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# **Are there effects of consultation-liaison-psychiatry on length of stay in the general hospital? A path analysis**

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## **Abstract**

### Background and objectives

Recently, several publications have addressed interactions between selected factors related to the role of consultation-liaison (CL) psychiatric interventions and length of stay (LOS) in the general hospital anew. Yet at present, recent available research is restricted in the scope of factors studied. This study aims at providing an analysis of factors associated with LOS in a large sample of patients, with a broad set of variables and by accounting for the complex relationships between them.

### Methods

Retrospective cohort analysis of n=3190 adult patients referred to the CL-psychiatry service of a general hospital. Univariate statistics and multiple regression were used to assess the association between patient characteristics and LOS. Path analysis was used to elucidate the mediating role of time-to-referral (TTR).

### Results

Univariate analysis and multiple regression showed that TTR, age, and poor general functioning were associated with longer LOS. Diagnosis on Axis I+II (according to DSM), suicidal ideation and somatic

diagnosis had no significant association with LOS. The four variables with the strongest total effect on LOS in the path analysis were TTR, the year of consultation, age and general functioning. Age had a higher indirect effect on LOS, while general functioning had a higher direct effect on LOS.

## Conclusions

In the path model, TTR is a highly significant predictor of LOS and also a mediator of other predictors. This highlights the role of the CL-psychiatrist in the management of patients in the general hospital. Further research should investigate how referrals are prioritized by consultees and which different effects consultation recommendations might have on LOS.

## Introduction

There is renewed interest in the association of consultation-liaison (CL) psychiatric interventions and length of stay (LOS), in a context where many health systems are in the process of reshaping their case-based hospital payment systems. Earlier studies suggested that timely consultations are associated with shorter LOS. Yet, during the end of the 1990s, interest in LOS and its possible reduction by CL somewhat subsided in the context of a marked general reduction of LOS as a consequence of the introduction of diagnosis related groups (DRGs) for general hospital inpatients. In addition, further scrutiny showed that the formerly hypothesized correlations were more complex, e.g. with possibly differential effects of distinct CL-psychiatric recommendations on LOS, such as additional referral to social work or prescription of psychotropic drugs (1–4).

A recent surge of analyses has addressed possible interactions between factors associated with LOS anew. For example, Sockalingam et al. (2016) reported that patients with longer time to referral (TTR) had significantly longer LOS, even after controlling for severity of medical comorbidity (5). In pediatric patients, earlier psychiatric consultation was associated with shorter LOS and lower costs after adjusting for psychological functioning, physical illness severity, and the availability of

subsequent psychiatric care options; poorer psychiatric functioning and milder physical illness were associated with shorter TTR (6).

Yet, available research often studied selected aspects omitting a larger body of variables that seem relevant (7–9), which is often related to the size of the sample. Such missing factors include e.g. the so-called lag time 2 (from referral to consultation - RTC), the effects of psychotropic medication (e.g. adverse effects of psychotropic drugs prescribed by the CL-psychiatrist) and overall physical and psychological functioning.

Therefore, as main focus we present a path analysis of factors associated with LOS in a large sample of adult patients referred to CL psychiatry, with a broad set of variables and accounting for the complex relationships between them based on clinical hypotheses, as reported previously (1–4). Based on clinical experience as visualized in Figure 1, we hypothesized an association between TTR and LOS; the year of consultation and LOS (1); and a more rapid discharge if no institutional bed has to be found (6). Finally, we assumed age and general and psychosocial functioning to have an influence on all other variables. Some of the links between variables have been tested in an earlier analysis of a sub-sample excluding patients without a psychiatric diagnosis (10).

