Predictors of Early Psychiatric Rehospitalization: A National Case Register Study

Nelly Zilber, D. ès Sc., Tzipi Hornik-Lurie, MA, and Yaacov Lerner, MD

The Falk Institute for Mental Health Studies, Jerusalem, Israel

ABSTRACT

Background: Inconsistent results have been published on variables affecting readmission to psychiatric hospitals, in particular length of hospitalization before discharge. The objective of the present study was to develop a predictive model for 30-days readmission after discharge, as the latter is one of the performance indicators in the pending mental health reform in Israel.

Method: The data were extracted from the Israeli national psychiatric case register. They concerned all patients discharged from psychiatric hospitals in Israel during a six-month period (January 1,-June 30, 2004). A follow-up since the first discharge during this period (discharge from "index hospitalization") until November 30, 2005 was performed for each patient. A Cox regression allowed constructing a multi-factorial prediction model for readmission within 30 days from discharge.

Results: The readmission rate within 30 days was 13%. The variables predicting early readmission were age up to 45, history of prior hospitalization, short time between index and prior hospitalization and being discharged from a hospital in the Tel Aviv-Center district. Length of hospitalization was not a predictor of early readmission, except for the very short ones (up to eight days) which predicted earlier readmission.

Conclusion: The policy of shortening hospitalizations, which potentially could lead to premature discharge, was not found to be associated with early readmission, except for extremely short hospitalizations.

INTRODUCTION

During the last decades, deinstitutionalization has led to impressive changes in the use of psychiatric services all over the western world (1). Length of stay (LOS) in psychiatric hospital has decreased dramatically (1), but claims have been made by some that readmission occurs consequently earlier (2-6). Other studies have not confirmed such a relationship (7, 8). The discrepancies may be due to the fact that only few studies (9, 10) are based on national representative data and that the follow-up periods for assessing readmission vary widely across studies, extending from 30 days to as much as five years.

The Israel Psychiatric Case Register, which includes both demographic and cumulative clinical and administrative information on all patients admitted to a psychiatric hospital in Israel since 1950 (11), makes it possible to aggregate all episodes of inpatient care for each patient in a nation-wide sample.

The structural mental health reform, which started in Israel in 2001 and aimed at an overall reduction of psychiatric inpatient stay, chose as one of its performance indicators the 30-day hospital readmission rate. This is also one of the indicators recommended by the OECD (Organization for Economic Co-operation and Development) Mental Health Panel (12). Studying readmission within a short time from discharge strengthens the probability that it will reflect the impact of the care during the previous hospital stay. It is assumed that, for a longer period of follow-up, other factors than hospitalization come into play, such as the natural course of the illness, environmental stressors, access to community services.

The objective of the present study was thus to develop a prediction model for 30-day hospital readmission after discharge, examining specifically the effect of the length of the inpatient stay preceding the discharge. This

Address for Correspondence: ✉ Dr. Yaacov Lerner, Falk Institute, Kfar Shaul Hospital, Givat Shaul, Jerusalem 91060, Israel
falk1@012.net.il

addresses the present concern prevailing in the professional community that the current pressure to shorten length of inpatient stay may lead to premature discharge with increased risk of readmission (8).

MATERIAL AND METHODS

DATABASE AND STUDY POPULATION

The data (without any identifying information on patients) were extracted from the Israel Psychiatric Case Register. They concerned all patients discharged from psychiatric hospitals in Israel, during a six-month period (January 1-June 30, 2004). A follow-up since the first discharge during this period (discharge from "index hospitalization") until November 30, 2005 was performed for each patient.

For each index hospitalization, demographic, clinical and administrative data were extracted.

