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Review article

A systematic review of proactive psychiatric consultation on hospital length of stay

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ABSTRACT

Objective: Roughly half of general hospital patients may have a psychiatric issue that impacts care, yet most of these are not recognized during hospital admission. Proactive mental health screening offers an opportunity for timely identification and clinical attention to improve outcomes.
Method: We conducted a PRISMA systematic review of Pubmed, Embase, PsycINFO, and Cochrane Library for proactive models of psychiatric consultation to reduce hospital length of stay (LOS) in adult inpatients. For each study, we evaluated the level of evidence and defined the study sample, means of group allocation, screening process, interventions, and outcomes.
Results: Of the 12 included studies, the 8 whose screening was informed by clinicians with mental health care expertise or whose providers were integrated with primary services reported a reduction in LOS. Two of these also reported favorable cost-benefit analyses. All positive studies represent versions of either psychiatrists embedded within medical or surgical settings or a multidisciplinary team-based model.
Conclusions: Proactive CL psychiatry with clinically-informed screening and integrated care delivery appear to reduce LOS. Further studies are needed to explore a broader range of outcomes, hospital populations beyond hospital medicine, and additional benefits of proactive integrated mental health care in the general hospital.

1. Introduction

More than a third of medical and surgical inpatients have psychiatric comorbidity [1,2], and up to half of inpatients have a clinically-actionable mental health issue [3]. However, literature suggests that more than half of hospital patients with psychiatric comorbidity are not recognized by primary teams [4] with the lowest rates of detection for chronic psychiatric illness, such as anxiety disorders or personality disorders [2]. The unmet need for psychiatric care in the general hospital is substantial and compromises the quality and delivery of care [5,6].

Such psychiatric comorbidity is known to predict longer hospital length of stay (LOS). Roughly three decades ago Ackerman et al. found that patients receiving psychiatric consultation had 2.5-times the LOS relative to a comparison group [7]. This same research team also demonstrated a strong correlation between the timing of psychiatric consultation and hospital LOS with earlier consultations associated with a shorter LOS [8]. Subsequent studies have consistently confirmed this relationship between time to consultation and LOS [9–12], which persists even after adjusting for severity of medical illness [11,12]. Whereas these findings were based on observational studies, the research question emerged: might CL psychiatry reduce hospital LOS and improve outcomes if it met mental health needs among general hospital patients sooner?

For outpatient settings, a consensus has emerged that collaborative care models can identify psychiatric comorbidity through systematic screening (*e.g.*, depression based on the PHQ-9) and that they deliver mental health interventions to improve a broad range of outcomes. For instance, the Improving Mood-Promoting Access to Collaborative Treatment (IMPACT) model improves depression symptoms, patient satisfaction with care, functional ability and overall quality of life [13,14]. This model not only improves mental health outcomes but also those related to chronic medical diseases as well [15]. Further, when compared to care as usual, collaborative care improves outcomes with no increase in overall healthcare costs [16].

Research on non-psychiatric proactive consult services in the hospital also provides evidence for the potential value of early specialty service involvement. For instance, proactive geriatrics consultation has been shown to reduce delirium incidence after hip fracture surgery in older adults by more than a third [17] and, among general hospital patients, to reduce LOS index and overall hospital costs [18]. Likewise, among older trauma care patients, proactive geriatrics consultation has

