Observational Study

Medicine

OPEN

Variables associated with concordance or discordance for delirium diagnosis between referring and consulting physicians at a Tertiary Hospital in Colombia

Prospective observational study

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Abstract

Delirium is an acute state of impaired consciousness and a medical urgency. Its broad range of alterations in mental status make diagnosis challenging. Awareness and accurate provisional diagnosis by nonpsychiatric clinicians are important for prompt management. Because delirium symptoms overlap and mimic other neuropsychiatric conditions, a referral to a consultant psychiatrist is often needed. The aim of this study was to determine the discriminating variables that are associated with concordance or discordance for a DSM-5 delirium diagnosis made by the consultation/liaison (C/L) psychiatrist as compared to the referral diagnosis/reasons given by the referring physicians for inpatients from a Tertiary Hospital in a Latin-American country. Prospective study of a cohort of 399 consecutive patients admitted to any ward of a university hospital in Medellin-Colombia and referred by a specialist physician to the C/L Psychiatry service. Analyses for diagnostic concordance used a nested sample of 140 cases diagnosed with delirium by the psychiatrist. Two multivariate logistic models were run, for delirium diagnosis concordance and discordance between the referring physician and C/L psychiatrist. The referral diagnosis was concordant with that of Psychiatry in 90/140 patients in 64.3%, with 35.7% discordance. Increasing age (OR = 1.024) and internal medicine ward (OR = 3.0) were significantly related (Wald statistic $P < .05$) to concordance in the multivariate analysis whose model accuracy was 68.6%. Trauma/orthopedics ward (OR = 5.7) and SARS-CoV-2 infection (OR = 3.8) were important contributors to the model fit though not significant. Accuracy of the discordance model was 70.7%, where central nervous system (CNS) disorder (OR = 6.1) and referrals from ICU (OR = 4.9), surgery (OR = 4.6), neurology/neurosurgery (OR = 5.1) and another consultant (OR = 4.7) were significantly related (Wald statistic $P < .05$), while metabolic/endocrine disorder (OR = 2.7) was important for model fit, but not significant. Concordance for delirium diagnosis was higher from services where education, guidelines and working relationships with C/L Psychiatry could have contributed beneficially whereas, surprisingly, CNS disorders and neurology/neurosurgery services had higher discordance, as well as the ICU. Routine use of brief sensitive delirium assessment tools such as the DDT-Pro could enhance provisional delirium diagnosis.

Abbreviations: 4-AT = Four "A"s test, 95% CI = 95% confidence interval, BPSD = dementia with behavioral and psychological symptoms, C/L psychiatry = consultation/liaison psychiatry, CAM-A = 4-item Confusion Assessment Method-Algorithm, CCI-SF = Charlson Comorbidity Index-Short Form, CNS = central nervous system, COVID-19 = coronavirus disease of 2019, CUB = Clínica Universitaria Bolivariana, DDT-Pro = Delirium Diagnostic Tool-Provisional, DSM = Diagnostic and Statistical Manual of Mental Disorders, ICU = intensive care unit, IQR = interquartile range, JAMA = Journal of the American Medical Association, OMS = acute organic-mental syndrome, OR = odds ratio, SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.

Keywords: delirium, diagnostic concordance, differential diagnosis, general hospital, referral

This work received internal support from the Centro de Investigación para El Desarrollo y la Innovación (CIDI), Universidad Pontificia Bolivariana, Medellín, Colombia.

The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

Supplemental Digital Content is available for this article.

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How to cite this article: Zapata C, Garces JJ, Duica K, Restrepo C, Ocampo MV, Velásquez-Tirado JD, Ricardo C, Trzepacz PT, Franco JG. Variables associated with concordance or discordance for delirium diagnosis between referring and consulting physicians at a Tertiary Hospital in Colombia: Prospective observational study. Medicine 2022;101:49(e32096).