## **Methods**

### Design and population

The present study is a retrospective cohort analysis of patients referred to the CL psychiatry service of Mount Sinai Hospital (MSH), New York City, between 1988 and 1997. The cohort includes all patients whose psychiatric consultation was requested by a somatic ward. MSH is a tertiary care university hospital of 1,200 beds and 30,000 inpatient admissions per year during the study period. Since several specialty units (e.g. gerontology, HIV/AIDS) employ their own psychiatrists or psychologists (and are thus not included in this analysis), consultations requests were issued predominantly by general medical or surgical wards. In total, 3032 patients with a diagnosis of Axis I and/or II of the DSM-III-R classification system between the ages of 17-65, who did not have private

insurance (the latter received care through private attending physicians), were included. For an additional 158 patients of the cohort, no psychiatric diagnosis was coded or missing, leading to a total cohort size of 3190 patients.

Multiple regression analysis excluded 23 patients, for whom data on psychiatric and/or somatic main diagnosis were not available.

#### Data collection

Patient characteristics and the data reflecting the consultation process were collected using the MICRO-CARES Consortium Psychiatric Consultation Questionnaire (11). Documentation was performed by the consultant psychiatrists only. In order to ensure reliability, residents were supervised by the head of the CL psychiatry service and training was provided using case vignettes. Psychiatric diagnosis was made by the consultant psychiatrists based on clinical interviews without the use of structured diagnostic interviews.

#### Variables

Demographic characteristics (age, gender, living situation, job status, psychiatric treatment during the previous year, reason for the consultation) were recorded at the initiation of the consultation, as well as the somatic (based on ICD-9) and psychiatric diagnoses. The Karnofsky Index, scaled from 0 to 100 (low values indicate a high need for care), was used to assess general functioning and morbidity during the month preceding the admission. The global assessment of functioning (GAF) was applied as a measure of psychological, occupational and social functioning, with low values indicating poor functioning.

Process variables included lag time 1 (TTR, time from hospital admission to requesting a psychiatric consultation), lag time 2 (RTC, time from referral to consultation) and LOS. The consultant psychiatrist also assessed, on request by ward staff, whether discharge against medical advice (AMA) was possible or not. If psychotropic medication was recommended by the consultant, adverse

reactions were recorded. For the discharge location, we distinguished home from all other options.

The year of the consultation was managed as a continuous variable in order to account for changes in case-mix and discharge practice over time.

In order to reduce the influence of outliers and the skewed distribution of LOS, logarithmic transformation of the data was performed. For 25 patients with a LOS-value of zero, these values were transformed from zero to one in order to include them in the analysis. Missing data was not missing completely at random and treated using the full-information maximum likelihood method (12) under SPSS, except for the psychiatric and somatic main diagnoses which showed too many dimensions.

### Analysis

A path analysis was employed in order to account for the complex relationships between the variables. Based on structural equation modeling, this technique allows to distinguish direct from indirect effects, in the sense of a mediation analysis. In such a model, the direct effect of an independent variable on a dependent variable is described by a path coefficient, controlling for other variables just as in a multiple regression analysis. The indirect effect is the effect of the independent variable on the dependent variable mediated by variables on the paths between them. Finally, the total effect of one variable on another is the sum of the direct and indirect effects (13).

In order to keep the path model as parsimonious as possible, we first performed univariate and multiple regression analyses of variables associated with LOS. Only variables with a p-value of  $< .05$  in univariate and multiple regression analyses were kept for the subsequent steps of the analysis.

The fit indices used for the path analysis were the root mean square error of approximation (RMSEA), the Tucker-Lewis Index (TLI) and the Comparative Fit Index (CFI) (14). To evaluate RMSEA, values of  $< .05$  demonstrate a good fit to the model (15). TLI and CFI values of  $> 0.90$  and  $0.95$  respectively are considered as marginal and good fits (16).

All analyses were performed using SPSS version 20.

## **Results**

### Description of the cohort

The mean age of patients in our cohort was 44.0 years ( $\pm 12.6$ ), with 52% male patients.

Average LOS was 20.5 days ( $\pm 32.8$ ), TTR was 10.9 days ( $\pm 41.1$ ) and RTC .66 day ( $\pm 1.51$ ) (see Table 1).

