 | | | 1.000 | | |
| 2 | 2.056 | 1.901 2.225 | <.0001 | 1.461 | 1.098 1.944 | 0.009 | 2.413 | 1.484 3.923 | 0.000 |
| 3 | 2.972 | 2.720 3.247 | <.0001 | 1.491 | 1.005 2.213 | 0.047 | 1.884 | 0.967 3.673 | 0.063 |
| ≥4 | 5.190 | 4.721 5.705 | <.0001 | 2.127 | 1.583 2.857 | <.0001 | 2.071 | 1.158 3.703 | 0.014 |
| **Psychotherapy** | | | | | | | | | |
| 0 per week | 1.000 | | | 1.000 | | | 1.000 | | |
| 1-2 per week | 1.571 | 1.203 2.053 | 0.001 | 1.111 | 0.688 1.796 | 0.667 | 1.828 | 0.580 5.757 | 0.303 |
| 3-4 per week | 1.896 | 1.476 2.436 | <.0001 | 0.654 | 0.401 1.065 | 0.088 | 1.051 | 0.362 3.049 | 0.927 |
| 5-6 per week | 1.972 | 1.535 2.535 | <.0001 | 0.816 | 0.533 1.249 | 0.349 | 1.759 | 0.681 4.539 | 0.243 |
| above 7 per week | 1.973 | 1.549 2.513 | <.0001 | 0.820 | 0.540 1.243 | 0.349 | 1.917 | 0.761 4.832 | 0.168 |
| **Antidepressants** | | | | | | | | | |
| No | 1.000 | | | 1.000 | | | 1.000 | | |
| Yes | 1.176 | 1.093 1.265 | <.0001 | 1.145 | 0.905 1.449 | 0.260 | 1.235 | 0.783 1.948 | 0.365 |

Appendix Table 4. Results of the Cox proportional hazards model for readmission, all-cause mortality, and suicide within 1 year after hospital discharge (continued)

| Variable | Readmission | | | All-cause mortality | | | Suicide | | |
|---|---|---|---|---|---|---|---|---|---|
| | AHR | 95% CI | p-value | AHR | 95% CI | p-value | AHR | 95% CI | p-value |
| **Antipsychotics** | | | | | | | | | |
| No | 1.000 | | | 1.000 | | | 1.000 | | |
| Yes | 1.211 | 1.126　1.303 | <.0001 | 1.444 | 1.131　1.843 | 0.003 | 1.716 | 1.103　2.670 | 0.017 |
| **Anxiolytics** | | | | | | | | | |
| No | 1.000 | | | 1.000 | | | 1.000 | | |
| Yes | 0.907 | 0.794　1.036 | 0.151 | 0.871 | 0.601　1.264 | 0.467 | 0.754 | 0.377　1.509 | 0.425 |
| **Stabilizer** | | | | | | | | | |
| No | 1.000 | | | 1.000 | | | 1.000 | | |
| Yes | 0.985 | 0.908　1.069 | 0.715 | 0.740 | 0.551　0.994 | 0.045 | 0.975 | 0.611　1.556 | 0.915 |
| *Hospital level* | | | | | | | | | |
| **Type of hospital** | | | | | | | | | |
| General hospital | 1.000 | | | 1.000 | | | 1.000 | | |
| Hospital | 1.045 | 0.940　1.162 | 0.411 | 1.172 | 0.853　1.610 | 0.327 | 1.318 | 0.774　2.244 | 0.309 |
| Clinic | 1.370 | 1.171　1.603 | <.0001 | 1.126 | 0.682　1.859 | 0.642 | 0.621 | 0.232　1.658 | 0.342 |
| **Location** | | | | | | | | | |
| Rural | 1.000 | | | 1.000 | | | 1.000 | | |
| Urban | 1.076 | 0.975　1.188 | 0.147 | 1.172 | 0.853　1.610 | 0.327 | 0.793 | 0.457　1.378 | 0.411 |
| **No. of beds** | | | | | | | | | |
| <30 | 1.000 | | | 1.000 | | | 1.000 | | |
| <300 | 0.911 | 0.736　1.128 | 0.393 | 1.012 | 0.394　2.598 | 0.981 | 1.019 | 0.133　7.812 | 0.985 |
| <1000 | 0.967 | 0.765　1.222 | 0.778 | 1.116 | 0.416　2.995 | 0.828 | 1.203 | 0.144　10.071 | 0.865 |
| ≥1000 | 0.852 | 0.662　1.097 | 0.214 | 1.470 | 0.518　4.168 | 0.469 | 1.695 | 0.191　15.041 | 0.636 |
| **Ownership** | | | | | | | | | |
| Public | 1.000 | | | 1.000 | | | 1.000 | | |
| Corporate | 1.027 | 0.903　1.168 | 0.687 | 0.652 | 0.429　0.992 | 0.046 | 0.702 | 0.311　1.580 | 0.392 |
| Private | 1.073 | 0.933　1.235 | 0.323 | 0.731 | 0.466　1.145 | 0.171 | 0.818 | 0.340　1.970 | 0.655 |