Received: 10 June 2022 / Received in final form: 8 November 2022 / Accepted: 8 November 2022

http://dx.doi.org/10.1097/MD.0000000000032096

1. Introduction

Delirium is one of the most important disorders in Consultation/Liaison (C/L) Psychiatry practice with general hospital inpatients. Its prevalence in pediatric wards is 10% to 66%, medical-surgical wards 7% to 24% and adult intensive care units (ICU) 4% to 55%, especially in geriatric patients.[1–3] It contributes to patient and family/caregiver suffering and clinical staff stress[4] and is a marker of poor prognosis in the elderly for increased morbidity (including functional and cognitive) and mortality at longer term follow-up.[5,6]

Delirium is an acute state of impaired consciousness with a broad range of symptoms making accurate diagnosis challenging. It is a medical urgency and complex to manage due to a wide variety of medical, surgical and pharmacological etiologies that need to be investigated. Many higher cerebral cortical functions are disturbed so patients have cognitive and behavioral abnormalities that interfere with their ability to consent and comply with medical management. Etiological, environmental, supportive and psychopharmacological management of delirium are needed.[7] Accurate preliminary diagnosis by nonpsychiatric clinicians is important for prompt management but because delirium symptoms overlap and mimic other neuropsychiatric conditions, a referral to a consultant psychiatrist is often needed. Comorbid dementia and other neuropsychiatric disorders especially complicate differential diagnosis as do many medical conditions with overlapping symptoms.[8]

Studies of diagnostic concordance between referring physicians and psychiatrists are mostly retrospective, and delirium was usually studied amongst other psychiatric disorders. Though prevalence varies across types of hospital wards, delirium is among the top three most common conditions in patients diagnosed by C/L psychiatrists, together with major depression and adjustment disorder,[9–11] and is first in geriatric[9] or critically ill patients, such as those undergoing liver transplantation.[12] However, concordance between diagnoses made by medical/surgical referring physicians and C/L psychiatrists is quite low (Kappa indexes 0.2–0.4 or concordance around 40%).[11,13,14] Concordance (Kappa = 0.5) for hyperactive delirium is somewhat higher.[11]

Concordance for all psychiatric conditions referred to C/L Psychiatry, where delirium was common, but not studied separately, was low for referrals from ICU (38.5%), internal medicine (22.5%) and surgical wards (21.5%).[15] In contrast, the agreement ratio for delirium diagnosis in patients referred from an oncology ward (0.87) was significantly higher than that for "depression" (0.43) or "anxiety" (0.50).[16]

Diagnostic and Statistical Manual of Mental Disorders (DSM)-III released in 1980 was the first diagnostic manual to describe a diagnosis of delirium, with criteria. In 1985 the first study that analyzed referral reasons in a U.S. tertiary care hospital for patients diagnosed with DSM-III delirium by C/L psychiatrists found more than half were from internal medicine, followed by neurology and surgery, though delirium patients were not diagnosed as such, rather were referred using nonspecific, affective terminology or as a behavioral management problem.[17] In 2008 for elderly inpatients in Switzerland hospitals, diagnostic concordance was 24.3% for DSM-IV delirium by a C/L psychiatrist.[18] Presence of a comorbid preexisting psychiatric disorder is a contributing factor for delirium misdiagnosis by referring physicians.[19]

Our study aim was to determine the discriminating variables associated with concordance or discordance for a DSM-5 delirium diagnosis made by the C/L psychiatrist as compared to the referral diagnosis/reasons given by the referring physicians for inpatients from a tertiary care teaching hospital in a Latin-American country.

2. Methods

2.1. Design, study population, setting and ethics

Prospective study of a cohort of 399 consecutive patients admitted to any ward of the teaching hospital, Clinica Universitaria Bolivariana (CUB), with 203 beds for pediatric and adult medical-surgical care in Medellin-Colombia, during a 6-month period. Patients referred by a specialist physician to the C/L Psychiatry service. Analyses for diagnostic concordance used a nested sample of cases diagnosed with delirium by the psychiatrist. There were no exclusion criteria. Information for analyses was extracted from the electronic medical charts following either discharge or death.

The study protocol was approved by the Ethics Committee for Health Research of the Universidad Pontificia Bolivariana that authorized, as along with the CUB, the extraction of anonymized information from the charts.

2.2. Instruments

Study variables included clinical, baseline, referral and psychiatric assessment. Follow-up/outcome variables are reported. All information was collected using a standardized instrument.

Charlson Comorbidity Index-Short Form (CCI-SF) measured severity of baseline medical status (0–10 points) with one point each for presence of cerebrovascular disease, diabetes mellitus, chronic obstructive pulmonary disease, congestive heart failure or ischemic cardiopathy, dementia, and peripheral arterial disease. Chronic renal failure or dialysis, and cancer score two points each.[20] Information for completing the index was obtained from the charts.