The leading main psychiatric diagnoses were organic mental disorders (23.4%), adjustment disorder (19.3%) and substance related disorders (18.1%) (see Table 2).

The somatic main diagnoses were most frequently neoplasms (15.0%), followed by disorders of the digestive system (13.9%) and infectious diseases (11.6%) (see Table 3).

### Univariate and multiple regression of LOS

Due to non-significance at a level of .05, we excluded GAF ( $p = .345$ ), diagnosis on Axis I ( $p = .807$ ) and lag time 2 ( $p = .879$ ) from the subsequent steps of analysis.

In multiple regression of LOS, the strongest significant association was observed between TTR and LOS (stand. Beta .666); followed by the Karnofsky index (stand. Beta -.095); and the assessment of AMA (stand. Beta .077).

Suicidal ideation, diagnosis of personality disorder, the type of somatic diagnosis and a history of major psychiatric treatment in the previous year had neither statistically significant nor clinically relevant associations with LOS and were not retained for the path analysis (see Table 4).

### Path analysis

The model relationships with standardized regression weights are described below (Figure 1). All associations were significant at a level of  $p < .01$ , except for: age and discharge location; age and year of consultation; age and urgency; general functioning (as measured by the Karnofsky index) and

urgency as well as general functioning and drug side effects; which were not significant at a level of  $p < .05$ . Overall, the findings indicate that the model fits well, with RMSEA .049, TLI .911 and CFI .968.

The four variables with the strongest total model effect on LOS were TTR, year of consultation, age and general functioning (see supplementary Table 1 for detailed data on standardized effects). While longer TTR and higher age predicted an increase in LOS, better general functioning and a later year of consultation were associated with shorter LOS. Age had a higher indirect effect on LOS (i.e. through intermediate variables (17)), mostly mediated by TTR, while overall functioning had a higher direct effect on LOS. Of all four variables, TTR had the strongest effect on LOS.

While with a later year of consultation, and higher general functioning (as measured by the Karnofsky Index), TTR decreased in the model, higher age was a predictor of longer TTR. Of all clinical and patient variables (i.e. excluding the year of consultation), age had the strongest effect on TTR (Figure1).

## **Discussion**

To the best of our knowledge, this study presents the largest cohort of CL psychiatry patients to have been systematically investigated for factors related to LOS. The main finding of our analysis is the quantification of the key role of time to referral (TTR) as predictor of LOS. In the available literature, regression coefficients of TTR and LOS were .42 in multiple regression (7), and .50 in a path analysis in pediatric patients (6). Sockalingam et al. have used a 3-component finite mixture of exponential regression models, where TTR was significantly associated with LOS in each of the 3 components. In univariate analysis, the Spearman correlation coefficient was .77 (5). Hence, with a coefficient of .67 in our sample, the share of variance explained by TTR in the present analysis is slightly above the range of other multivariate models and in our view seems to be coherent.

Our path analysis suggests that TTR is a mediator for several other variables, including, most importantly, age and general functioning, while keeping in mind that patients older than 65 years were not included in our study. To the best of our knowledge, a general positive correlation between



age and TTR has not been reported in the literature for CL psychiatry patients before. Albeit, in a recent review on predictors of referral rates to CL psychiatry, Chen et al. found that younger age led to more frequent referral in most studies (18). Further, Wood et al. found that TTR was higher in the group of patients aged 65 or older, which they impute, however, to a higher need for interpreters in their ethnically diverse population (19). Possible explanations for these phenomena can be derived from the literature on suicide prevention in the elderly. On the one hand, older adults may be more likely to deny problems associated with mental health-related issues. On the other hand, clinicians may be less likely to initiate treatment because they may incorrectly attribute comments about death to normal aging or to a rational wish to end pain or suffering (20). Hence, the link between age and TTR in the CL-psychiatry setting should be subject to further research, including qualitative analyses on underlying conceptions.

