Original Article

Effective mental health interventions to reduce hospital readmission rates: a systematic review

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Background: Hospitals in the United States are financially penalized for having a higher than expected thirty-day readmission ratio among patients initially hospitalized for heart failure, acute myocardial infarction (AMI), pneumonia, chronic obstructive pulmonary disease (COPD), coronary artery bypass graft (CABG) surgery, or hip and knee replacement. Patients hospitalized for these conditions that have comorbid mental health diagnoses or symptoms are at high risk for readmission.

Methods: We conducted a systematic review to determine if interventions, that are specifically designed to assess or treat mental health symptoms, can effectively reduce risk of readmission following hospitalization for physical health conditions. We searched on PubMed and Google Scholar for peer-reviewed articles published between January 2010 and June 2018 that examined the impact of mental-health interventions on readmissions for physical conditions.

Results: After screening 81 full text articles, we found eleven intervention studies, one meta-analysis, and one cross-sectional study that met our inclusion criteria. Only three of the intervention studies found significant differences in readmission rates between intervention and comparison groups. Each of these interventions targeted patients after discharge from the hospital. One of the interventions was a physical health telemonitoring and individual psychotherapy intervention for patients that were initially admitted for heart failure. The second intervention was individual and group psychotherapy sessions for patients who were initially admitted for AMI. The third intervention was a nurse-driven depression care management protocol for home care patients with depressive symptoms who were initially admitted for any physical health condition. The cross-sectional study showed that communities with a stronger, social-based public mental health infrastructure had significantly lower physical health readmission rates.

Conclusions: The literature identified in this review, appears to provide support for the use of mental health interventions after discharge as a mechanism for reducing physical health condition readmissions. Future research is needed to determine if these interventions can specifically reduce thirty-day readmissions for the six conditions linked to financial penalties.

Keywords: Mental health; depression; readmissions; psychological interventions; behavioral health integration

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Introduction

Reducing readmissions is a priority for hospitals across the United States. The Hospital Readmission Reduction Program (HRRP) was passed into law in 2010 as a component of the Patient Protection and Affordable Care Act (ACA). Since the fiscal year 2013, acute care hospitals

have been at risk for receiving financial penalties for each year that they have a higher than expected, thirty-day readmission ratio for a particular physical health condition (1). Under program guidelines, a readmission is defined as an unplanned, inpatient admission, for any condition, within thirty days of discharge from the initial admission. The program excludes readmissions to psychiatric hospitals and psychiatric units, cancer hospitals, and long-term acute care hospitals. Currently, the program includes patients that were initially admitted with six conditions: heart failure (HF), acute myocardial infarction (AMI), pneumonia, chronic obstructive pulmonary disease (COPD), coronary artery bypass graft (CABG) surgery, and hip or knee replacement (2). In 2017, the Centers for Medicare and Medicaid Services (CMS) penalized 2,573 hospitals for having excessive readmission rates in one or more of those conditions (3).

Hospitals have responded to the financial incentives of the HRRP by establishing readmission risk-assessment protocols, robust medication reconciliation processes, multidisciplinary discharge planning rounds, discharge bundles, transitional care programs, readmission reduction quality improvement teams, and partnerships with post-acute care providers, community hospitals, and physician groups (4-9). As a result, hospital readmission rates in the United States have dropped significantly. The average hospital readmission rate for the conditions included in the HRRP dropped from 21.5% in 2007 to 17.8% in 2015 (10). However, based on the design of the program's financial penalties, hospitals must continue to improve, as they are annually compared to the performance of their peers, which is continually shifting downward.

A substantial percentage of patients hospitalized with the conditions included in the HRRP have comorbid mental health conditions. Researchers have found that approximately 28% of patients hospitalized for HF, AMI, and pneumonia were diagnosed with a mental health condition in the twelve months prior to their admission (11). Furthermore, researchers have found that patients with mental illnesses are at a high risk for physical health condition readmissions (9,12). Patients hospitalized for physical health conditions who have comorbid mental illness have been found to be 28% more likely to be readmitted within thirty days than their counterparts without mental illnesses. For the six conditions included in the HRRP, patients with comorbid mental illness were found to be 56% more likely to be readmitted (13). This increased readmission risk does not only apply to patients with formal mental illness diagnoses. Self-reported depressive symptoms and low quality of life ratings, have been found to be the patient-level characteristics, most strongly associated with readmission following AMI (14).