The diagnosis of delirium and other psychiatric conditions was made according to DSM-5 criteria by the C/L psychiatrist. Motor subtype was determined by the same clinician using the Delirium Motor Subtype Scale-4 Item for classification as hyperactive, hypoactive, mixed or no motor subtype delirium.[21]

2.3. Procedures

Three C/L psychiatrists on the clinical staff evaluated the patients and four independent research physicians were responsible for data collection. There was a meeting before the data collection period started where study instruments, criteria and procedures were discussed for team consensus standardization and to assure that the C/L psychiatrists would ensure all study related information was recorded in the charts.

The study did not introduce variables or assessments different from those of the routine clinical care and each psychiatrist was in charge of his/her own patients, as they were referred for assessment during his/her corresponding shift. Referrals could come from the responsible specialist at his/her corresponding ward or from any other consultant physician and are always written in the electronic charts who includes a diagnosis/reason for them. There are no screening tools used routinely for delirium or for any other psychiatric diagnosis in any ward.

Psychiatric diagnoses, including that of dementia were made according to patient assessment and all other available information included family/caregiver interview, nurse staff interview, clinical chart information or all other solicited or available laboratory or neuroimaging studies.

When the study collection started, each psychiatrist reviewed the charts for completeness of information and entered study information in his/her clinical notes. The psychiatrist notified one of the research physicians about study patients.

The research physician reviewed the CUB records every day until discharge or death of patients assessed by C/L Psychiatry and informed the other three independent research physicians, who took turns collecting the study information. The definitive psychiatric diagnosis, the duration of psychiatric care and

Table 1

Baseline characteristics of 140 inpatients diagnosed with DSM-5 delirium by Consultation-Liaison Psychiatry, shown according to the concordance or discordance between referral reason and consultant psychiatric diagnosis of delirium. Data in the first two columns are reported within concordance group. A third column reports percent occurrence of each variable in the concordant group (by row). Data expressed as n (%) unless otherwise specified.

Characteristic	Delirium concordant group n = 90	Delirium discordant group n = 50	Presence of variable in concordant group
Age in years median (IQR)	81.0 (69.7–89.0)*	73.0 (49.0–83.2)*	
Male	49 (54.4%)	24 (48.0%)	67.1%
Female	41 (45.6%)	26(52.0%)	61.2%
Most common active medical diagnoses			
COVID-19 pneumonia	28 (31.1%)	18 (36.0%)	60.9%
Systemic infection	14 (15.6%)	6 (12.0%)	70.0%
Metabolic/endocrine	11 (12.2%)	8 (16.0%)	57.9%
Organ insufficiency	10 (11.1%)	3 (6.0%)	76.9%
SARS-CoV-2 infection	9 (10.0%)	2 (4.0%)	81.8%
Fracture	6 (6.7%)	2 (4.0%)	75.0%
CNS disorder	4 (4.4%)	5 (10.0%)	44.4%
Cerebrovascular	2 (2.2%)	1 (2.0%)	66.7%
At least one second active diagnosis	44 (48.9%)	31 (62.0%)	58.7%
CCI-SF 0-10 score, median (IQR)	2.0 (1.0–4.0)	2.0 (0.0–4.0)	

CCI-SF = Charlson Comorbidity Index-Short Form, CNS = central nervous system, DSM = Diagnostic and Statistical Manual of Mental Disorders, IQR = interquartile range.
* Different according to Mann–Whitney *U* test $P < .01$.

hospital stay, and patient deaths during the admission were recorded. Study inclusion criterion was having delirium diagnosed by one of the C/L psychiatrists.

2.4. Study groups, variables and analysis

The two study groups are comprised of patients where the referring physician's assessment and reason for referral was concordant with the delirium diagnosis made by the C/L psychiatrist and those where it differed (discordant).

We defined referral diagnosis as concordant if included was the term delirium either as diagnosed, suspected, needed to be ruled out or similar or if they used confusion, confusion syndrome, etc., ICU psychosis, acute organic-mental syndrome (OMS) or consciousness alteration, fluctuation or similar. The remainder of the diagnoses/reasons for referral were considered discordant for this report.