Appendix Table 5. Results of the sensitivity analyses of readmission, all-cause mortality, and suicide within 1 year after hospital discharge

| Variable | Readmission | | | | All-cause mortality | | | | Suicide | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AOR | 95% CI | | p-value | AOR | 95% CI | | p-value | AOR | 95% CI | | p-value |
| *Individual level* | | | | | | | | | | | | |
| *Continuity of care index* | | | | | | | | | | | | |
| Total visits : 0 | 1.149 | 1.003 | 1.317 | 0.046 | 1.880 | 1.280 | 2.762 | 0.001 | 1.032 | 0.507 | 2.098 | 0.932 |
| Total visits : 1-2 | 1.050 | 0.921 | 1.197 | 0.467 | 1.611 | 1.090 | 2.381 | 0.017 | 1.845 | 0.932 | 3.653 | 0.079 |
| <1 | **1.704** | **1.461** | **1.988** | **<.0001** | **2.190** | **1.409** | **3.404** | **0.001** | **3.539** | **1.795** | **6.974** | **0.000** |
| 1 (perfect continuity) | 1.000 | | | | 1.000 | | | | 1.000 | | | |
| *Sequential nature of provider continuity* | | | | | | | | | | | | |
| Total visits : 0 | 1.156 | 1.026 | 1.302 | 0.017 | 1.692 | 1.205 | 2.377 | 0.002 | 0.788 | 0.415 | 1.497 | 0.467 |
| Total visits : 1 | 1.022 | 0.901 | 1.159 | 0.736 | 1.537 | 1.033 | 2.288 | 0.034 | 1.172 | 0.594 | 2.314 | 0.647 |
| <1 | **1.786** | **1.556** | **2.049** | **<.0001** | **1.928** | **1.288** | **2.887** | **0.001** | **3.031** | **1.652** | **5.559** | **0.000** |
| 1 (perfect continuity) | 1.000 | | | | 1.000 | | | | 1.000 | | | |
| *Sequential nature of provider continuity* | | | | | | | | | | | | |
| Total visits : 0 | 1.113 | 0.989 | 1.252 | 0.075 | 1.579 | 1.138 | 2.192 | 0.006 | 0.739 | 0.396 | 1.379 | 0.342 |
| Total visits : 1 | 0.987 | 0.871 | 1.118 | 0.834 | 1.441 | 0.977 | 2.124 | 0.065 | 1.096 | 0.564 | 2.130 | 0.786 |
| Low | **2.035** | **1.650** | **2.509** | **<.0001** | 1.834 | 0.903 | 3.724 | 0.093 | **3.550** | **1.456** | **8.655** | **0.005** |
| Medium | **1.494** | **1.218** | **1.834** | **0.000** | **1.987** | **1.133** | **3.487** | **0.017** | **2.615** | **1.111** | **6.155** | **0.028** |
| High | 1.000 | | | | 1.000 | | | | 1.000 | | | |

Appendix Table 6. Results of the conditional logistic regression analysis of readmission by mental disorder (substance use disorders, schizophrenia, bipolar disorders, and unipolar disorders)

| Variable | Readmission within 1 year | | |
|---|---|---|---|
| | AOR | 95% CI | p-value |
| *Substance use disorders* | | | |
| **Continuity of care index** | | | |
| Total visits : 0 | 0.692 | 0.546 0.876 | 0.002 |
| Total visits : 1-2 | 0.793 | 0.620 1.016 | 0.067 |
| Low | 1.346 | 0.839 2.160 | 0.218 |
| Medium | 1.055 | 0.682 1.633 | 0.810 |
| High | 1.000 | | |
| *Schizophrenia* | | | |
| **Continuity of care index** | | | |
| Total visits : 0 | 2.367 | 1.803 3.106 | <.0001 |
| Total visits : 1-2 | 1.249 | 0.967 1.614 | 0.089 |
| Low | **3.177** | **1.983 5.090** | **<.0001** |
| Medium | **1.702** | **1.221 2.371** | **0.002** |
| High | 1.000 | | |
| *Bipolar disorders* | | | |
| **Continuity of care index** | | | |
| Total visits : 0 | 1.551 | 0.902 2.669 | 0.113 |
| Total visits : 1-2 | 1.129 | 0.717 1.779 | 0.600 |
| Low | 2.103 | 0.932 4.747 | 0.074 |
| Medium | **1.853** | **1.063 3.229** | **0.030** |
| High | 1.000 | | |
| *Unipolar disorders* | | | |
| **Continuity of care index** | | | |
| Total visits : 0 | 0.454 | 0.295 0.699 | 0.000 |
| Total visits : 1-2 | 0.600 | 0.405 0.888 | 0.011 |
| Low | **2.057** | **1.122 3.773** | **0.020** |
| Medium | 1.522 | 0.940 2.466 | 0.088 |
| High | 1.000 | | |

*Adjusted for all other covariates.