Evidence suggests that mental health conditions and symptoms can raise physical health readmission rates directly and indirectly. Depression has been found to be an independent risk factor for coronary heart diseases (CHD), AMI, and strokes (15). Patients hospitalized for physical health conditions who have symptoms of depression have been found to have lower rates of adherence to medications and other treatment recommendations following their discharge (16). Adults with mental illness have also been found to have significantly poorer social determinants of health than adults without mental illness (17). Poor social determinants of health, including low levels of education, lower socioeconomic status, unemployment, unstable housing, and lack of social support, have also been found to be associated with increased readmission rates for HF and pneumonia (18).

Interventions specially focused on improving mental health have been shown to be effective for patients with the conditions included in the HRRP program. Psychological interventions, like emotional support or cognitive therapy, have been found to reduce cardiovascular mortality and improve symptoms of depression and anxiety in patients with CHD, COPD, and CABG (19-21). Integrated physical and mental health care programs have been found to improve mental health symptoms, health-related quality of life, and overall functioning in patients with heart diseases (22).

The aim of our systematic review was to determine if interventions designed to treat mental health symptoms can effectively reduce readmission risk among patients hospitalized for physical health conditions. While our focus was on the conditions included in the HRRP, we evaluated studies of adult patients hospitalized for any physical health condition in order to identify interventions that could be adapted for study in our populations of interest.

Methods

Search strategy

A comprehensive literature search was carried out on PubMed and Google Scholar. Key words included "readmission" and "mental health," "depression," "depressive," "behavioral health," "psychiatric,"

"psychology," and "adult." The search was limited to English-language articles published in peer reviewed journals between January 2010 and June 2018.

Selection criteria

Studies were screened by title and abstract, and identified for full-text screening. We included studies if they involved a mental health related intervention, and measured the total number or rate of readmissions as an outcome. We defined a mental health intervention as an intervention that involved assessment of mental health symptoms, psychoeducation, therapy, or psychotropic medication management. We also included interventions that involved the direct provision of care by, consultation with, or referral to a mental health provider. We did not include interventions that improved mental health without specifically targeting mental health symptoms, like palliative care consultation (23) and disease management programs (24). We included both healthcare system level, and policy level studies in our analysis. Studies were excluded if they were duplicates of other articles, non-original research reports, protocol papers, or interventions without a comparison group. Studies were also excluded if they focused primarily on pediatric populations or patients discharged from inpatient psychiatric units.

Results

Study selection

From the 1,714 records identified from the search, 1,017 were screened at the title and abstract level after duplicates (n=697) were removed. Seven additional records identified from other sources were included in the review. Of the 81 full-text articles assessed for eligibility, thirteen studies were included in this systematic review.

Study characteristics

Table 1 describes the studies included in this systematic review. One study was a meta-analysis of randomized controlled trials (RCTs) and observations studies. Six of the studies were single-site RCTs, and one study was a multi-site cluster randomized trial. Four of the studies were quality improvement studies that compared the intervention group to a historical cohort or another cohort of similar patients that did not receive the intervention. One study was a cross-sectional analysis using inpatient claims data and survey data.

Three of the studies evaluated interventions that occurred entirely during the inpatient hospitalization period. Five of the studies evaluated interventions that started after the patient was discharged from the hospital. Three of the studies evaluated interventions that started during the inpatient period, and continued after the patient was discharged from the hospital. One of the studies was a meta-analysis of medication trials. One of the studies evaluated the behavioral health infrastructure of the community, and its relationship with readmissions.

Inpatient only interventions

The studies by Orsak and colleagues (25) and Sledge and colleagues (26) evaluated proactive psychiatric consult liaison services in two different academic medical centers. In the study by Orsak, the intervention occurred on two hospitalist teams, and outcomes were compared to three hospitalist teams who continued to consult psychiatry in the traditional fashion. In the study by Sledge, the intervention was disseminated to all services in the hospital, and the results were compared to patients who received a traditional psychiatry consultation in the period prior to dissemination of the intervention. In the Orsak study, a psychiatrist met daily with the intervention hospitalist teams to identify newly admitted patients with mental health needs and help develop treatment plans for those patients. In the Sledge study, a behavioral health team reviewed the medical records of all new admissions, and met with nursing staff to identify patients with mental health needs. The team would either provide formal consultation, or informal advice to the primary physician team. Both studies did not find any significant difference in thirty-day readmissions between the intervention and comparison groups.