The main active admission diagnoses were grouped in standardized categories according to the Delirium Etiology Checklist but it was not used to reflect the delirium etiologies as intended using the Delirium Etiology Checklist. Two modifications were the creation of a separate category for fractures (included in the diagnostic system within the category Other) and a separation for the new COVID-19 infection related diagnosis from the Infection category, specifically as COVID-19 pneumonia or severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection.

The remaining variables are reported as collected.

Study variables were entered into a SPSS database for analysis. Since continuous variables are not normally distributed, these are reported as medians with interquartile range (IQR). Discrete variables are in absolute frequencies and percentages, including percentages of concordance for delirium diagnosis. The correspondent bivariate comparisons are with Mann-Whitney *U*, Chi-squared or Fisher exact test.

Two multivariate logistic models were run for delirium diagnosis – concordance and discordance. Backward likelihood ratio with 0.05 and 0.01 criteria was defined for entrance and exclusion of variables in each of the two models. Wald tests and their *P* values, betas (*B*), exponentiated betas (odds ratios; ORs) with 95% confidence intervals and accuracy of the models are reported.

Discrete variables with a concordance percentage ≥ 65%, continuous variables (age, CCI-SF, days in the hospital before referral) where the means difference between the two study groups were considered clinically relevant for concordance by the researchers, and discrete or continuous variables where statistical significance for comparisons favored concordance were preset for initial entrance into the concordance model.

Conversely, discrete variables with concordance < 65%, continuous variable medians clinically relevant for discordance and variables where significance favored discordance, were preset for initial entrance into the discordance model.

3. Results

Of 399 consecutive referrals during the study period, 140 (35.1%) were diagnosed with delirium (Table 1) by the C/L psychiatrist. The age range of the delirious sample was 22 to 100 years old. The referring physician's diagnosis or assessment was concordant in 90/140 patients (64.3%). Most referrals were from internal medicine (80; 57.1%) and ICU (30; 21.4%), followed by surgery and neurology/neurosurgery with 10 cases (7.1%) each, and trauma/orthopedics with seven (5%). Medical diagnoses and CCI-SF scores were not different between concordant and discordant groups. The only statistically significant demographic or admission clinical variable with a high level of diagnostic concordance for delirium was older age (81 vs 73 years). The highest % concordance for the main active diagnosis was for SARS-CoV-2 infection followed by organ insufficiency. Conversely the least concordant were central nervous system (CNS) and metabolic/endocrine disorders. The presence of at least one other active medical-surgical diagnosis also had a lower concordance percentage.

Concordant referring reasons were delirium in 68/90 (75.6%), suspected delirium in 18/90 (20%), consciousness fluctuation in 3 (3.3%) and acute OMS in one (1.1%).

The remaining 50/140 (35.7%) were discordant. Discordant referral reasons were grouped as follows: restlessness/agitation (34%); rule out psychiatric disorder (14%); dementia (12%); anxiety (10%); depression (8%); schizophrenia/psychosis (8%); nonsynchrony with mechanical ventilation (4%); assess psychopharmacological treatment (4%); decompensated bipolar disorder (4%); and insomnia (2%). Examples of verbatim referral reasons included: "agitation during sedation discontinuation," "persecutory delusion" and "rule out psychiatric disorder to validate the patient's decision-making capacity about disengagement from the dialysis program."

The large number of discordant cases referred as restlessness/agitation could have been requests for treatment of

hyperactive symptoms of delirium, without explicitly mentioning any neuropsychiatric diagnosis as with the other discordant cases. However, chart review found only 2/17 of these cases where delirium was mentioned, both of whom had preexisting Alzheimer's dementia and were referred from neurology/neurosurgery. However, neither chart revealed that symptoms of delirium were related to the reason for referral to C/L psychiatry, but instead these referrals were noted as dementia-related behavioral symptoms.

Table 2 displays bivariate analysis for characteristics of referrals to C/L Psychiatry according to concordance or discordance for delirium diagnosis, including percent concordance rates within each referrer group. The only ward significantly related to diagnostic concordance was internal medicine (66.7%). Referrals from both neurology/neurosurgery and another consultant had statistically greater discordance than concordance among their cases.