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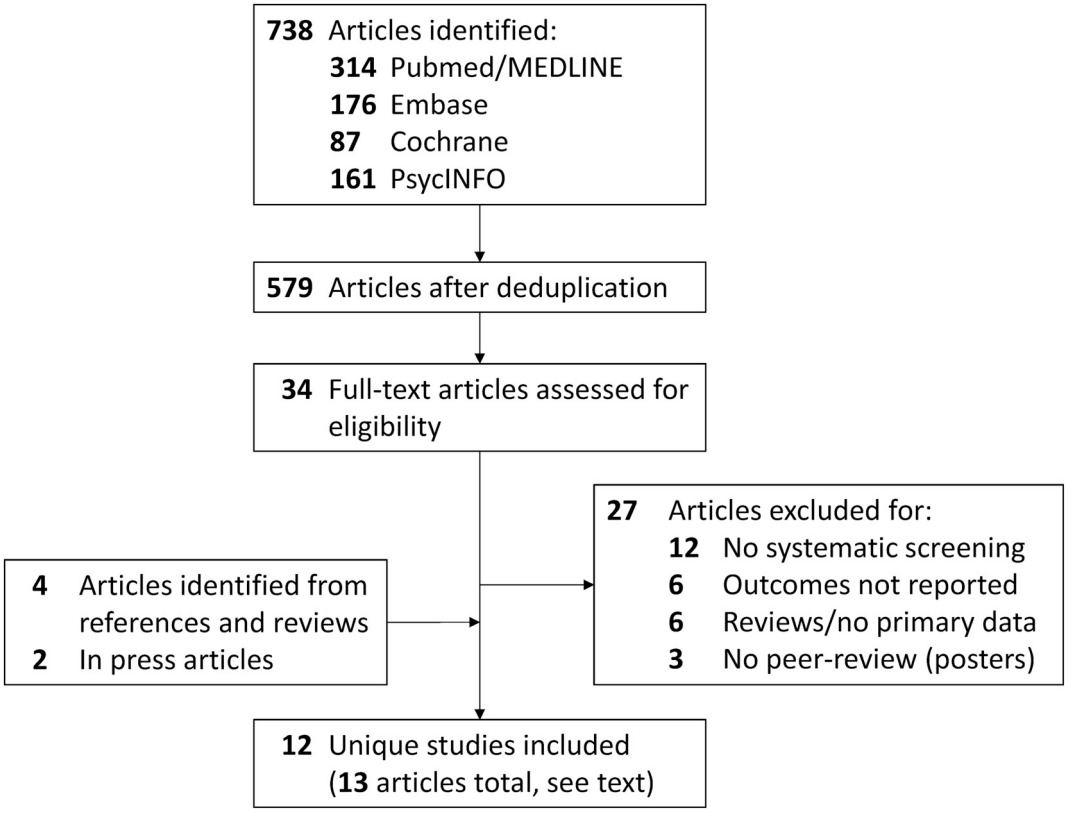

Fig. 1. PRISMA study selection flow diagram.

been shown to reduce delirium incidence and the likelihood of placement upon discharge [19]. Proactive ethics consultation on critically and terminally ill patients has been shown to produce more frequent and better documented care communication, more frequent decisions to forego life-sustaining treatment in dying patients, and reduced LOS in the ICU [20]. Similar results have been reported by proactive palliative care programs [21,22]. Additionally, proactive pathology consultation decreases delay in diagnosis of hematological malignancies [23].

In terms of psychiatric consultation in the general hospital, it is unrealistic to consult on all patients with mental health concerns because of the high prevalence of psychiatric comorbidity. At the same time, primary hospital teams often do not have the time to identify or the experience and expertise to prioritize which of their patients might benefit most from enhanced mental health care or psychiatric consultation, as their patients typically have several acute medical problems requiring dedicated clinical attention. In fact, a primary team may not pursue psychiatric consultation for a host of reasons independent of a given patient or even in the face of acknowledged mental health needs [24]. This means that without systematic screening by those with mental health expertise, the mental health care needs of many patients will go unmet or scarce psychiatric resources may be misplaced [3].

Unrecognized psychiatric comorbidity in the general hospital can compromise care delivery and extend overall LOS; however, proactive identification of these concerns stands to improve care delivery as well as reduce LOS. Therefore, in this era of value-based care, we present a systematic review of the literature for proactive models of psychiatric consultation aimed at reducing length of stay (LOS) and consider how the various elements of these models may influence clinical outcomes.