The study by Jennings and colleagues (27) used a randomized controlled design to study the effectiveness of a group of discharge interventions for patients with COPD that included a mental health intervention. The mental health intervention was depression and anxiety screening, with the Hospital Depression and Anxiety Scale (38). The research team communicated positive screenings to the primary inpatient team, who was responsible for referring the patient for mental health treatment. The intervention also included smoking cessation education, gastroesophageal reflux disease screening, inhaler education, and a post-discharge phone call. There was no significant difference between the treatment group and the control group.

Table 1 List of studies included in the systematic review

Author/year/country	Participants	Design	Intervention	Comparison	Outcome measure	Results
Inpatient only interventions						
Orsak *et al.* [2018], United States (25)	600 patients with psychiatric comorbidities admitted to the hospitalist service of an academic medical center in Texas	Observational	Consult a liaison psychiatrist on weekday mornings with medical teams to review and discuss new admissions in order to identify patients with existing psychiatric conditions and develop a treatment plan	Usual psychiatric consultation practices; primary team consults psychiatry	Readmission within 30 days	No significant difference; intervention: 1.22%; comparison: 0.46%
Sledge *et al.* [2015], United States (26)	1044 general medical patients hospitalized at an urban academic medical center in Connecticut	Observational (pre-post design)	Behavioral intervention team (psychiatrist, clinical nurse specialist, social worker) reviewed medical records of new patients to identify behavioral health problems. The team huddled to determine patients who would benefit from formal or informal consultation	Usual psychiatric consultation practices; primary team consults psychiatry	Readmission within 30 days	No significant difference: numerical data not presented
Jennings *et al.* [2014], United States (27)	172 patients hospitalized at an urban academic medical center in Michigan for COPD exacerbation	Randomized controlled trial	Patients received a group of discharge interventions including smoking cessation counseling, GERD screening, inhaler education, 48-hour post discharge phone call, and screening for depression and anxiety. Positive depression/anxiety screenings were communicated to the primary inpatient team who was responsible for referral to behavioral health treatment	Usual discharge protocol	Readmission within 30 days	No significant difference; intervention: 19.35% (18/93); comparison: 22.78% (18/79)
Post-discharge only interventions						
Berge *et al.* [2017], United States (28)	191 patients receiving care at a family medicine clinic serving low-income and minority patients in Minnesota within 14 days of discharge from the hospital (included both physical health and psychiatric discharges)	Observational	Readmission-focused transitional care visit within 14 days of discharge jointly conducted by pharmacist, medical clinician, and behavioral health clinician	Readmission-focused transitional care visit within 14 days of discharge jointly conducted by pharmacist and medical clinician	Readmission within 30 days of discharge	No significant difference; intervention: 7.1% (6/84); comparison: 9.3% (10/107)

Table 1 (*continued*)

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Author/year/country	Participants	Design	Intervention	Comparison	Outcome measure	Results
DeCaporale-Ryan *et al.* [2017], United States (29)	17 patients receiving care at a medical practice in upstate New York within 7 days of discharge from the hospital	Observational	Patients received a team-based post-discharge visit that included a primary care physician, psychologist, pharmacist, case manager, and medical assistant. Visits included inpatient chart review, pre-visit team huddle, depression screening, behavioral health symptom interview, medication reconciliation, development of plan to address social and environmental factors, and a team debrief	Overall clinic performance during the month prior to the start of the program	Readmission within 30 days of discharge for an avoidable reason	No significant difference; intervention: 5.9% (1/17); comparison: 13% (31/238)
Villani *et al.* [2014], United States (30)	80 patients hospitalized for heart failure at an Italian hospital with a high risk for readmission status (excluded patients with psychiatric or substance use diagnoses)	Randomized controlled trial	Patients were provided with a device allowing daily transmission of vital signs and weights to the cardiologist. Cardiologist reviewed information daily and could modify therapy or schedule consultation. The device would also screen patients for medication noncompliance. The device would screen patients for depression, anxiety, and perceived well-being monthly. A psychologist was available for counseling after HF clinic appointments	Appointments every three months at the HF clinic	Total number of major (admitted >3 days for HF) and minor readmissions (all other admissions and ED visits) within 1 year	Significant difference for major readmissions (12 *vs.* 23, P<0.03) and minor readmissions (6 *vs.* 17, P<0.02)
Roncella *et al.* [2013], Italy (31)	101 patients hospitalized for MI	Randomized controlled trial	3–11 sessions of individual psychotherapy (1 hr) over the first three months followed by 5 group sessions (2 hr) over the next three months with a psychologist	Usual care	Average total readmissions within 1 year	Significant difference (P=0.02): intervention: 0.77 (0.53–0.98); comparison: 1.2 (0.92–1.57)
Bruce *et al.* [2016], United States (32)	326 older adult patients receiving home health care following hospital discharge who had a positive PHQ-2 depression screen across 6 home care agencies located 6 different regions	Cluster randomized trial, exploratory analysis	Home care nurses followed depression care management guidelines that included weekly depression screenings, communication of symptoms to prescribers, management of side effects and adherence to antidepressant medications, patient and family psycho-education, and assistance with goals	Enhanced usual care: Home care nurses received depression assessment training	Readmission within 30 days of discharge	Significant difference (P=0.0001): Hazard ratio of being hospitalized within 30 days for intervention compared to control was 0.45
Both inpatient and post-discharge interventions						