The two wards with the highest concordance rates among their referrals were trauma/orthopedics (85.7%) and internal medicine (75%). The lowest delirium diagnostic concordance among their referred cases was from neurology/neurosurgery at 30%, with surgery having the next lowest at 40% and those referred by another consultant at 44.1%.

The baseline dementia diagnosis was not related to discordance, having a 65.1% concordance, in contrast to the presence of at least one other major psychiatric diagnosis with only 41.7% concordance.

Most of the delirium cases were hyperactive (57; 40.7%), followed by mixed (49; 35%), hypoactive (31; 22.1%), and cases with no motor subtype (2; 1.4%). Only the mixed subtype had a bivariate relationship to discordance, with its concordance (53.1%) below the preset threshold.

Regarding follow-up/outcome of the sample, the median duration for psychiatric care was 6 days (IQR 2.0–12.0), median length of stay 14.5 days (IQR 7.0–29.7) and 32 (22.9%) patients died before discharge. No differences were found for these variables between study groups.

Only two of the study variables did not meet criteria for initial introduction into the multivariate models (Table 3) for diagnostic concordance and discordance: the continuous CCI-SF score and the number of days before referral. Older age (0.02 odds per year, OR = 1.024) and internal medicine ward (OR = 3.0) were significantly related with concordance, while trauma/orthopedics ward (OR = 5.7) and SARS-CoV-2 infection (OR = 3.8) were not significant but still important for the concordance model fit whose accuracy was 68.6%.

Accuracy of the discordance multivariate model was 70.7% and three wards were significantly related to this outcome (ICU, surgery, neurology/neurosurgery) as well as referrals by another consultant and CNS disorders, while metabolic/endocrine disorder was important for this model fit, but not significant.

The Table in the Supplemental Digital Content, http://links.lww.com/MD/I21 shows referral reason excerpts for three wards that the multivariate model showed as significantly related to discordance. It is apparent that reasons did not include suspicion of possible delirium.

4. Discussion

In this prospective study of 399 consecutive general hospital inpatients with a wide range of age, we sought to understand the level of agreement between referring physicians and C/L psychiatrists for accuracy of delirium diagnosis. The concordance between physicians' referral reasons with the delirium diagnosis by the C/L psychiatrist was 64.3% (90/140) which reveals considerable opportunity for improvement, though much better than previous reports.[17,18] To be considered concordant the exact term "delirium" was not required, where several usually synonymous terms were allowed. In all but four cases the term delirium was used in the concordant group.

Table 2

Characteristics related to the Consultation-Liaison Psychiatry referral and assessment according to concordance or discordance between referral reason and consultant psychiatric diagnosis of delirium. Data in the first two columns are reported within study group. A third column reports percent occurrence of each variable in the concordant group (by row). Data expressed as n (%) unless otherwise specified.

Characteristic	Delirium concordant group n = 90	Delirium discordant group n = 50	Presence of variable in concordant group
Referral			
Five most common wards			
Internal medicine	60 (66.7%)*	20 (40.0%)*	75.0%
Adult ICU	16 (17.8%)	14 (28.0%)	53.3%
Trauma/orthopedics	6 (6.7%)	1 (2.0%)	85.7%
Surgery†	4 (4.4%)	6 (12.2%)	40.0%
Neurology/neurosurgery	3 (3.3%)*	7 (14.0%)*	30.0%
Referral by another consultant	15 (16.7%)*	19 (38.8%)*	44.1%
Complete days in the hospital before referral, median (IQR)	4.0 (1.0–10.0)	4.0 (1.0–10.0)	
Psychiatric assessment			
Delirium motor subtype‡			
Hyperactive	39 (43.3%)	18 (36.0%)	68.4%
Mixed	26 (28.9%)*	23 (46.0%)*	53.1%
Hypoactive	23 (25.6%)	8 (16.0%)	74.2%
No motor type	1 (1.1%)	1 (2.0%)	50.0%
Dementia diagnosis	28 (31.1%)	15 (30.0%)	65.1%
Preexisting major psychiatric diagnosis	5 (5.6%)	7 (14.0%)	41.7%
Follow-up/outcome			
Psychiatric care duration in complete days, median (IQR)	6.0 (2.0–11.0)	6.0 (2.7–15.0)	
Hospital length of stay in complete days, median (IQR)	12.5 (7.0–28.2)	19 (8.0–32.5)	
Death before discharge	20 (22.2%)	12 (24.0%)	

ICU = intensive care unit, IQR = interquartile range.