STUDY VARIABLES

The dependent variable was the probability of readmission within 30 days from discharge. If readmission occurred within three days from discharge, the next hospitalization was considered as the continuation of the previous one. This allowed excluding administrative leaves, such as transfer to another hospital or leaves for weekends. The independent variables were: demographic data (gender, age, ethnic group), clinical data (ICD-10 diagnosis), history of prior hospitalization, time between discharge from former hospitalization and admission to index hospitalization, legal status at admission to the index hospitalization (compulsory vs. voluntary), length of index hospitalization and district of hospitalization. The six districts differ in the availability of community services (measured by the number of mental health agents per 10,000 adult population). The rates are the following: in the North 0.7 (the lowest), in Haifa 1.4, in Jerusalem 1.7, in the Center 1.4, in Tel Aviv 2.3 and in the South 1.1 (Internal Report of Mental Health Services, Ministry of Health, Israel, 2003). As hospitals in Tel Aviv and the Center admit patients from both districts, the two districts were combined in the analysis.

The ICD-10 diagnoses were recoded into five diagnostic groups according to the main diagnosis: Disorders due to alcohol and drug abuse (F10-F19), schizophrenia and other functional psychoses (F20-F29), organic mental disorders (F00-F09), mood disorders (F30-F39) and neurotic and personality disorders (F40-F48 and F60-F69). Only 1.3% of the cases did not belong to any of these categories and were not included in the analysis. Comorbidity was not considered because only the main diagnosis is recorded in the Case Register.

DATA ANALYSIS

Since the studied variable (time to readmission) revealed a decaying exponential rather than a normal distribution (data available on request), a survival analysis was preferred to ANOVA procedures, which assume that the dependent variable is normally distributed (cf. 13). In addition, survival analysis has the advantage of including censored cases (patients not readmitted by November 30, 2005). We performed a Kaplan–Meier analysis, in which time to readmission was the time-to-event variable, while the "event" was readmission. A Cox regression allowed constructing a multi-factorial prediction model for readmission within 30 days from discharge, controlling for various independent variables, which were entered simultaneously in the analysis.

Data analyses were carried out using SPSS/PC version 15.0.

RESULTS

The study population consisted of 6,868 psychiatric discharges from hospitalization. The main characteristics of the discharged patients can be seen in Table 1. The median length of the index hospitalizations was 25 days. As shown in Fig. 1, the median time to readmission was 444 days and the readmission rate within one month was 13%. In Table 1, the predictors of readmission within 30 days are given. Regarding the demographic characteristics of the hospitalized patients, gender and ethnic origin were not found to be significantly related to the probability of readmission, while age was. Patients aged up to 45 years had a higher probability of readmission than older patients; no significant difference was found between patients aged 45-65 and 66^{+}. Diagnosis and legal status were not found to be significantly related to the probability of early readmission. A significant predictor of early readmission was the recency of prior hospitalization: the more recent the previous hospitalization, the higher the probability of early readmission. Another significant predictor of 30-day readmission related to hospitalization was an index hospitalization of up to eight days; no statistically significant difference was found between all other groups with various longer lengths of hospitalization.

We then examined the interaction between two predictors of readmission, length of index hospitalization

and time in the community between former and index hospitalizations. For both short and longer hospitalizations, the shorter the time since former hospitalization, the higher the probability of rehospitalization (Figure 2). On the other hand, the effect of the length of index hospitalization is dependent on the time in the community prior to the index hospitalization. As seen in Figure 2, one group is significantly different from all others,

Table 1. *Cox Regression Results for Predictor Variables of Readmission within 30 Days from Discharge*