Table 1 (*continued*)

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Author/year/country	Participants	Design	Intervention	Comparison	Outcome measure	Results
Dekker *et al.* [2012], United States (33)	41 patients hospitalized for heart failure and screenings of mild to moderate depression based on the Beck Depression Inventory Version II (excluded patients with severe depression)	Randomized controlled trial	Patients received one 30-minute cognitive therapy session focused on reducing negative thinking in the hospital with an advanced practice nurse and a 5- to 10-minute follow-up telephone session 1 week after discharge	Usual care	Readmission with 3 months	No significant difference: intervention 20% (4/20); comparison: 43% (9/21)
Huffman *et al.* [2011], United States (34)	175 patients hospitalized at an urban academic medical center for acute coronary syndrome, arrhythmia, or heart failure with a positive PHQ-9 depression screening (>9)	Randomized controlled trial	In the hospital, a care manager educated the patient about depression, helped patient schedule pleasurable activities after discharge, consulted with psychiatrist to create treatment plan (psychopharmacology or a psychotherapy referral), and communicated a plan to inpatient and outpatient providers. During the first 12 weeks following discharge, patients were reassessed for depression using the PHQ-9 on 3 occasions. If patient screened positive, care manager contacted the patient, discussed case with psychiatrist, communicated psychiatrist's treatment recommendations to patient and primary care physician, and ensured implementation of recommendations	Enhanced usual care: Care manager notified inpatient clinical team that patient met criteria for depression and recommended treatment. During the first 12 weeks following discharge, patients were reassessed for depression using the PHQ-9 on 3 occasions. If screening was still high, information was transmitted to primary care physician	Readmission within 6 months for cardiac condition	No significant difference; intervention: 39.5%; comparison: 40.5%
Huffman *et al.* [2014], United States (35)	183 patients hospitalized at an urban academic medical center for cardiac conditions and a positive screening for depression (PHQ-9), anxiety or panic disorders (PRIME-MD panic and anxiety modules)	Randomized controlled trial	In the hospital, the care manager worked with the psychiatrist to create a treatment plan for psychopharmacology or cognitive behavioral therapy (CBT). Treatment recommendations were communicated to inpatient team, and outpatient providers. Patients receiving CBT would complete the first chapter of a condition-specific CBT workbook with the care manager while in the hospital, and received six or more telephone CBT sessions with the care manager after discharge. Patients could also be referred to a mental health specialist if they desired	Enhanced usual care: Care manager informed inpatient team that patient met criteria for screening criteria depression or anxiety. Patients were rescreened at 6-week follow-up. If screening was still high, information is transmitted to primary care physician	Readmission within 6 months for cardiac condition	No significant difference; Intervention: 32%; Comparison 33%

Table 1 (*continued*)

Table 1 (*continued*)

