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Identification and Mitigation of Environmental Hazards in Psychiatric Patient Suicide Prevention: A Review

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Abstract

Background: Environmental hazards are a factor in the bulk of inpatient suicide cases, which disproportionately impact psychiatric patients. Current measures to minimize suicide risk include process-oriented solutions and environmental safeguards such as breakaway structures.

Aims: To perform a review of the literature that identifies environmental suicide hazards and interventions implemented to abate hazards and reduce suicide risk.

Methods: Electronic databases were searched using relevant keywords. Inclusion criteria consisted of articles published 2009-2020 that identified environmental suicide hazards or examined efficacy of interventions implemented to abate hazards. The Johns Hopkins Research and Non-Research Evidence Appraisal Tools were used for critical appraisal.

Results: Final article yield consisted of one level V-B literature review, one level II-B quasi experimental research study, and five level III-B non-experimental descriptive studies. Checklists and structural interventions demonstrated statistically significant reductions in inpatient suicides. The most common environmental hazards were ligatures (sheets/bedding) and ligature points (door fixtures) used in hanging.

Conclusions: Findings have valuable clinical implications, such as providing guidance in the systematic elimination of more commonly occurring hazards and support the use of structural and checklist interventions alongside existing suicide prevention measures. However, additional research is needed on efficacy in different settings.

Keywords: environment, suicide prevention, inpatient suicide, psychiatric, hazard

Introduction

Unexpected incidents resulting in or involving the risk of significant psychological/physical harm or death are defined as sentinel events by hospital accreditation committees. Mental health patients can present with the capacity to harm themselves, potentially resulting in patient deaths by suicide, which are considered sentinel events. Patient suicide has been consistently ranked as the first or second most common sentinel event, but has dropped to the fifth spot in recent years (The Joint Commission, 2019; Williams et al., 2018). While this ranking has dropped, suicide prevention is no less important and the majority of these events involve psychiatric patients, which are a high-risk group (Williams et al., 2018). While many factors can contribute to the risk of patient suicide, the most important may be the physical environment, which was a primary factor in the majority of reported suicides (Sakinofsky, 2014). Mental health staff may lack the tools and training needed to perform proper risk assessments in order to identify environmental hazards as well as abate patient suicide (Sakinofsky, 2014). Patient suicide and the presence of environmental hazards is an issue because if not addressed, a greater means to facilitate suicide will exist in health care settings, resulting in the ultimate harm to patients and decreased staff satisfaction in addition to a consistently high sentinel event ranking (Cardell et al., 2009; Sakinofsky, 2014). The purpose of this manuscript is to perform a review of the literature that identifies environmental hazards within psychiatric inpatient suicide cases in addition to interventions that have been implemented to mitigate such hazards.

Background

While sentinel events such as inpatient suicide are defined as unexpected, they are not considered unpreventable. The Joint Commission (2018) requires mental health units to perform environmental risk assessments that identify aspects of the physical environment that could be

used in suicide attempts and take action to abate them, such as the removal of ligature points that could be used in hanging. A number of recommendations have been proposed and interventions have been employed to minimize physical suicide hazards in the form of environmental safeguards (which include breakaway structures to circumvent hanging) and process oriented solutions (such as the use of checklists or restricting patient belongings) (Cardell, Bratcher, & Quinnett, 2009; Sakinofsky, 2014). Despite this, inpatient suicide still remains one of the most commonly occurring sentinel events.

The primary data sources for estimating statistics of patient suicides are the Centers for Disease Control and Prevention's (CDC) National Violent Death Reporting System (NVDRS) Restricted Access Database (RAD), and the Joint Commission's Sentinel Event (SE) Database, both of which primarily have inpatient data. In terms of suicide statistics from these data sources in relation to environmental hazards and involvement of mental health patients, as high as 80% of patient suicides involved psychiatric inpatients and the physical environment was involved in 84% of reported suicides, which show that psychiatric patients are disproportionately affected and that environmental suicide hazards are a primary contributing factor to patient suicide (Sakinofsky, 2014; Williams et al., 2018). More detailed data on suicide methods and specific hazards showed that hanging was the most common method of inpatient suicide (accounting for over 70% of all inpatient suicide events) in both databases, and a door hinge or handle was used as a ligature point in approximately half of all hanging events, which took place in private spaces such as patient bathrooms and bedrooms (Williams et al., 2018). It is apparent that environmental hazards play a large role in patient suicide events and that psychiatric patients are a high-risk group.