2. Methods

Following PRISMA reporting standards, we conducted a systematic review of Pubmed, Embase, PsycINFO, and Cochrane Library, each from inception to May 2019, for proactive psychiatric CL services in general hospital settings that involved screening to guide early psychiatric evaluation and intervention. Our inclusion criteria were (1) systematic screening for mental health concerns, (2) adult populations admitted to general medical or surgical hospital settings, (3) assessment of the impact of a systematic mental health intervention on hospital length of stay (LOS) and (4) inclusion of a valid comparison group to determine effectiveness (or efficacy). Our search in each database combined three sets of terms:

1. [(psychiatry OR psychiatr*) AND (consult OR consultat* OR liaison)] OR psychosomatic
2. (proactive OR screen* OR early OR rapid OR prompt)
3. (length OR cost OR quality).

We searched MEDLINE *via* Pubmed, limiting searches to title/abstract (n = 314). The Embase search combined both exact terms above and relevant suggested Emtree terms such as 'length of stay' and 'psychosomatics' (n = 176). Search of Cochrane library allowed for word variations of search terms (n = 87). PsycINFO was searched *via* Ovid, and the search combined both exact terms and relevant explode terms such as "exp Consulation Liaison Psychiatry/" and "exp Screening/" (n = 161). Two authors (MO and KC) independently reviewed titles and available abstracts of search results and retrieved full texts of potentially eligible articles. To review eligibility, studies were assessed for sample characteristics, screening process, intervention, comparator, and relevant outcomes. After MO and KC had completed an independent literature review, all authors reviewed these results and synthesized findings. We also reviewed the references of included studies as well as the studies found in reviews identified by our search for additional eligible publications. All decisions regarding inclusion were resolved by author consensus. As performed in Wood and Wand's review [5], we graded the level of evidence for each study [25]. Also, for each study, we defined the study sample, means of group allocation,

Table 1
Proactive psychiatric CL services.