* Different according to chi-squared or Fisher test $P < .05$.

† Includes general surgery, chest surgery, urology, plastic/reconstructive surgery.

‡ One concordant case had missing motor subtype.

Table 3

Multivariate logistic model of variables explaining concordance and of variables explaining discordance between referring physician diagnosis and final delirium diagnosis made by C/L psychiatrist*.

	B	Wald test	*P* value	Exp *B* (OR)	95% CI
Model for concordance, accuracy 68.6%					
Patient age	0.024	4.690	.03	1.024	1.002–1.046
Internal medicine	1.111	7.695	<.01	3.037	1.385–6.657
Trauma/orthopedics	1.743	2.375	.12	5.713	0.623–52.408
SARS-CoV-2 infection main diagnosis	1.335	2.407	.12	3.800	0.704–20.526
Model constant	−1.901	5.567	.02	0.149	–
Model for discordance, accuracy 70.7%					
Adult ICU	1.586	9.620	<.01	4.882	1.793–13.298
Surgery†	1.525	4.297	.04	4.597	1.087–19.449
Neurology/neurosurgery	1.637	4.225	.04	5.139	1.079–24.479
Referral by another consultant	1.543	10.180	<.01	4.680	1.813–12.076
CNS disorder main diagnosis	1.809	5.227	.02	6.102	1.295–28.766
Metabolic/endocrine main diagnosis	1.009	2.928	.09	2.743	0.864–8.712
Model constant	−1.895	25.411	<.01	0.150	–

95% CI = 95% confidence interval, B and Exp B = beta and exponentiated beta, CNS = central nervous system, ICU = intensive care unit, OR = odds ratio.

* Hosmer and Lemeshow goodness of fit test for the model for concordance 7.774, $P = .46$, and for the model for discordance, 2.230, $P = .69$.

† Includes general surgery, chest surgery, urology, plastic/reconstructive surgery.

Delirium has been the preferred term for this acute confusional state for over four decades and appears as such in DSM and International Classification of Diseases diagnostic classification systems, along with specific criteria. The term deliria was used by ancient Greeks to mean being "out of one's furrow." In the 1970's delirium was termed by a variety of less specific terms including acute encephalopathy, acute organic brain syndrome, ICU psychosis, etc. Consistent usage of the term delirium has improved clinical awareness and standardization of this neuropsychiatric condition, as well as enabled increasing amounts of research. Dr Zbigniew Lipowski is credited with educating and promulgating the consistent use of this term, including in his book chapters in Neurology textbooks and his own seminal Delirium books.[22,23]

Our study sample was broadly representative of types of medical-surgical wards including critical care units, active medical diagnoses and medical comorbidities per CCI-SF (scores ranged 0–4). We evaluated a number of clinically relevant variables using bivariate and multivariate analyses to elucidate their associations with diagnostic concordance and discordance. Multivariate models identified different variables for concordance and discordance, each model with about 70% accuracy.

The multivariate concordance model found advanced age and internal medicine ward as significantly related to greater concordance, and referrals from trauma/orthopedics and a main active medical diagnosis of SARS-CoV-2 infection had even higher ORs despite statistical nonsignificance. Motor subtype per the Delirium Motor Subtype Scale-4 Item was not related to concordance, surprising because hyperactivity (present in 40% of our cases) is known to bias detection and predominate in referral samples as compared to hypoactive subtype.[11] Conversely, we found that restlessness/agitation, as a symptom without a suspected diagnosis, was the referral reason in more than a third of the discordant group. Hypoactivity largely occurred in our concordance group (74%).