**For each disorder, up to one control was randomly extracted from the risk set and matched by follow-up time and year of discharge for readmission with the same disorder.

## Korean Abstract

## 정신질환자의 의료의 질에 관한 연구: 진료 지속성의 효과를 중심으로

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**서론:** 전 세계적으로 정신질환의 사회경제적 부담은 증가하고 있으며, 우리나라도 다른 선진국들과 마찬가지로 정신질환의 질병 부담은 더욱 커질 것으로 예상된다. 증가하는 부담과 함께, 우리나라는 경제협력개발기구 국가들보다 퇴원 후 재입원, 자살 등과 같은 의료의 질이 좋지 않다. 의료의 질을 개선하기 위해 경제협력개발기구는 정신질환자의 퇴원 후 지속적인 관리를 권고하고 있다. 실제로, 다른 분야의 많은 연구들에서 진료의 지속성은 건강 결과에 긍정적인 영향을 준다고 알려져 있다. 그러나, 기존의 정신질환 환자를 대상으로 한 연구들에서 그 둘의 관계가 분명하지 않았다. 특히, 한국에서는 퇴원 후 진료의 지속성이 의료의 질을 향상시킬 수 있는지에 관하여 연구가 부족하다. 따라서, 이 연구는 정신질환자의 퇴원 후 진료의 지속성과 의료의 질과의 관계를 규명하고자 하였다.

**연구방법**: 이 연구는 2002 년부터 2013 년까지 국민건강보험 공단 표본코호트 자료를 이용하였다. 연구 대상자는 2002 년부터 2012 년 사이에 주진단명

정신활성물질사용장애, 조현병, 양극성장애, 우울장애, 기타 정신질환으로 입원한 18,702 명의 환자로 한정하였다. 이 연구의 종속변수는 퇴원 후 1 년 이내 재입원, 사망, 자살을 의료의 질로 이용하였다. 이 연구는 코호트 내 환자-대조군 연구 설계를 바탕으로, 각각의 환자군은 1 년 이내 재입원 한 환자 8022 명, 사망한 환자 355 명, 자살한 환자 108 명이었다. 각각의 환자군에 대하여, 재입원은 1 명을 (사망과 자살은 10 명)을 추적관찰기간과 퇴원 연도가 일치하는 위험 집단(risk set)에서 무작위로 추출하였다. 기준 날짜(index date)는 각각의 이벤트가 발생한 날짜로 정의하였다. 정신과 외래 환자 진료의 지속성은 퇴원한 시점부터 재입원 또는 사망(자살)이 발생한 날짜까지 (대조군의 경우 기준 날짜까지) 측정되었다. 통계분석방법은 조건부 로지스틱 회귀 분석을 실시하여 교차비(odds ratio)를 추정하였다.

연구결과: 정신과 입원 환자 18,702 명 중 1 년 이내 재입원은 8,022 명, 모든 원인으로 인한 사망은 355 명, 자살은 108 명(0.6 %)이었다. 지속성이 높은 입원 환자와 비교했을 때, 중간 수준 지속성(OR 1.519 95% CI 1.250-1.845)과 낮은 수준의 지속성 (OR 1.769 95% CI 1.425-2.263)이 퇴원 후 1 년 이내 재입원의 위험이 높았다. 퇴원 후 1 년 이내에 모든 원인으로 사망 할 위험은 지속성이 높은 군에 비해, 낮은 그룹의 위험(OR 3.118 95 % CI : 1.592-6.106)이 증가했다. 지속성 수준이 높은 환자들과 비교했을 때, 중간 수준(OR 2.709 95 % CI: 1.168-6.284) 및 낮은 수준의 지속성 (OR 3.839 95 % CI: 1.351-10.914)을 가진

환자들이 병원 퇴원 후 1년 이내에 자살의 위험이 증가했다. 지속성 수준을 한 의료 제공자에게 받은 환자들과 그렇지 않은 환자들로(Perfect 1 vs. <1)하여 시행한 민감도 분석 결과, 지속성 수준이 좋은 환자들보다 지속성 수준이 좋지 않은 환자에서 재입원, 사망, 자살 모두 위험이 증가하였다.

**결론**: 이 연구에서는 정신병 입원 환자의 퇴원 후 외래 진료의 지속성은 의료의 질(재입원, 모든 원인의 사망 및 자살)을 향상하는 것을 알 수 있었다. 따라서, 재입원, 사망 및 자살을 줄이기 위한 정책을 설계 할 때 진료의 지속성은 중요한 고려사항이라 제안한다.