Study	Level of evidence	Sample	Screening process	Intervention	Comparator	LOS[a] in days (level of analysis)	Other outcomes
Triplett 2019 (USA) [28]	3	General medicine N_{admits} = 15,816 Age = 52.0 Male: 44.5%	Multidisciplinary team screened charts of patients admitted to 3 units; intervention graded per screening acuity	Psychiatric consult for high acuity screens (3 units) $n_{consults}$ = 311	*Historical* (3 study units): $n_{consults}$ = 163 *Contemporary* (5 separate units): $n_{consults}$ = 224	Reduced LOS (analysis of consults only) *Vs. historical*: 6.7 *vs* 8.5 (p = 0.005) *Vs. contemp.*: 6.7 *vs* 8.2 (p = 0.005)	Time to consult: *Vs historical*: 2.2d *vs* 3.4d ($p < 0.001$) *Vs contemp.*: 2.2d *vs* 2.9d (p = 0.01) Consult rate: 7.2% (*study*) *vs* 3.4% (*historical*) *vs* 3.2% (*contemp.*) Physician & nurse satisfaction: improved 30-day readmissions: similar
Bronson 2019 (USA) [29]	3	General medicine $N_{discharges}$ = 13,909 Age = 60.5 Male: 45.7%	Embedded attending psychiatrist chart-screened patients on one unit and rounded daily with unit staff	Psychiatric consult if deemed high-yield (a 30-bed unit) $n_{consults}$ = 257	*Historical* (study unit) $n_{consults}$ = 143 *Contemporary* (3 separate units) $n_{consults}$ = 402	Reduced LOS (analysis of consults only; adjusted for age, sex, insurance, disposition) *Vs. historical*: 6.4 *vs* 8.0 (p_{adj} = 0.03) *Vs. contemp.*: 6.4 *vs* 8.3 (p_{adj} = 0.002) $\Delta\Delta$: −1.13 (p_{adj} = 0.07)	Consult rate: 27% (*study*) *vs* 14.7% (*historical*) *vs* 17.1% (*contemp.*)
Bui 2018 (USA) [30]	3	Medical ICU N_{admits} = 822 Age: 59.9 Male: 54.5%	Embedded attending psychiatrist rounded with MICU team daily	Real-time consult when indicated in study MICU; n = 429 ($n_{consults}$ = 104)	*Contemporary*: consult per usual in comparison MICU; n = 393 ($n_{consults}$ = 24)	Reduced median LOS (all admits): 6.92 *vs* 7.62 (p = NS)	Time to consult: 3.2d *vs* 7.5d (p = 0.004) Consult rate: 24.2% *vs* 6.1% ($p < 0.001$) MICU LOS, delirium-coma-free hours, & ventilator-free hours: all similar
Muskin 2016 (USA) [31]	4[b]	General medicine N_{admits} = NR Age: NR Male: NR	Co-managing attending psychiatrist who rounded daily with medical team	Real-time consult by co-managing psychiatrist; $n_{co\text{-}managed}$ = 324	*Historical*: consults per usual the prior year on same unit; n = NR	Reduced LOS (all admits ≤10 d, adjusted for case-mix): 1.19d reduction ($p < 0.003$)	Time to consult: 2d *vs* 6d (statistics not provided)
Sledge 2015 & 2016 (USA) [26,27]	2[c]	General medicine N_{admits} = 10,549 Age: 56.9 Male: 45.3%	Multidisciplinary team screened charts of those admitted to 3 units; reviewed "screens" with nursing & medical staff; intervention graded on a per-case basis	All admissions; n = 5391 Formal consults; $n_{consults}$ = 509	*Historical*: all admits prior year over corresponding 11 months; n = 5158 *Historical*: consults per usual during comparison period, $n_{consults}$ = 535	Reduced LOS (all admits): 4.68 *vs* 4.98 ($p < 0.0002$; LOS < 31) Reduced LOS (consults only): 6.65 *vs* 7.29 (p = 0.004; LOS < 31)	Annualized cost-benefit: benefit $906 k minus cost $334 k = net benefit $572 k Time to consult: 2.26d *vs* 2.74d Consult rate: 9.4% *vs* 10.4% (*i.e.*, slightly lower during intervention) Staff satisfaction: 85% rated 4 or 5 on 5-point Likert scale
Desan 2011 (USA) [3]	3	General medicine N_{admits} = 593 Age: 53.3 Male: 56.8%	Embedded attending psychiatrist rounded with medicine team daily	Consult if psychiatric issue might delay discharge; n = 62 ($n_{consults}$ = 14)	A_1-B-A_2 design *Pre-comparison admits* (A_1); n = 257 ($n_{consults}$ = 24) *Post-comparison admits* (A_2); n = 274 ($n_{consults}$ = 33)	Reduced LOS (all admits; all p's < 0.05) *Vs. pre-comparison* (B vs A_1): 2.9 vs 3.8 *Vs. post-comparison* (B vs A_2): 2.9 vs 3.7	Consult rate: 22.6% (B) *vs* 10.7% ($A_1 + A_2$) ($p < 0.01$) Time to consult: 1.4d *vs* 3.0d ($p < 0.01$) Extrapolated financial benefits: 593.2 saved days annualized = $237 k cost avoidance plus $591 k revenue enhancement
De Jonge 2003 (Netherlands) [32]	3 3	General medicine N_{admits} = 1311 $N_{screened}$ = 644 Age: 65.9 Male: 45%	Nurse screen hospital day 1–3; COMPRI > 5 or INTERMED > 20 as "positive" screen	Positive screens: CL nurse reviewed interventions with medical team; n = 100	*Historical:* positive screens; n = 93	Similar LOS (positive screens only): 12 *vs* 13 Reduced LOS (positive screens ≥65 yr): 11.5 *vs* 16 (p = 0.05)	Patient quality of life: similar on SF-36

(*continued on next page*)

Table 1 (*continued*)