The diagnostic discordance multivariate model found five variables as significant in the model: CNS diagnoses and referrals from neurology/neurosurgery, ICU, surgical specialties and another consultant different from the attending physician. It was surprising because we expected that other brain specialists and ICU physicians would have better familiarity with delirium. Chart review found referrals for dementia with behavioral and psychological symptoms ("BPSD") by the neurology service for two discordant cases. This might be explained by research using the Neuropsychiatric Inventory where neuropsychiatric symptoms did not reliably differentiate delirium, dementia and comorbid delirium-dementia groups but found that such symptoms were exaggerated by copresence of delirium in dementia patients.[24] Nonetheless, the higher risk for CNS disorders (OR = 6.1) and neurology/neurosurgery (OR = 5.1) are consistent with a European study in 33 hospitals where appropriate detection of delirium in neurology wards was only 2.7%.[25]

Also worrisome was our ICU (OR = 4.9) and surgery (OR = 4.6) discordance risk. Delirium is common in neurology/neurosurgery wards (25%),[26] the ICU (55%)[3] and patients undergoing surgical procedures, ≥7%.[2] Critical Care Practice Guidelines address delirium and its management.[27] Patients from these three areas are especially complex. The direct effects on the brain in neurological disorders, and the need for sedatives and analgesics in patients undergoing surgical procedures or in the ICU, complicates assessment by non-psychiatrists. Moreover, interviewing is difficult due to neuromuscular effects, intubation, procedures, devices or other reasons especially by non-psychiatrists.

Psychiatrists are trained and experienced in detailed assessment of mental functions and in differential diagnosis with other neuropsychiatric disorders. Though neurologists, neurosurgeons and ICU physicians are familiar with delirium, these specialist physicians are focused (and trained) in assessing stupor, coma, sedation, but not in the detailed examination of mental functions such as cognition, executive function, thought process or content, perceptual disturbances, affect, etc., or in their neuropsychiatric differential diagnosis. Many ICUs do not use regular delirium screening despite the ICU Guidelines and expanding research on delirium in the ICU.

Metabolic/endocrine diagnosis was relevant for discordance model fit. Dementia diagnosis was not linked to discordance despite its challenges in differential diagnosis with delirium and had a higher occurrence (65%) in the concordance group. Further, we found that older age and internal medicine referrals were related to concordance suggesting that older patients with dementia seen by internal medicine physicians might reflect better delirium education efforts in that specialty. Geriatric medicine research in delirium is notable.

Being referred by another consultant different from the responsible doctor also related to discordance in the model (OR = 4.7). These odds might be explained by not knowing patients as well as the responsible doctor or being a specialist in a field of medicine less familiar with delirium.

Our concordance of 64.3% is much higher than that of similar reports. Shortly after DSM-III introduced the diagnosis of

delirium in 1980 only 3/133 referrals stated the correct diagnosis for delirium (n = 77) or other organic mental disorders,[17] and in a study 28 years later, concordance was about 25% wherein the need for education on delirium and its features was highlighted.[18] Though referring physicians' diagnostic concordance with C/L psychiatrist diagnosis has improved over time, a need persists for enhancing collaborative work between general hospital clinical staff and C/L Psychiatry to increase appropriate delirium detection and reduce its negative consequences. We found no difference between study groups in number of hospital days prior to psychiatric consultation nor in outcomes such as length of stay, days of psychiatric care and deaths during hospitalization suggesting that C/L intervention following a correct delirium diagnosis was similar despite initial misdiagnoses. What is not known are outcomes for patients who were delirious but not referred.

We believe that our higher overall concordance rate, as well as a better rate even for neurology/neurosurgery (30%) than other studies, is related to the close working relationship between our C/L Psychiatry team and referring attending staff on the different adult wards, discussing patients' clinical status and our therapeutic plan for management. We also do training about delirium and share our research findings with them in a collaborative medical model.[28] There has also been an increasing awareness of delirium among internists.[29,30] A previous study reporting low concordance for internal medicine included all psychiatric diagnoses, without specifying delirium prevalence or concordance, therefore, is not possible to do a comparison with our findings.[15]

We had no cases younger than 22 despite the increasing evidence that delirium is common in pediatric wards and worsens prognosis.[31] Pediatric delirium is less appreciated than adult delirium and educational strategies, research and increased clinical collaboration with pediatric teams is needed.