Review of the Literature

The search process for literature pertaining to the topic of environmental suicide hazards and patient suicide was conducted on several electronic databases: Scopus, PubMed, PsycINFO, and Cumulative Index to Nursing and Allied Health Literature (CINAHL) Complete. Various combinations of relevant search terms were utilized, which included: “Inpatient,” “suicide,” “prevention,” “suicide prevention,” “psychiatric,” “mental health,” “environment,” “unit,” “tool,” “checklist,” and “patient safety.” Inclusion criteria consisted of articles that were peer-reviewed, had a subject age of 18 years or older, were in the English language, and published from 2009 to 2020. Accepted publication types included individual research as well as critically appraised research studies, clinical practice guidelines, electronic textbooks and systematic reviews or meta-analyses. Articles were filtered for relevancy, which included articles with a study population consisting of adults experiencing suicidal ideation or with mental health conditions and involved recommendations or interventions to address environmental hazards that would minimize risk of suicide in, but not limited to, mental health care settings. To generate additional results, reference lists of relevant articles were examined to see whether any references adhered to search criteria. Critical appraisal of these articles was performed using the Johns Hopkins Research and Non-Research Evidence Appraisal Tools (Dang & Dearholt, 2017).

The search resulted in seven articles: One non-research level V-B literature review (Cardell et a., 2009), one level II-B quasi experimental research study (Mills et al., 2010), and five level III-B non-experimental descriptive studies (Hunt et al., 2012, Mills et al., 2013, Mohl et al., 2012, Watts et al., 2017, and Watts et al., 2012). The evaluation table in the Appendix details the characteristics and appraisal results of each article. The literature review by Cardell et al. (2009) aimed to review environmental safeguards in mental health facilities to decrease suicide risk and provide recommendations to bolster patient safety. Cardell et al. (2009) found

that safeguards included breakaway structures (shower rods), impenetrable glass, slanted door hinges, and restriction of patient belongings to prevent suicide by use of personal items, hanging and jumping from heights. It was concluded that while implementing environmental precautions is a primary step in decreasing patient suicide, additional research is needed to determine effectiveness and such measures should be utilized alongside environmental risk assessment, training on environmental hazards, and therapeutic interventions targeting patient behaviors (Cardell et al., 2009).

Hunt et al. (2012) and Mills et al. (2013) conducted retrospective analyses of databases (hospital, government and police sources) to examine environmental hazards in psychiatric inpatient suicide cases. Hunt et al. (2012) aimed to address the lack of national studies detailing psychiatric inpatient suicide cases involving hanging with various ligatures and ligature points, whereas Mills et al. (2013) was geared towards providing an updated list of environmental suicide hazards on inpatient psychiatric units. Both Hunt et al. (2012) and Mills et al. (2013) reviewed suicide case reports with data related to suicide method and use of ligatures or ligature points and found that the most common suicide method was hanging, sheets or bedding were the most common ligatures (often brought into the health care environment by a patient), and doors were the most prevalent ligature points. In the study by Hunt et al. (2012), the most common ligature points (doors, hooks, handles and windows) made up 59% of all anchor points and the most common ligatures (belts, sheets and towels) made up 61% of all ligatures out of 448 inpatient psychiatric suicide cases surveyed. In addition, in 73% of cases, ligature was brought onto the unit by the patient via worn or as a personal belonging (Hunt et al., 2012). Findings by Mills et al. (2013) found that out of 243 suicide attempts and completions that occurred on inpatient mental health units, 106 (43.6%) were hanging related, and for these reports for suicide