Study	Level of evidence	Sample	Screening process	Intervention	Comparator	LOS[a] in days (level of analysis)	Other outcomes
Camus 2003 (Switzerland) [33]		General medicine, MMSE ≥24 N_{admits} = 515 $N_{screened}$ = 176 Age: 60.5 Male: 63%	Screening with General Health Questionnaire (GHQ) on hospital day 1–2	Study period, psychiatric consult for GHQ > 9; n = 95 ($n_{consults}$ = 33)	*Historical*: consult per usual; n = 81 ($n_{consults}$ = 26)	Similar LOS (all screened patients): 11.6 *vs* 11.2	Hospital charges: no difference 10,168 Fr *vs* 9282/patient Patient satisfaction: no difference Staff satisfaction: subjectively improved
Slaets 1997 (Netherlands) [34]	2	General medicine, ≥75 years old N_{admits} = 237 Age: 82.8 Male: 29.5%	Randomized to unit for multidisciplinary psychogeriatric team consult or to care as usual	Randomized to 1 of 2 study units; n = 140	Randomized to 1 of 2 control units; n = 97	Reduced LOS (all randomized patients): 19.7 *vs* 24.8 (p = NR)	Physical functioning: (all p's < 0.01) More "better ADLs": 61.3% *vs* 45.7% More "better mobility": 47.9% *vs* 43.5% Nursing home placement: Trend toward reduced placement
Levenson *AJP* 1992 (USA) [35]	2	General medicine N_{admits} = 1541 Age: 47.6 Male: 50.2%	Screen with Medical Inpatient Screening Test (MIST) 24–48 h after admission ("high" defined categorically)	Only high MIST patients randomized to psychiatric consultation; $n_{consults}$ = 256	*Historical*: high MIST; $n_{consults}$ = 232 *Contemporary*: high MIST randomized to PRN consult; $n_{consults}$ = 253	Similar or longer LOS (high MIST patients only): *Vs historical*: 11.3 *vs* 11.3 (p = NS) *Vs contemporary*: 11.3 *vs* 10.2 (p < 0.02)[d]	Hospital charges: *Vs historical*: $11,109 *vs* $10,039/patient (NS) *Vs contemp.*: $11,109 *vs* $8465/patient ($p$ < 0.005)[d]
Strain *AJP* 1991 (USA) [36] 2 hospitals: MSH and NWM	3	Hip fracture elders N_{admits} = 464 Age: 82.2 Male: 20.1%	All patients on study units seen by psychiatrist during intervention period within 72 h of admit, consult as needed	Psychiatric evaluation of all consenting patients; MSH: n = 136 ($n_{consults}$ = 114) NWM: n = 55 ($n_{consults}$ = 36)	*Historical*, MSH; n = 114 ($n_{consults}$ = 12) *Contemporary*, NWM; n = 51 ($n_{consults}$ = 3)	Reduced/similar LOS (all eligible admits): *Vs MSH historical*: 18.5 *vs* 20.7 (p < 0.05) *Vs NWM contemporary*: 13.8 *vs* 14.7 (p = 0.1)	Hospital charges: *MSH*: $178,572 savings *NWM* (unit A): $97,361 savings Discharge location: No difference in disposition location
Hengeveld 1988 (Netherlands) [37]	4[b]	Medicine patients N_{admits} = 407 $N_{screened}$ = 220 Age: 57.5 Male: 53.2%	BDI within 5d of admission; BDI ≥ 13 eligible for enrollment	Consult on every other patient with BDI ≥ 13 (completed within 3d of BDI); $n_{consults}$ = 33	*Contemporary*: alternating patients with BDI ≥ 13, care as usual; $n_{consults}$ = 35	Similar LOS (assigned patients only): mean of 19 across both cohorts (LOS of each group not specified)	Psychotropics & analgesic use: fewer without these among consults (17% *vs* 39%, p < 0.05) Lab testing: no difference Other consults: no change Discharge BDI: study group with lower BDI by discharge but not in controls

Abbreviations: BDI = Beck Depression Inventory; COMPRI = complexity prediction instrument; ΔΔ (delta-delta) = LOS change in study unit minus LOS change in comparison units; GHQ = General Health Questionnaire; INTERMED = Interdisciplinary Medicine; LOS = length of stay; MIST = Medical Inpatient Screening Test; MMSE = Mini-Mental State Examination; MSH = Mount Sinai Hospital; NR = not reported; NWM = Northwestern Medicine.