Author/year/country	Participants	Design	Intervention	Comparison	Outcome measure	Results
Medication studies						
Pizzi *et al.* [2011], Italy (36)	Evaluated data from 3 high quality RCTs and 3 observational studies or RCTs with potential bias in randomization	Meta-analysis	Initiation of selective serotonin reuptake inhibitors (SSRI) in patients hospitalized for a cardiac event with symptoms of depression	Usual care for patients hospitalized for a cardiac event with symptoms of depression	Readmission for coronary heart disease related condition (time interval not defined)	No significant difference when only including the 3-high quality RCTs (risk ratio =0.74, 95% CI: 0.44–1.23). Significant difference when including all 6 studies (risk ratio =0.63, 95% CI: 0.46–0.86)
Public health approach						
Chen *et al.* [2018], United States (37)	469,590 hospitalized patients in the state of Maryland	Observational	Patient resides in a county where the local health department provides direct preventative mental health services or non-preventative mental health services	Patient resides in a county where the local health department does not provide direct preventative mental health services or non-preventative mental health services	Readmission within 30 days of discharge	Significant difference for those who reside in community with direct preventative care (adults <65 =0.713, adults >64 =0.614) and non-direct preventative (adults <65 =0.816, Adults >64 =0.634).

Discharge only interventions

The studies by Berge and colleagues (28) and DeCaporale-Ryan and colleagues (29) evaluated the impact of primary care behavioral health interventions at two primary care practices that serve low-income patients. Primary care behavioral health is a model of behavioral health integration where behavioral health providers are embedded in the primary care team (39). In the study by Berge, patients had a joint appointment within fourteen days of discharge with a medical provider, a pharmacist, and a behavioral health provider. Intervention patients were compared to patients who had a post-discharge appointment with only a medical provider and a pharmacist. In the study by DeCaporale-Ryan, patients had a joint appointment within seven days of discharge with a primary care physician, psychologist, pharmacist, case manager, and a medical assistant. The intervention group's avoidable readmission rate was compared to the clinic's overall avoidable readmission rate in the month prior to implementation of the primary care behavioral health model. Both interventions did not yield any significant difference in readmission rates between the treatment and the comparison groups.

The RCT by Villani and colleagues (30) examined a telemonitoring intervention with a mental health component. The study included patients hospitalized for HF without a history of mental illness or substance use disorders. Patients were telemonitored by a cardiologist who reviewed vital signs and weight daily, while text-messaging patients to make changes to treatment regimens. The patients were also telemonitored for medication noncompliance, and received medication reminders. Patients were electronically screened for depression, anxiety, and their perceived well-being, monthly. Additionally, a psychologist was available for counseling after each HF clinic appointment. Villani found a statistically significant difference in the total number of readmissions within one-year of discharge between the intervention and control groups, eighteen readmissions versus forty readmissions. Although it is unclear if the reduction in readmissions can be attributed to the cardiac telemonitoring, the medication compliance monitoring, or the mental health component, the intervention group did have a significant reduction in depressive symptoms at the twelve-month evaluation, while the control group had a significant worsening of depressive symptoms.

The RCT by Roncella and colleagues (31) examined a psychotherapy intervention for patients hospitalized for AMI. Patients received three to eleven sessions of individual psychotherapy over the first three months, followed by five group therapy sessions over the next three months. This short-term psychotherapy intervention was delivered by a psychologist and focused on resolving conflicts, improving interpersonal relationships, and gaining insights into body sensations. Roncella evaluated the average number of readmissions in the year following discharge, and found a significant difference between the intervention and control groups: an average of 0.77 readmissions compared to an average of 1.2 readmissions.

Bruce and colleagues (32) used a cluster randomized trial to study the impact of a depression management protocol for older adult patients with positive Patient Health Questionnaire two-item (PHQ-2) depression screens. In the Bruce study, home health nursing supervisors across six different home care agencies were randomized to intervention and control groups. The home health nurses managed by the supervisors in the intervention group were trained on the CAREPATH protocol, and their patients received the intervention. Enrolled patients were re-screened using the full PHQ nine-item (PHQ-9) tool (40). For patients with a PHQ-9 score greater than nine, the intervention included weekly PHQ-9 depression screenings, communication of positive screenings to primary care physicians and mental health providers in accordance with agency protocol, antidepressant side effects and adherence management, patient and family education about depression, and assistance with short-term functional and behavioral goals (41). For patients with a PHQ-9 score of nine or less, the nurse rescreened the patient for depression with the PHQ-9 weekly for two weeks and provided education and encouragement. Patients received the full intervention if symptoms worsened, or if suicidal ideation emerged. Bruce found a statistically significant difference between interventions and controls. The adjusted hazard of being readmitted within thirty days was 55% lower among intervention patients.