attempts/completions by hanging, doors were 40.6% of anchor points. Out of the 29 completed suicides in the study, 22 (75.9%) were by hanging and within these cases, door parts were 52.2% of anchor points and for ligatures used in hanging events, 58.5% were sheets/bedding (Mills et al., 2013). Hunt et al. (2012) and Mills et al. (2013) recommended that measures such as systematic elimination of hazards, environmental surveys, structural safeguards, and protocols on restricting patient belongings should be employed that emphasize such ligature/ligature points.

The remaining studies explored the effectiveness of interventions that were implemented to reduce risk of suicide from environmental hazards on inpatient mental health units. Mohl et al. (2012) examined the effect of installing a structural intervention in reducing suicide jumps, whereas Mills et al. (2010), Watts et al. (2017) and (2012) explored the efficacy of a mental health environment of care checklist (MHEOCC) in the identification and mitigation of suicide hazards on Veterans Affairs (VA) inpatient mental health units. Studies focused on the MHEOCC identified and obtained data on inpatient suicide cases through root cause analysis (RCA) reports, whereas Mohl et al. (2012) acquired similar data from hospital and police databases. Watts et al. (2012) found that checklist implementation resulted in a statistically significant reduction in inpatient suicide rates (2.64 per 100,000 inpatient mental health admissions before use and decreased to 0.87 afterwards with $P<0.001$) and that the most prevalent hazards were ligature points used in hanging cases, which Mills et al. (2010) also found for most common hazards. In the study by Mills et al. (2010), after use of the MHEOCC for one year, 113 VA sites identified several thousand (7,642) hazards and abated around three quarters (76.3%) of them. Watts et al. (2017) found that implementation of the MHEOCC was associated with a sustained reduction in suicides over a timespan longer than seven years. The suicide rate prior to implementation was 4.2 suicides per 100,000 admissions and afterwards, the

rate decreased to 0.74 with no loss of effect in seven years after implementation (Watts et al., 2017). Studies exploring efficacy of the MHEOCC determined that results support its use as an evidence-based tool to prevent suicide and Mohl et al. (2012) reflected similar findings supporting a structural intervention to prevent suicide jumps not only for psychiatric patients, but general hospital patients (findings showed that 10 counts of suicide by jumping out of hospital windows happened out of 119,269 cases and this was reduced to 2 out of 104,435 cases with p=0.037).

Analysis

Overall, studies that identified environmental suicide hazards found that the most prevalent hazards were ligature points on doors and ones that detailed suicide methods discovered that hanging was the most common method (Hunt et al., 2012; Mills et al., 2013; Mills et al., 2010; Watts et al., 2012). Results that were inclusive of ligature data found that the most common ligatures used in hanging were sheets and bedding (Hunt et al., 2012; Mills et al., 2013). In regards to the efficacy of interventions implemented (checklist or structural interventions) to identify and abate environmental hazards to reduce suicide risk, all resulted in a statistically significant reduction in the number of inpatient suicides after implementation, supporting use of these interventions as evidence-based tools to address environmental suicide hazards (Mohl et al., 2012; Watts et al., 2017; Watts et al., 2012). While findings support the efficacy of interventions implemented, researchers acknowledged that further research is needed to evaluate the effectiveness of such interventions, environmental safeguards, and their use alongside environmental risk surveys as well as therapeutic interventions in suicide prevention (Cardell et al., 2009, Mills et al., 2010; Mohl et al., 2012; Watts et al., 2017; Watts et al., 2012).