The significant but moderate role that the categorization as urgency by the consultee has in determining TTR should be noted. In fact, the effect of urgency on TTR is smaller than that of age. This confirms the clinical experience that urgency is one factor, amongst others, in the process of patient prioritization. Likewise, in patients assessed by the consultant psychiatrist for AMA, TTR and LOS were shorter, yet with low clinical significance. Finally, there was a significant but small effect of discharge location on LOS, which seems to confirm the clinical experience that the search for a post-discharge care arrangement other than being discharged back to one's home requires additional time.

In summary, TTR can be regarded as a mediator on the one hand; but it also has a strong direct independent effect on LOS on the other hand. Along with recent interventions which show that a change in TTR leading to earlier intervention through enhanced cooperation of services influences LOS (5,21), our analysis strengthens the case for a timely intervention of the consultant psychiatrist. Further research should address whether a reduction of TTR might be achieved by collaborative care models with liaison psychiatrists or nurses as a viable mechanism of "not losing time" in the management of behaviorally disturbed patients.

No significant association of main psychiatric or somatic diagnosis with LOS could be found in our analysis (with a non-significant tendency for suicidal ideation to shorten LOS). There may be several explanations for this. In the context of this study, it is important to note that diagnosis of all disorders was based on a psychiatrist's clinical interview, and not a structured clinical assessment. Although recent evidence suggests that structured diagnostic instruments may have higher validity than clinical interviews for predicting subsequent functioning (22), it remains a challenge to include such a standard methodology in busy naturalistic settings as in CL-psychiatric services. Hence, we propose the following vantage point. On a more general level, psychiatric diagnoses in particular might indeed not be sufficiently discriminative as predictors of LOS, contrary to more tangible factors such as age, general functioning and lag time. This is in line with issues such as reliability (23), diffuse symptom expression in early stages of illness (24) and, even more so, research dismissing diagnosis-based approaches due to their lack of reliability in non-research "real world" settings (25). Indeed, instead of diagnoses, functional dimensions such as coping strategies may have higher relevance for LOS in patients with somatic and/or psychiatric conditions (26). This then would mean, as was discussed by Ramchandani et al. (27) that the CL-psychiatrists' role might develop more into becoming case managers, addressing e.g. how patient behavior can be improved in such patients feeling being overwhelmed within the complex hospital situation. In addition, an increased interest in liaison models based on CL-nurses can be noted with one study showing possible reduction of LOS in elderly medical inpatients (28). Yet the mechanism for this remains unclear, and it was hypothesized that better interprofessional communication via the integration of a CL-nurse might play a pivotal role (28,29).

The highly significant and relevant role of the year of consultation along our study period, as a controlling variable, is plausible in light of its association with other variables. Indeed, it is correlated with higher age, lower general functioning, shorter TTR and shorter LOS. All these tendencies are well documented effects of a general policy, in virtually all high-income countries, to limit hospitalizations to the most severely ill patients and to shorten their in-hospital stay (30). Of note,

during our study period, average LOS of all patients at MSH showed a steady decrease from 8.98 days in 1988 to 6.94 days in 1997 (4).

Furthermore, to our knowledge, our study is the first to report on the effect of psychotropic drugs recommended by the consultant psychiatrist and their side effects. Although De Jonge et al. have found a positive correlation between prescribed medication and LOS in the general hospital, their study did not distinguish prescribing physicians and types of medications (2). In our analysis, the presence of documented adverse events is associated with a significant though small increase of LOS, as clinical experience may well suggest. This effect is negatively correlated with the year of consultation: over time, the occurrence of side effects decreases. As suggested in a similar cohort over the same time span, this is most likely explained by changing patterns of recommendation, as e.g. the prescription of tricyclic antidepressants over time was replaced by newer agents such as the selective serotonin reuptake inhibitors (1). However, the relatively high level of missing data for this variable, albeit addressed by an appropriate imputation method, warrants some caution in our interpretation.