Both inpatient and post-discharge interventions

The study by Dekker and colleagues (33) used an RCT design to evaluate a cognitive behavioral therapy (CBT) intervention for patients hospitalized for HF with mild to moderate depression based on the Beck Depression Inventory Version II (42). In the hospital, patients received a thirty-minute cognitive therapy session focused on reducing negative thinking with an advanced practice nurse. Patients also received a ten-minute telephone follow-up session,

one week after discharge. Dekker did not find a statistically significant difference in three-month readmission rates between the intervention and control groups.

The 2011 and 2014 RCTs by Huffman and colleagues (39,43) examined collaborative care interventions for patients hospitalized with cardiac conditions. Collaborative care is a model of behavioral health integration that uses non-physician care managers located in medical settings to monitor symptoms, coordinate care, provide psychotherapy, review cases with a team psychiatrist, and communicate the psychiatrist's treatment recommendations to the primary medical providers (31,43). The 2011 study only examined patients with positive PHQ-9 depression screens, while the 2014 study examined patients with positive PHQ-9 depression screens, or positive anxiety or panic disorder screens based on the Primary Care of Mental Disorders (PRIME-MD) screening tool (44). In the 2011 study, a care manager educated patients about depression and possible treatment options, helped patients schedule pleasurable activities after discharge, consulted with a psychiatrist to create treatment plan, such as antidepressants or psychotherapy referrals, and communicated the plans to inpatient and outpatient medical providers. The primary medical team was responsible for prescribing the antidepressant medication and referring patients to therapy. For the first twelve weeks following discharge, patients were rescreened for depression three times using the PHQ-9. If a patient screened positive, the care manager contacted the patient, discussed the case with the psychiatrist, and communicated the psychiatrist's treatment recommendations to patient and their primary care physician. In the 2014 study, if the psychiatrist's initial treatment recommendations were for psychotherapy, CBT was provided by the care manager. While in the hospital, patients completed the first chapter of a condition-specific CBT workbook with their care manager. After discharge, patients received six or more, fifty-minute telephone CBT sessions. Both studies found no significant difference in six-month readmission rates for cardiac conditions between the intervention and control groups.

Medication studies

Pizzi and colleagues (36) used a meta-analysis design to examine the impact of antidepressant therapy using selective serotonin reuptake inhibitors (SSRIs) in patients with CHD on cardiovascular readmissions. Pizzi evaluated data from three high quality RCTs and three observational studies or RCTs with potential bias. When Pizzi restricted the analysis to the three-high quality RCTs, there were no significant differences between the groups. However, when Pizzi included all six studies, the intervention group had a significantly lower risk of readmission than the comparison group.

Public health approach

Chen and colleagues (37) used a cross-sectional design to determine the association between mental health services provided by the local health department and the rate of readmissions in the locality. After controlling for the individual-level, hospital-level, and community-level characteristics, Chen found that hospitalized patients who reside in communities where the local health department provides direct preventative mental health services or non-preventative mental health services are significantly less likely to be readmitted within thirty days of discharge than hospitalized patients who reside in communities where the local health department does not provide those services.

Discussion

The evidence supporting mental health strategies as a mechanism to reduce readmissions is mixed; however, we did find evidence from two randomized controlled, and a multi-site randomized cluster trial, Villani (30), Roncella (31), and Bruce (32), that mental health strategies in the post-discharge period, can effectively reduce physical health readmissions. In all three studies, the post-discharge mental health intervention was delivered in-person. The studies by Villani and Bruce used routine screenings for mental health symptoms, and included a medication adherence component. The studies by Villani and Roncella used a psychotherapist to deliver the intervention, and demonstrated that mental health strategies do not need to be restricted to patients with mental health symptoms to yield results. Unfortunately, the study by Villani combined a mental health intervention with a cardiac telemonitoring intervention, and it is difficult to measure the role that the different interventions played on reducing readmissions. Additionally, the Villani study excluded patients with formal mental illnesses and substance use diagnoses, so we cannot generalize the findings to those high-risk patient populations. The Roncella study included both patients with and without mental health comorbidity. Secondary data analysis is needed to determine if the effectiveness

of the intervention varied between those two groups. Additionally, the intervention in the Roncella study took place over 6 months, and the researchers measured the average number of readmissions at one-year following discharge. Additional research is needed to determine if this six-month intervention could also be effective at reducing thirty-day readmissions. The Bruce study is the strongest study supporting the use of mental health interventions to reduce thirty-day physical health condition readmissions. Bruce and colleagues showed that a depression management protocol for home care nurses can significantly reduce readmission rates among home care patients with depressive symptoms. This intervention did not require any additional staffing, and very little additional resources. Hospitals should encourage home care agencies in their communities to adopt depression management protocols similar to the CAREPATH protocol studied by Bruce and colleagues.