[a] Mean LOS reported excepted where noted otherwise; comparisons described in each cell (*e.g.*, all admits, only enrolled subjects, only those receiving consultation/intervention).

[b] Complete data unavailable.

[c] High external validity given very large sample size.

[d] Intervention group with longer LOS and higher costs.

screening process, interventions, and outcomes.

3. Results

In May 2019, our search yielded 738 results, of which 579 were unique references (Fig. 1). After review of titles and available abstracts, 34 full-text articles were retrieved among which 7 eligible studies were identified. We identified an additional 4 studies upon review of references, a recent review article [5] and a review chapter [6]. One of these concerned a financial analysis from a cohort described by a study already included in our initial review, so its results are synthesized herein and reported in tandem below as part of the "same study" [26,27]. The authors were personally aware of an additional 2 studies in press at the time of this review and have included these as well. The 12 proactive models are described in Table 1.

3.1. Patient sample

Eight models were studied in the US, 3 in The Netherlands, and 1 in Switzerland. Ten of the models were implemented on hospital medicine units (one of which was restricted to adults age 75 or older [34], another which excluded cognitive impairment [33]), 1 among older adults after hip fracture, and 1 in a medical intensive care unit. The mean age of patients across studies ranged considerably from 47.6 to 82.8 yrs. and proportion of males in a given study sample from 20.1% to 63%.

3.2. Group allocation

Neither of the 2 studies that incorporated randomization found a statistical reduction in LOS. In the first of these, all subjects were evaluated for symptom burden using standardized instruments, and those with high symptom burden were randomized either to proactive or PRN consultation [35]. In the second randomized study, patients were randomized either to a unit where all patients received consultation or to a unit for care as usual including PRN psychiatric consultation [34]. In 1 additional study, patients with depression as identified by the Beck Depression Inventory were allocated in alternating fashion either to proactive or PRN consultation [37]. The remaining 9 studies were naturalistic and evaluated patients based on specific hospital setting or care service.

3.3. Screening

Four studies used standardized instruments to identify a target group for proactive mental health care [32,33,35,37]. In another 2 studies, a psychiatrist personally met with all patients in a given setting, either after hip fracture surgery [36] or all older adults randomized to a hospital medicine unit, to receive in-person psychiatric evaluation [34]. Four studies involved a psychiatrist who rounded with a primary medical service or unit daily; among these, 2 involved an embedded psychiatrist on internal medicine [3,29], 1 an embedded psychiatrist on a medical intensive care unit team [30], and 1 a co-managing psychiatrist on internal medicine [31]. A final model, implemented at both Yale and Johns-Hopkins, screened the electronic medical records of patients admitted to specific internal medicine floors and reviewed patients identified on chart review with nursing and medical staff for potential intervention [26,28]. All studies in which screening was aided by the expertise of mental health providers yielded either a statistical reduction in LOS [3,26,28,29,31,36] or a trend favoring the proactive CL service [30,34].

3.4. Intervention

In 8 studies, the intervention delivered was a formal psychiatric consultation by services variously staffed by psychiatrists, trainees, nurses and research personnel. In a ninth study, a CL nurse working under the supervision of a CL psychiatrist reviewed patient care and potential interventions (*e.g.*, delirium prevention) with medical teams for patients who screened positive on either of 2 standardized instruments [32]. In the remaining 3 studies, psychiatric care was delivered by a multidisciplinary team, one of which specialized in geropsychiatry [34] and in the other two a multidisciplinary mental health team that provided graded care ranging from outpatient referrals and "curbsides" to formal psychiatric consultation [26,28]. All studies investigating models wherein care delivery was integrated with primary services—either as embedded psychiatrists or multidisciplinary team-based care—reported either a statistical reduction in LOS [3,26,28,29,31] or a trend in favor of reduced LOS [30,34].