There are other limitations in our study. Our cohort dates back to the 1990s, reducing transferability and generalizability, since practice and populations change over time. However, clinical experience suggests that the main characteristics of patients in CL psychiatry since have varied little, even if CL-psychiatry responded to changes in the hospital setting (1). Further, selection effects regarding our sample must be considered, e.g. concerning the HIV/AIDS-patients who were not consulted by the regular CL-team, and private patients who were assessed by private physicians. The strengths of our study are the large cohort and the path analysis.

## **Conclusions**

In our model, TTR is a highly significant predictor of LOS and also a mediator of other predictors such as age and general functioning. It is important that we learn of ways to decrease LOS for our inpatient medical and surgical patients. Our data illustrate the benefit of a CL service in a general

hospital and underline the possible economic value of a behavioral medicine service in the general hospital that could be incorporated in the usual assessment of hospital services. This highlights the role of the CL-psychiatrist in the management of patients in the general hospital. Further research should investigate mechanisms of prioritization in referral and its potential impact on LOS, as well as ways of speedier psychiatric service delivery such as liaison models to release CL-psychiatry from just being a last resort in cases that seem to be in a deadlock.

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Table 1: Demographic and procedural data (n = 3190)

Variable	Value	Missing (n)
Age (years)	43.0 ± 12.6	0
Gender % male	52.0	19
Time to referral (days)	10.9 ± 41.1	53
Referral to consultation (days)	0.66 ± 1.51	86
General functioning	62.6 ± 23.9	61
GAF	63.7 ± 16.7	73
LOS (days)	20.5 ± 32.8	703
Major psych. treatment last year %	24.0	403
Urgency: immediate	438	
Urgency: same day	2029	180
Urgency: routine	543	
Discharge: home	2245	
Discharge: other	500	329
Discharge: does not apply	445	
Drug side effects <sup>§</sup> %	15.6	1956
Suicidal ideation %	10.8	64
AMA possible	187	
AMA refused	182	130
AMA no issue	2821	

Values are mean ± SD unless otherwise stated. LOS = length of stay. AMA = discharge against medical advice. GAF = global assessment of functioning. <sup>§</sup> only for psychotropic medication recommended by psychiatric consultant.

Table 2: Main psychiatric diagnosis (n = 3190)

Diagnosis	N	%
Organic mental disorders	747	23.4
Adjustment disorder	617	19.3
Substance related disorders	578	18.1
Depression	312	9.8
Anxiety and somatof. disord.	192	6.0
Schizophrenia	165	5.2
None	128	4.1
Personality disorder	69	2.2
Bipolar disorder	60	1.9
Dementias	53	1.7
Other	238	7.5
Missing	31	1.0

Table 3: Main somatic diagnosis (n = 3190)