	N	Exp(B)*	95% C.I.			p.
Age						0.030
Up to 45 years	3873	1.00				
45 to 65 years	1928	0.85	0.73	-	0.99	0.038
66 years or more	657	0.75	0.57	-	0.99	0.040
Gender						0.683
Male	3666	1.03	0.89	-	1.18	
Female	2792	1.00				
Ethnic origin						0.688
Jewish	5469	1.00				
Arab	695	0.93	0.73	-	1.18	
Unknown	294	0.88	0.62	-	1.26	
Diagnosis						0.942
Schizophrenia or other psychosis	4153	1.00				
Organic Disorder	311	1.05	0.74	-	1.49	0.773
Affective Disorder	1036	1.05	0.86	-	1.30	0.620
Neurotic and Personality Disorder	753	1.08	0.86	-	1.34	0.505
Drugs and Alcohol	239	0.94	0.64	-	1.39	0.771
Legal Status at Admission						0.293
Compulsory Admission	1523	1.00				
Voluntary Admission	4935	1.10	0.92	-	1.30	
Hospitalization History						0.000
No prior hospitalization	1627	0.38	0.30	-	0.47	0.000
> 365 days since former hospitalization	2174	0.45	0.37	-	0.55	0.000
91-365 days since former hospitalization	1751	0.59	0.49	-	0.71	0.000
<=90 days since former hospitalization	906	1.00				
Length of Index Episode (days)						0.009
2 - 8	1247	1.00				
9 – 30	2299	0.81	0.68	-	0.98	0.030
31 - 60	1377	0.70	0.56	-	0.87	0.002
61+	1535	0.75	0.61	-	0.92	0.007
Hospital District						0.001
Northern district	674	1.26	0.92	-	1.71	0.144
Haifa district	1207	1.02	0.77	-	1.35	0.901
Jerusalem district	722	1.09	0.80	-	1.47	0.593
Tel Aviv and Center districts	3090	1.43	1.13	-	1.81	0.003
Southern district	765	1.00				
Total	6458					

* The analysis is based only on the hospitalizations for which none of the values of the variables was missing.

Figure 1. *Kaplan Meier Survival Curve for Time to Readmission*

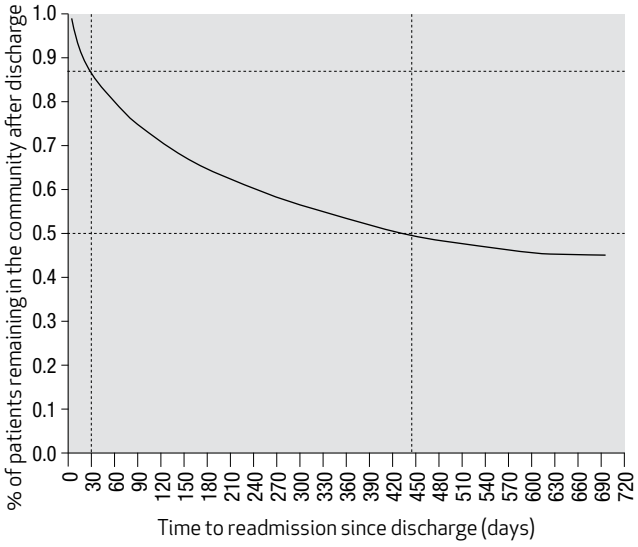
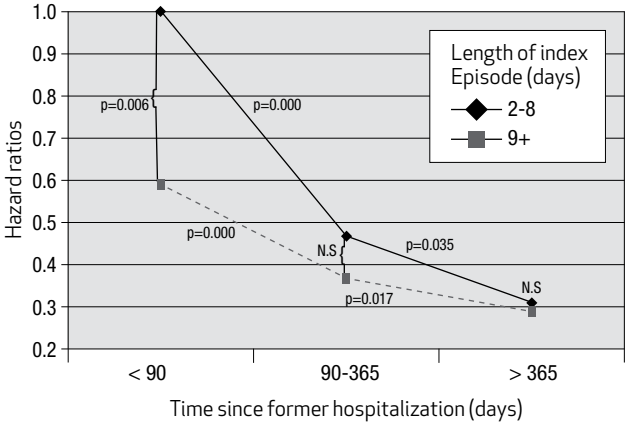


Figure 2. *Probability of Readmission within 30 Days from Discharge*



Each point in the graph represents the hazard ratio relative to the reference group (time since former hospitalization <90 and length of index episode 2-8 days)
Each p value between two points relates to the significance of the difference between the hazard ratios at these two points.

with a significantly quicker readmission (hospitalization of up to eight days and previous hospitalization within 90 days). This particular group concerns only a small number of patients (1.5% of all discharged patients and 7.3% of those with short hospitalizations).