In terms of appraisal ratings, results ranged from level V-B (for literature review) to level

II-B (for quasi-experimental study), with B denoting good quality for that level of evidence. Analysis of the literature review by Cardell et al. (2009) resulted in a level V-B rating because it did not identify knowledge gaps and use up-to-date literature. The study by Watts et al. (2012) was a level II-B quasi-experimental study with manipulation of the MHEOCC as an independent variable. The studies conducted by Hunt et al. (2012), Mills et al. (2013), Mills et al. (2010), Mohl et al. (2012), and Watts et al. (2017) were level III-B non-experimental research studies that did not have independent variable manipulation and used review of secondary data, such as RCA reports or hospital records. The five aforementioned studies analyzed pre and post intervention data and did not possess a control group, resulting in level B ratings. This may be justified, considering that the absence of a control group is inherent in almost all other studies outside of the ones discussed in this manuscript examining suicide prevention measures due to ethical concerns.

Clinical Implications

Findings and recommendations gleaned from these studies can help direct practice. Results demonstrating that hanging remains as the most frequent suicide method and that the most common environmental hazards consist of ligatures (sheets/bedding) and ligature points (on doors) used in hanging provide guidance in the restriction of belongings for high risk patients, the systematic elimination of more frequent, high risk hazards, and warrant emphasis on such hazards in environmental risk surveys as well as training (Hunt et al., 2012; Mills et al., 2013; Mills et al., 2010; Watts et al., 2012). Findings supporting the efficacy of structural and checklist interventions in identifying and mitigating environmental hazards to reduce suicide risk endorse their implementation as evidence-based suicide prevention measures alongside existing practices such as environmental/patient risk assessments, staff training, and therapeutic interventions

(Cardell et al., 2009; Mills et al., 2010; Mohl et al., 2012; Watts et al., 2012; Watts et al., 2017). In addition, structural and checklist interventions such as the MHEOCC can provide direction in increasing the sustainability of mental health interventions, considering that alterations to the physical environment are more likely to be sustained (compared to a strictly process oriented change), and checklists involve physical changes to the environment after hazard identification (Watts et al., 2017).

Discussion

Studies produced reasonably consistent results on identified environmental suicide hazards as well as the efficacy of interventions examined, drew fairly definitive conclusions from their results (noting the degree to which interventions were effective or how prevalent suicide methods/hazards were) and proposed plausible, consistent recommendations (e.g. systematic elimination of high risk hazards or possible use of structural/checklist interventions as evidence-based measures alongside existing practices). The sample sizes utilized were sufficient based on study design and rationale (e.g. 113 or 150 VA mental health units where the MHEOCC was implemented), even for Hunt et al. (2012), where suicide data for a comprehensive national sample needed to be taken (n=1,559 inpatient suicides, 448 of which were on psychiatric units). A common limitation among these studies was the lack of a control group, which researchers acknowledged. Most analyzed data between pre and post intervention periods and even controlled for the number of inpatient cases as well as admissions, noting that the lack of a control group is inherent in nearly all suicide prevention studies due to ethical concerns (Hunt et al., 2012; Mohl et al., 2012; Watts et al., 2012). All studies that implemented the MHEOCC at VA sites acknowledged non generalizable results as a limitation considering that results might differ at non-VA sites (Mills et al., 2010; Watts et al., 2017; Watts et al., 2012). Limitations of

this review can include differences in the data collection time, type of database where data was collected, and settings used in studies. For instance, the time range for data collection was as low as eight and as high as fifteen years across studies, which could have an impact on consistency in overall outcomes, especially when examining the sustainability of interventions. Variances in the type of database sources used (e.g., where cases were obtained, such as VA RCA databases compared to government records) and study settings (VA sites versus general hospitals) could impact comprehensive summaries of evidence since patient populations differ and VA sites are less diverse with primarily male patients. Lastly, a potential limitation of this review is publication date of the articles and how current they are: Aside from Watts et al. (2017), which was the only study published within the last five years, the search had to be expanded to as far back as 2009 to find additional relevant articles, which could result in use of outdated evidence.