3.5. Level of analysis for LOS

In 3 studies, only patients who screened positive on a standardized instrument and who also received the study intervention were included in the LOS analysis; among these, 1 found no change in LOS [33], another found reduced LOS only among those ≥65 yrs. [32], and the third found either no change or a longer LOS among intervention patients depending on the sample for comparison [35]. The fourth study that also screened patients using a standardized instrument evaluated LOS across all screened patients and found no improvement among the intervention cohort [33]. Two studies evaluated LOS reduction among those who received psychiatric consultation alone [28,29], both of which found statistically reduced LOS during the study period. Similarly, both studies that analyzed LOS among all patients eligible for mental health intervention found lower LOS among study patients [34,36] as did the 4 studies that analyzed LOS across all patients admitted by a given primary service [3,26,30,31].

3.6. Additional outcomes

All studies that reported time to consult found that screening led to earlier consultation [3,26,28,30,31]. The consult rate with screening increased universally except in the study by Sledge et al., which is likely explained by the graded nature of services provided [26]. The 3 studies that report on staff response to these models found enhanced satisfaction [26,28,33]. Finally, the two studies conducted at Yale-New Haven Hospital report a cost-benefit analysis, both of which found favorable return on investment that more than offset the cost of enhanced care [3,27].

4. Discussion

Many of these studies report reduced LOS, but the heterogeneity across study designs makes it difficult to attribute this to any one study element in isolation. Nevertheless, three interrelated elements do appear to be associated with positive outcomes—screening that draws upon mental health care expertise, integrated care delivery, and unit- or service-level analysis. Interestingly, where each one of these three elements is present in a study it co-occurs with at least one other element [3,26,28–31,34,36]; moreover, all 6 studies published in the past decade incorporate both clinically-informed screening and integrated care delivery.

4.1. Screening

As required for inclusion in this review, all screening performed in these studies was systematic. Several screening methods have been employed: standardized scales, personal chart review for index criteria (though, notably, automated screening tools are being developed [38]), communication with primary nursing and medical providers, and brief in-person evaluation. Multidisciplinary team-based approaches incorporate several of these [26,28]. These results suggest that the presence of an experienced mental health clinician in the screening process

is important and associated with reduced LOS. Given the breadth of potential mental health conditions and the practically innumerable ways that these may interact with the range of clinical scenarios encountered in acute medical settings, the clinical expertise of a mental health clinician may quickly identify and help prioritize specific mental health concerns such as mental status changes or care-compromising behaviors that may benefit from clinical attention.

Whereas all studies that incorporated clinical expertise in case identification yielded reduced LOS, how clinical expertise was incorporated differed across studies. For instance, in 2 studies a psychiatrist visited all patients on the study unit and provided consultative services as indicated [34,36]. In the 4 embedded care models, a psychiatrist provided real-time recommendations and consulted as indicated [3,29–31]; in one of these, this was enriched by morning chart reviews by the embedded psychiatrist [29]. In the team-based, proactive CL model, clinical judgment was incorporated during chart review (*i.e.*, reviewing admitting History and Physical, Problem List, and recent notes for key words such as "suicide attempt" or "agitation"), in case review with nursing and medical staff, and also when a licensed clinical social worker with psychiatric expertise would meet with certain patients briefly to assess mental status [26,28].

As studied, screening has been performed in a single step (*e.g.*, a brief clinical evaluation determines whether to consult) or as a multi-step process (*e.g.*, when patients with mental health comorbidity first identified by chart review are subsequently discussed with a primary medical service). Each approach has its relative merits. Single-step screening may be more efficient but require more personnel to visit more patients. Multi-step approaches offer a series of sieves to identify patients who may benefit from mental health care expertise, but they also introduce new variables and logistics that need to be coordinated with medical services and unit workflows. We suggest that the clinical environment and available mental health care resources should guide development of screening processes that maximize case identification while helping to prioritize and allocate mental health resources. Any such approach should strive to optimize face validity while considering reliability and the potential for reproducibility of results. It also remains to be seen whether clinically-informed automated algorithms based on electronic medical records might be developed that supplement case identification or that stratify potential clinical need in the future.