Another predictor of early readmission was being discharged from a hospital in the Tel Aviv and Center districts. Interestingly, although the highest proportion of the very short hospitalizations was found in the southern district (28.2% vs. 16.8% in the Northern district, 16.7% in the Haifa district, 20.5% in the Jerusalem district and 20.9% in the Tel Aviv and Center districts), the southern district showed the lowest risk of readmission (Table 1).

DISCUSSION

The main strength of the present study is an analysis based on cumulative national data from the Israel National Psychiatric Hospitalization Register, which enables an analysis of non-biased nationwide data. The findings are important, even with the following limitations: lack of detailed information about individual patients' clinical characteristics - other than diagnosis - and quality of treatment. Gathering such data, however, is not feasible for a nationwide study, as individual clinical patient characteristics and quality of treatment are not registered in a standard form and differ greatly from hospital to hospital. As stated by Kolbasovsky et al. (7), "There is… a need for the development of a practical predictive model…using only information easily obtainable from administrative databases."

Prior hospitalization was found to be related to earlier readmission in accordance with the literature (9, 10, 14, 15). The more recent the prior hospitalization was, the sooner the readmission. Recent hospitalization can possibly be considered as a proxy for severity of psychopathology and/or poor social support in the community.

The findings in the literature regarding the relationship between length of hospitalization and readmission are inconsistent. Some authors (8-10, 16, 17) reported that patients with longer stay are more likely to be readmitted, suggesting that longer stays may act as a proxy for the patients' severity of illness. The cutting point defining longer stay was 60 days (17), 30 days (10) and even 20 days (8). In contrast, others (3, 18) reported that shorter stay is associated with earlier readmission, possibly because of a premature discharge. Similarly, Heeren et al. (4) found that, over the years (between 1993 and 1997), the mean LOS decreased and, in parallel, the rate of readmission increased. Wickizer and Lessler (6) found that restriction on LOS imposed by utilization management programs in the U.S.A. lent to an increase in re-admissions during the 1990s. In these studies, the mean LOS was 7-15 days. These different studies seem to support the association between very short hospitalization and early readmission.

In the present study, we examined a full spectrum of LOS, from very short to very long, after adjusting for variables that may reflect severity of pathology and were

found to be associated with the probability of readmission (diagnosis of schizophrenia, existence and recency of a previous history of hospitalization and compulsory hospitalization). Our study results did not confirm the claim that shortening length of inpatient stay, after controlling for other variables, leads to earlier readmission, except for those patients who had been hospitalized during the 90 days preceding the index hospitalization, and whose length of index hospitalization was less than nine days. In our study, they represent a small number of discharged patients (1.5%).

Interestingly, there was no significant association between *early* readmission and the rate of mental health professionals in the community in the different districts. The fate of the patient in the community at later stages depends of course on supportive networks and ongoing community services, which require a sufficient number of professionals.

It should be noted that the Southern district, which was found to have the lowest readmission risk, is the district with the highest proportion of short hospitalizations, probably due to its lowest bed ratio (19). A possible explanation is that hospitals in different districts differ in their discharge programs and in their interaction with the community services, which may be related to the bed pressure. Well-planned discharge programs and good interaction between hospital and community services seem to affect *early* readmission (20, 21). This of course should be preferably the result of good planning and not only of bed pressure.

CONCLUSION

The policy of shortening the hospitalizations, which potentially could lead to premature discharge, was not found to be associated with early readmission, except for extremely short hospitalizations (up to eight days). Preventing early readmission apparently depends mainly on effective discharge programs and pre-discharge contacts with outpatient services.