Despite these limitations, there are valuable implications for these study findings in the realm of psychiatric patient suicide prevention through abatement of environmental hazards. The interventions discussed, such as the MHEOCC and a minimal structural safeguard, are limited to changes in the care environment, rather than addressing care processes, which suggests that altering the physical environment solely can reduce the risk of psychiatric patient suicide and builds upon existing outpatient literature that posits the same notion but does not exclude the possibility the similar improvements could be brought about through improving care processes (Beautrias, 2001; Lester, 1990; Loftin et al., 1991, Watts et al., 2012).

Conclusion

Patient suicide is a grave patient safety issue that primarily affects mental health patients and could be addressed by mitigating environmental hazards, which are a contributing factor in the majority of reported suicides (Sakinofsky, 2014; Williams et al., 2018). A review of the

literature surrounding the topic of environmental suicide hazards and interventions implemented to abate them found that the most common suicide method was hanging, the most frequent hazards were ligatures (sheets/bedding) and ligature points (door fixtures), and that checklists in addition to structural interventions demonstrated efficacy in reducing suicide risk. Findings have valuable clinical implications, which include systematic elimination of more prevalent, higher risk hazards and use of structural/checklist interventions to identify and mitigate hazards alongside existing suicide prevention practices. However, study limitations such as non-generalizable results warrant the need for additional research, especially on the effectiveness of checklist and structural interventions at non-VA sites.

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Appendix

Evidence Appraisal and Evaluation Table

Purpose of article or review	Design / Method / Conceptual framework	Sample / Setting	Major variables studied (and their definitions)	Measurement of major variables	Data analysis	Study findings	Level of evidence (critical appraisal score) / Worth to practice / Strengths and weaknesses / Feasibility / Conclusion(s) / Recommendation(s) /
APA Reference: Cardell R., Bratcher K. S., & Quinnett, P. (2009). Revisiting "suicide proofing" an inpatient unit through environmental safeguards: A review. *Perspectives in Psychiatric Care, 45*(1), 36–44. https://doi.org/10.1111/j.1744-6163.2009.00198.x							
To identify types of environmental precautions in psychiatric facilities that can be implemented to protect suicidal individuals from harming themselves and provide recommendation for how inpatient units can be made safer.	Literature review. No details on design, method, or conceptual framework.	No sample size or comprehensive details on article pool/literature sources or databases mentioned. However, all sources mentioned pertain to the topic of environmental precautions in psychiatric facilities to reduce suicidal means. Manual review of this work (e.g. references used) showed	IV: Content pertaining to the history of environmental hazards and precautions implemented in psychiatric units to decrease suicidal means in literature sources. DV: Recommendations and implications for practice based off of the IV (findings/content from literature sources).	Authors summarized, reviewed and synthesized findings/content from literature sources with no explicit measurement or analysis method listed.	Authors summarized, reviewed and synthesized findings/content from literature sources with no explicit measurement or analysis method listed.	Proposed environmental safeguards included slanted door hinges/shower heads, breakaway shower rods, avoidance of bedrails, non-breakable glass and restriction of personal belongings to prevent suicide by hanging from fixtures, jumping and use of personal items. Research suggests that while such safeguards do decrease the incidence of suicide, they should not be depended upon solely and instead be combined with observation and supportive, caring	**Level of Evidence:** Level V-B **Worth to Practice:** Findings provide recommendation and direction on guidelines surrounding implementation of environmental precautions to decrease suicidal means in psychiatric facilities and increase unit safety (e.g. environmental safeguards alongside surveys, training and policies on belongings, assessment and documentation). **Strengths/Weakness:** Strengths of this review include clear aim and objective, a meaningful analysis of conclusions from the literature sources, and reasonably consistent recommendations that were made for future practice/study with some reference to scientific evidence. Weaknesses include providing no details provided on design, method, article pool or literature sources/types reviewed. While the format of a literature review is nonsystematic, knowing the quality of the sources reviewed would be helpful in