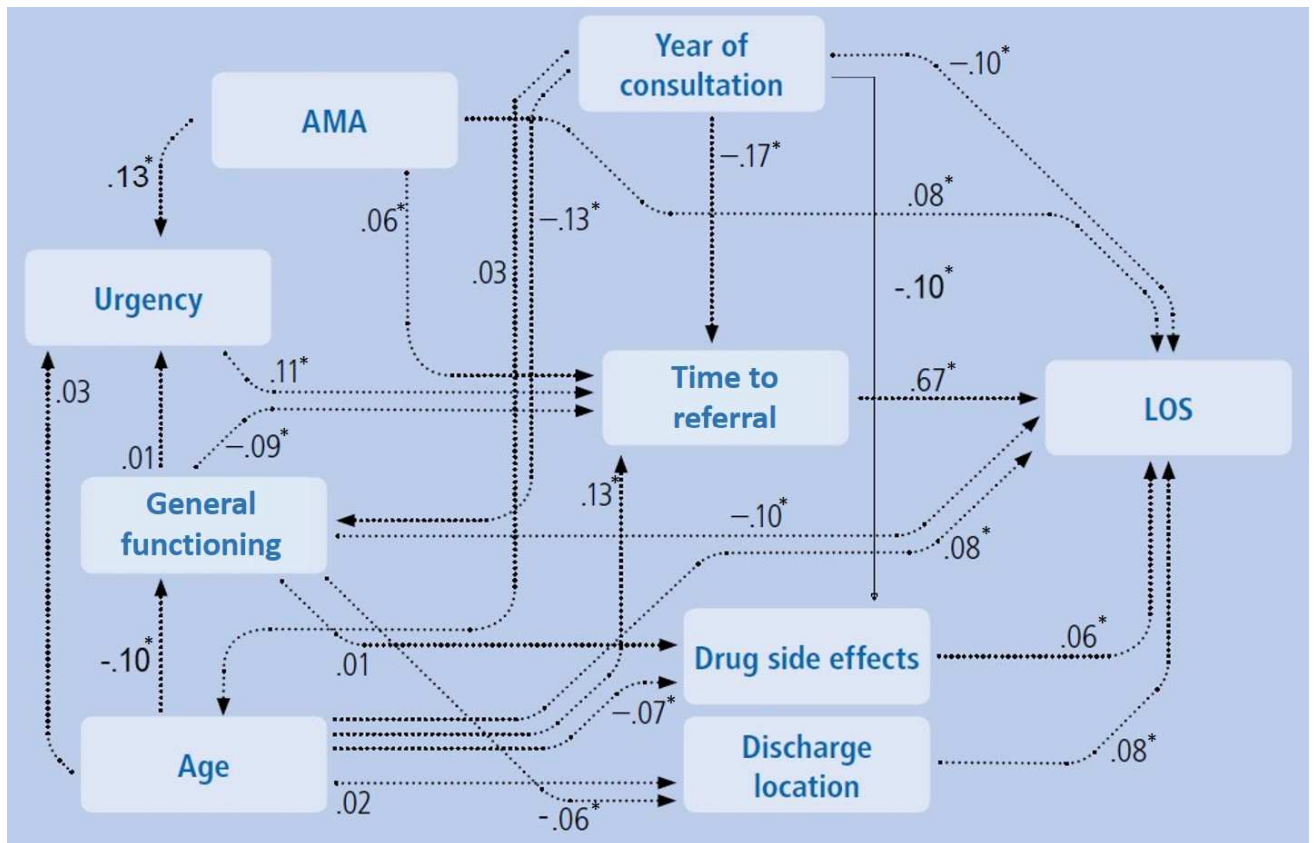
<b>Diagnosis</b>	<b>N</b>	<b>%</b>
Neoplasms	480	15.0
Digestive system	445	13.9
Infectious diseases	371	11.6
Circulatory system	341	10.7
Endocrine and metabolic	326	10.2
Respiratory system	285	8.9
Nervous system	202	6.3
Injuries and poisoning	151	4.7
Skin and musculoskeletal	146	4.6
Genitourinary system	120	3.8
Pregnancy and puerperium	62	1.9
Ill defined	57	1.8
None	181	5.7
Missing	23	.7

Table 4: Multiple regression of length of stay (N = 3167)

<b>Variable</b>	<b>Standard. beta</b>	<b>P-value</b>
Diagnosis on Axis II	-.026	.060
Age	.069	.000
Gender	.027	.053
Major psych. treatment previous year	.006	.626
Year of consultation	-.076	.000
Reason for consult: suicidal ideation	-.023	.059
General functioning	-.095	.000
Consult to assess Against Medical Advice	.077	.000
Side effects for psychotropic medication	.052	.002
Somatic diagnosis	-.023	.114
Urgency of consult request	.045	.000
Discharge Location	.052	.000
Time to referral	.666	.000



Figure 1: Path analysis (n = 3190)



Values shown are standardized regression weights. LOS = length of stay, AMA = Against Medical Advice. All associations with a significance level of  $p < .01$  are marked with an asterisk (\*); other values were not significant at a level of  $p < .05$ .