References

1. Fakhoury W, Priebe S. The process of deinstitutionalization: An international overview. Curr Opin Psychiatry 2002;15:187-192.
2. Lieberman PB, Witala ST, Elliott B, McCormick S, Goyette SB. Decreasing length of stay: Are there effects on outcomes of psychiatric hospitalization? Am J Psychiatry 1998;155:905-909.
3. Figueroa R, Harman J, Engberg J. Use of claims data to examine the impact of length of inpatient psychiatric stay on readmission rate. Psychiatr Serv 2004;55:560-565.
4. Heeren O, Dixon L, Gavirneni S, Regenold WT. The association between decreasing length of stay and readmission rate on a psychogeriatric unit. Psychiatr Serv 2002;55:76-79.
5. Heggestad T. Operating conditions of psychiatric hospitals and early readmission – effects of high patient turnover. Acta Psych Scand 2001;103:196-202.
6. Wickizer TM, Lessler D. Do treatment restrictions imposed by utilization management increase the likelihood of readmission for psychiatric patients? Medical Care 1998;36:844-850.
7. Kolbasovsky A, Reich L, Futterman R. Predicting future hospital utilization for mental health conditions. J Behav Health Serv R 2007;34:34-42.
8. Thompson EE, Neighbors HW, Munday C, Trierweiler S. Length of stay, referral aftercare, and rehospitalization among psychiatric inpatients. Psychiatr Serv 2003;54:1271-1276.
9. Hodgson RE, Lewis M, Boardman AP. Prediction of readmission to acute psychiatric units. Soc Psychiatry Psychiatr Epidemiol 2001;36:304-309.
10. Korkeila JA, Lehtinen V, Tuori T, Helenius H. Frequently hospitalized psychiatric patients: A study of predictive factors. Soc Psychiatry Psychiatr Epidemiol 1998;33:528-534.
11. Lichtenberg P, Kaplan Z, Grinshpoon A, Feldman D, Nahon D. The goals and limitations of Israel's psychiatric case register. Psychiatr Serv 1999;50:1043-1048.
12. Hermann R, Mattke S. The members of the Organization for Economic Co-operation and Development (OECD) Mental Health Care Panel. Selecting indicators for the quality of mental health care at the health system level in OECD countries. Organization for Economic Co-operation and Development, 2004.
13. Stevens A, Hammer K, Buchkremer G. A statistical model for length of psychiatric in-patient treatment and an analysis of contributing factors. Acta Psychiat Scand 2001;103:203-211.
14. Bernardo AC, Forchuk C. Factors associated with readmission to a psychiatric facility. Psychiatr Serv 2001;52:1100-1102.
15. Moran PW, Doerfler LA, Scherz J, Lish JD. Rehospitalization of psychiatric patients in a managed care environment. Ment Health Serv Res 2000;2:191-199.
16. Mojtabai R, Nicholson RA, Neesmith DH. Factors affecting relapse in patients discharged from a public hospital: Results from survival analysis. Psychiatr Q 1997;68:117-129.
17. Qiesvold T, Saarento O, Sytema S, et al. Predictors for readmission risk of new patients: The Nordic comparative study on sectorized psychiatry. Acta Psychiat Scand 2000;101:367-373.
18. Lin H-C, Tian W-H , Chen C-S, Liu T-C, Tsai S-Y, Lee H-C. The association between readmission rates and length of stay for schizophrenia: A 3-year population-based study. Schizophr Res 2006;83: 211-214.
19. Hospitalization Institutes 2007. Department of Information and Computerization, Ministry of Health, Jerusalem 2008.
20. Olfson M, Mechanic D, Boyer CA, Hansell S. Linking inpatients with schizophrenia to outpatient care. Psychiatr Serv 1998;49, 911-917.
21. Durbin J, Lin E, Layne C, Teed M. Is readmission a valid indicator of the quality of inpatient psychiatric care? J Behav Health Serv Res 2007;34, 137-150.