Purpose of article or review	Design / Method / Conceptual framework	Sample / Setting	Major variables studied (and their definitions)	Measurement of major variables	Data analysis	Study findings	Level of evidence (critical appraisal score) / Worth to practice / Strengths and weaknesses / Feasibility / Conclusion(s) / Recommendation(s) /
		that findings were obtained from fourteen literature sources (a combination of clinical practice guidelines, journal articles, and organizational reports). Settings mentioned are inpatient mental health units (worldwide, due to country not specified).				therapeutic interventions focused on patient moods and behaviors. Implementing environmental safeguards is one of the first steps in decreasing inpatient suicide, but more research is needed to evaluate effectiveness of such safeguards and whether other interventions are as effective. Environmental surveys should be used to identify hazards and make sure that precautions are in place. Training should involve awareness of such precautions, policies on patient visitation, belongings, suicide risk assessment and documentation.	assessing the quality of the literature review. **Feasibility:** Environmental precautions can decrease suicide but feasibility depends on the setting's financial resources and approval. **Conclusions:** Use of environmental safeguards is first of steps in inpatient suicide prevention but should not be solely depended upon. There are a variety of effective safeguards such as slanted door hinges/shower heads, breakaway shower rods, avoidance of bedrails, non-breakable glass and restriction of personal belongings. **Recommendation:** Inpatient mental health care settings should utilize environmental safeguards alongside other measures: Environmental assessments (to ensure that precautions are in place to identify any hazards), observation, and training (which should include awareness of environmental precautions, institutional policies on patient belongings, visitation, suicide risk assessment and documentation).

Purpose of article or review	Design / Method / Conceptual framework	Sample / Setting	Major variables studied (and their definitions)	Measurement of major variables	Data analysis	Study findings	Level of evidence (critical appraisal score) / Worth to practice / Strengths and weaknesses / Feasibility / Conclusion(s) / Recommendation(s) /
APA Reference: Hunt, I. M., Windfuhr, K., Shaw, J., Appleby, L., & Kapur, N. (2012). Ligature points and ligature types used by psychiatric inpatients who die by hanging: A national study. *Crisis: The Journal of Crisis Intervention & Suicide Prevension, 33*(6), 87–94. https://doi.org/10.1027/0227-5910/a000117							
To examine ligature points and ligatures used in hangings by psychiatric inpatients, to determine any trends over time in ligature points and ligatures used, and to compare characteristics of these patients with those in other inpatient suicides.	Non-experimental research study. Review of secondary data was performed, with data taken for a comprehensive national sample of death by from the ONS from 1999 to 2007. Next, information on whether those in the sample had been in contact with mental health services in their last year were obtained from hospitals and community trusts. Then, clinical data	The sample consisted of data from the ONS, hospitals, community trusts and physicians involving cases of suicides and self-poisoning/self-injury registered by the organization from January 1, 1999 to December 31, 2007. n=1,559 inpatient suicides were identified. The setting was in England and Wales.	IV: Review of suicide case data from the ONS, community trusts and physicians. DV: Data related to ligature points and ligatures used in hangings by psychiatric inpatients.	Dependent variable was measured by the percentage of ligature points and types used in psychiatric inpatient hanging cases, and patient characteristics as well as trends in regards to ligature usage.	Analysis was performed using Stata 11.0 software. Chi-squared analysis was used for subgroup analysis and the Fisher's exact test was used for any cell that had an expected frequency of less than 5. The Kruskal-Wallis test was used for age comparisons. For trends, the calendar year was input as a continuous variable in a Poisson regression model to test for linear trends in ligatures and points used over time, and then exhibited as	448 cases of inpatient suicide happened on psychiatric units out of all (1,559) inpatient suicides. Out of these, 344 (77%) died by hanging. The most common ligature points were doors, hooks, handles and windows, all together which made up 59% of all anchor points. The most common ligatures were belts, sheets and towels which made up 61% of all ligatures. Overall, in 73% of cases, ligature was brought onto the unit by the patient via worn or as a personal belonging. There was an increase in proportion of hangings from doors and windows, but decrease in other ligature points. Using	**Level of Evidence:** III-B **Worth to Practice:** Findings from this study can provide guidance in the identification and systematic abatement of the most common ligature points and ligatures used in the most common suicide method of hanging among psychiatric inpatients. **Strengths/Weakness:** Strengths include sufficient sample size based on study design and rationale (comprehensive national sample), producing reasonably consistent results, and making fairly definitive conclusions and recommendations from these results. Weaknesses include the lack of a comparison sample and the fact that information from physicians/clinicians were based on clinical judgment rather than standardized assessment (however, the authors note a fair amount of other suicide studies used similar methods). **Feasibility:** Findings can be used to provide direction on hanging-related suicide prevention measures in any setting with any potentially suicidal