Trauma/orthopedics ward was important in our multivariate concordance model. There is a large research literature about delirium following surgery for hip or knee fracture, and orthopedic surgeons see delirium often in their everyday practice.[32] The American Academy of Orthopedic Surgeons recommendations are followed by staff at CUB which advises consideration of delirium prevention and management, and assessment of peri-surgical risk factors and acute changes in behavior or mental status.[33]

Delirium patients can present as depressed or anxious and get misdiagnosed.[34,35] We found that anxiety and depression together were the second most common referral reason in the discordant group (18%). Mood and behavioral issues are nonspecific, noncore and unreliable symptoms in delirium where instead cognitive assessment reveals the characteristic symptoms.[24] A preexisting major psychiatric diagnosis was higher in the discordant group (58.3%) as noted by others[19] consistent with such symptoms complicating accurate diagnosis. In contrast dementia was predominantly in the concordant group (65%), being less misconstrued despite its symptom overlap with delirium.

Several decades of research have delineated the three core symptom domains of delirium: Cognitive (attention and other cognitive functions), Higher Level Thinking (comprehension and thought process) and Circadian (sleep-wake cycle and motor activity).[7,36–38] In contrast, affective, emotional or psychotic features are noncore[39,40] and therefore not surprising that reliance on those nonspecific symptoms led to diagnostic discordance in our study.

None of the referring physicians used the term encephalopathy and all but four of the concordant referrals used the appropriate term delirium. This is encouraging because encephalopathy is a nonspecific term that means any pathology of the brain (encephalon). In this regard, it is important to mention the seminal work of Dr Zbigniew Lipowski in the 1980's recommending the term delirium in book chapters and a JAMA article as the appropriate and preferred term for this impairment of consciousness.[41] Lipowski influenced many neurologists who started using the more specific term delirium and DSM-III of the American Psychiatric Association that included for the first time criteria for delirium diagnosis. There is literature encouraging physicians from Spanish speaking countries to use the specific term delirium,[42,43] which is promoted by our C/L team in our hospital.

Most nonpsychiatric physicians are not comfortable with psychiatric assessment therefore a simple screening method administered by nonexpert clinical staff is useful. Some have used simple questions like the Single Question to identify Delirium as to whether the patient feels confused.[44] More commonly used screening tools include the 4-item Confusion Assessment Method-Algorithm (CAM-A) for general hospitals,[45] the Four "A"s test (4-AT) for geriatric screening,[46] and the 8-item Intensive Care Delirium Screening Checklist for ICU screening[47] which largely rely on dichotomous items rated as present or absent. Positive cases using such screening tools would need further confirmation by a C/L psychiatrist, though more definitive diagnosis by an expert is not usual in practice when these tools are relied upon for diagnosis.

The Delirium Diagnostic Tool-Provisional (DDT-Pro)[48] has high performance metrics, importantly high sensitivity and negative predictive values, that exceed that of the CAM-A and 4-AT when administered in the same patients.[49,50] The DDT-Pro is highly structured and brief, designed to be easily administered by any clinical staff member, with its 3 items representing symptoms for each of the three core domains of delirium for high content validity. Its items are continuous measures which provides a continuous scale score range allowing discrimination of delirium and subsyndromal delirium[51] and it performs better in dementia patients than the CAM-A or 4-AT.

4.1. Limitations

Limitations include that our sample of 140 delirium cases was determined by referrals for a C/L psychiatrist's clinical diagnosis, so we do not know how many delirium patients were not suspected and not referred for consultation, nor how many were correctly diagnosed without being referred. However, the purpose of this study was to evaluate the accuracy for those patients actually referred. Prior literature suggests delirium underdetection, therefore our findings are biased by whatever nondetection variables were at play in our hospital where no regular delirium screening is performed. Another limitation is that we relied on clinical diagnosis using DSM criteria, to mimic real life clinical care, but did not also use detailed standardized instruments for delirium assessment.

4.2. Conclusions

Though our concordance rates (64.3%) were higher than previous reports for delirium diagnosis, there is much opportunity to improve accuracy for delirium detection and referral to expert C/L psychiatrists. Our data show that comorbid primary psychiatric conditions and patients with dementia BPSD who are under neurologists' care can complicate delirium diagnosis. C/L psychiatrists are the most specialized physicians who are trained to perform sophisticated interviews and assessments for differential diagnosis of delirium. Maximizing speed and accuracy of diagnosis is important because delirium is a medical urgency with high associated morbidity and mortality, but this needs to also be balanced by its high resource utilization for a work-up for possible delirium and therefore reducing false positive cases. Efforts should be made in hospital systems to incorporate brief delirium detection tools with

high sensitivity into routine care, including our own teaching hospital.

Author contributions

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