4.2. Care delivery

Whereas CL psychiatry seeks to provide not only consultations but serve as liaisons to non-psychiatric providers, proactive services included here not only aim to identify patients who may benefit from timely mental health care but also provide care proactively. Specifically, models that take a team-based approach by embedding mental health providers into medical teams and the medical milieu broadly report reduction in LOS: in these models providers have worked alongside primary medical and nursing staff on specific services or in geographically-defined hospital units. The more comprehensive services among them appear to resemble small-scale population mental health care in which mental health care providers are integrated into the system of care and manage patient flow for the designated areas while considering costs of care.

The 2 forms of proactive, integrated care models described in the studies are embedded psychiatrists [3,29–31] and multidisciplinary team-based care [26,28,34]. Embedded care models offer the comprehensive content expertise of a psychiatrist for all patients on a given service or unit, but the scalability of this approach remains to be seen as each of the published embedded care models report integration in no more than a single medical unit or clinical service. As investigated to date, larger multidisciplinary team-based models may offer the ability to provide graded services drawing upon discipline-specific areas of clinical and content expertise. At the same time, addressing the needs of larger patient populations on multiple units also appears to introduce a set of new interdisciplinary dynamics that require teamwork and thoughtful leadership.

4.3. Level of analysis

All studies that analyzed the LOS of all patients either in a given medical setting or all patients eligible for proactive psychiatric consultation favored the intervention group. However, each of these studies also incorporated the judgment of a mental health clinician in the screening process that led to provision of proactive and enhanced mental health services for the identified patients. The fact that this finding should be tied to integrated care in particular is both a natural complement to the enhanced nature of this approach to care—its spirit being to achieve population-wide benefits—and an especially auspicious finding because the benefits are service or unit-wide. The Yale study by Sledge et al., for instance, described a 'halo effect' of a 0.3 day reduction in LOS even among patients *not* receiving formal psychiatric consultation [26]. Future studies should consider whether curbside recommendations, nursing interventions, ongoing education of primary teams on mental health care interventions, or task-shifting among primary teams away from personally managing care-compromising behaviors might account for this penumbra of benefit.

4.4. Summary

Our review indicates that proactive models of CL psychiatry whose screening is enriched by clinical expertise in mental health care and that deliver enhanced, proactive mental health services appear to reduce LOS, with preliminary cost-benefit analyses reporting favorable returns on investment that more than offset the increased costs of providing this level of enhanced care [3,27]. However, despite these promising results, the science of proactive CL psychiatry needs to mature: the field awaits the results of its first randomized study of the team-based model, the Home Study in the UK, which studies hospitalized older adults [39]. Additional outcomes for this model also deserve investigation including reduction of sitter-related costs, 30-day readmission rates, as well as staff burnout and staff turnover. Clinical outcomes also remain largely unexplored. Further advance and refinement of proactive CL psychiatry will also require expansion beyond hospital medicine into either specialty-specific settings, especially those with higher per-patient costs (*e.g.*, surgery or critical care), whereas pediatric adaptation of the multidisciplinary team-based model is under development.

A growing number of published studies on proactive models of CL psychiatry appear to reflect the demands of complex healthcare systems that seek to deliver value-based care for medical patients with psychiatric comorbidities in general hospitals. The range of approaches investigated in these studies attests to the fact that general hospital patients with mental health needs—many of which are serious and compromise both care delivery and outcomes—go unmet. Proactive psychiatry in the general hospital is feasible, and it appears to offer a potential venue of investigation for enhancing mental health care for general hospital patients with psychiatric comorbidity.

Declaration of competing interest

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Appendix A. Supplementary data

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