In addition to the direct interventions that hospitals or outpatient providers can implement to reduce readmissions, the cross-sectional study by Chen (37) found that communities with strong public mental health infrastructure have lower thirty-day physical health condition readmission rates. A hospital's ability to prevent readmissions is limited by the post-acute care infrastructure of the communities that they serve. In addition to partnering with primary care providers, home care agencies, and post-acute care facilities, hospitals must also partner with private and public mental health providers to eliminate any barriers that patients may experience to accessing mental health treatment after discharge from a physical health hospitalization. The study by Chen is the only peer-reviewed publication, that we could find, measuring the effect of the availability of mental health services in a community on physical health readmissions. There is a great need for additional research around this relationship.

Although many of the interventions reviewed in this analysis did not produce reductions in readmissions for physical health conditions, we still believe that many of these interventions hold great value. Proactive psychiatric consultation, as studied by Orsak (25) and Sledge (26), may be able reduce psychotropic medication errors and delays, reduce agitation, and improve coordination with outpatient mental health providers, as proactive consultation has been found to reduce inpatient length of stay (26,45). Screening patients for depression or other mental health symptoms with validated tools during the inpatient hospital course, as studied by Jennings (27) and Huffman (34,35), also holds value. The inpatient team can use this information to request the appropriate consultations, and develop a discharge plan that addresses identified needs. Routine depression screenings have long been recommended by a number of professional societies, including the American Heart Association (46). Behavioral health integration, whether delivered through a primary care behavioral health model as studied by Berge (28) and DeCaporale-Ryan (29) or a collaborative care model as studied by Huffman (34,35), breaks down the silos that have long separated mental health from physical health, while simultaneously improving access to mental health services, and reducing the associated stigma. Primary care behavioral health models have been found to improve insomnia, posttraumatic stress disorder, and suicidal ideation (39). Collaborative care models have been found to decrease symptoms of depression and anxiety, increase the likelihood that patients receive medications for depression and anxiety, and improve mental and physical health quality of life (47). CBT, which was studied by Dekker (33) and Huffman (35), has been found to have multiple mental health and physical health benefits for medical patients, including lowering recurrent cardiovascular events (48), reducing CABG length of stay (21), and treating depressive symptoms in patients with a variety of physical health conditions (49).

Limitations

Due to the small number of studies published from January 2010 to June 2018 evaluating the impact of mental health interventions on physical health readmissions, we chose to include non-randomized studies, and meta-analyses in this systematic review. Many of the studies in this review suffered from sub-optimal study designs, and small sample sizes; however, we hoped that these findings will motivate researchers to design robust trials of mental health interventions in the future. There was also great variation in the readmission outcome measures used by the different studies. We limited our search to peer-reviewed journals and may have missed relevant studies that were published in reports, conference proceedings, or abstracts. Additionally, our search strategy may have missed some peer-review journal articles that met our inclusion criteria.

Conclusions

The literature identified in this review appears to provide support for the idea of using mental health strategies after a hospital discharge, as a mechanism for reducing

physical health condition readmissions. These strategies should include routine monitoring of symptoms using a standardized tool as well as medication adherence monitoring. These strategies should focus on reducing barriers to obtaining, in-person mental health services, either delivered by a therapist or a trained registered nurse. These strategies do not need to be limited to patients with active mental health symptoms, or a comorbid mental health diagnosis. Unfortunately, there is a lack of studies evaluating the impact of mental health interventions on physical health readmission. We hope that this review will motivate researchers to design, and study additional mental health interventions.

Hospitals working to reduce their thirty-day readmission rates should work with their post-acute care partners to ensure that the mental health symptoms of their recently discharged patients are being assessed and addressed. Hospitals should also work with their local public health entities, to ensure that preventative and non-preventative mental health services are available to all members of the community and especially for patients recently discharged from acute care settings.

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Footnote

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/jhmhp.2018.08.05). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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