Purpose of article or review	Design / Method / Conceptual framework	Sample / Setting	Major variables studied (and their definitions)	Measurement of major variables	Data analysis	Study findings	Level of evidence (critical appraisal score) / Worth to practice / Strengths and weaknesses / Feasibility / Conclusion(s) / Recommendation(s) /
	was gathered by sending a questionnaire to respective psychiatrists of those within the sample. No conceptual framework noted.				likelihood ratio chi-squared tests.	shoelaces as ligatures increased but use of other items decreased. There were no gender differences regarding ligature selection, except females were more likely to use a clothing item as a ligature than males and those over 65 years were more likely to use a belt.	patient population, but feasibility depends on the setting's financial resources and approval from organizational members. **Conclusions:** Hanging remains as the most common suicide method among inpatients. The most common ligature points are doors, hooks/handles and windows. The most common ligatures are belts, sheets and towels. Improving the unit environment can help reduce risk for potentially suicidal patients, especially early in admission. **Recommendation:** Environmental safeguards along with audits should be continually implemented that factor in the identification and abatement of environmental hazards related to common ligatures/ligature points used in hanging.

Definition of abbreviations: Office of National Statistics (ONS).

Purpose of article or review	Design / Method / Conceptual framework	Sample / Setting	Major variables studied (and their definitions)	Measurement of major variables	Data analysis	Study findings	Level of evidence (critical appraisal score) / Worth to practice / Strengths and weaknesses / Feasibility / Conclusion(s) / Recommendation(s) /
APA Reference: Mills, P. D., King, L. A., Watts, B. V., & Hemphill, R. R. (2013). Inpatient suicide on mental health units in Veterans Affairs (VA) hospitals: Avoiding environmental hazards. *General Hospital Psychiatry*, *35*(5), 528–536. https://doi.org/10.1016/j.genhosppsych.2013.03.021							
To provide an updated list of environmental hazards on inpatient mental health units in the VA system to help others identify and address similar hazards.	Non-experimental research study. Retrospective review of secondary data. All RCA reports between December 1999 and December 2011 from VA hospitals were searched and reviewed to identify inpatient completed suicides or suicide attempts on mental health units by using event codes and use of natural language processing software	Sample population consisted of RCA records of completed suicides or suicide attempts in VA inpatient mental health units. Sample number not listed. Setting: Inpatient mental health units in VA hospitals.	IV: Review of RCA reports relevant to inpatient completed suicides or suicide attempts on mental health units. DV: Suicide and environmental hazard data in RCA records of completed suicides or suicide attempts.	Measures for suicide and hazard data included: 1) Counts of completed suicides and attempts 2) Counts and percentages of suicide methods 3) Number and percentage of types of hazards 4) Percentage of suicide by location	After the search, RCA reports occurring in any area outside of inpatient mental health units and those not involving suicide/suicide attempts were excluded. RCA reports were coded for method of suicide or suicide attempt, and the location of the event. For instance, in cases where hanging as the suicide method, the type of anchor point and ligature was coded. The coding system was created in previous studies of RCA reports involving suicide	The search revealed 406 suicide attempts, 65 completed suicides on all VA units between December 1999 and December 2011. 243 reports took place on inpatient mental health units. Within inpatient mental health units, 46.3% events were hanging related, 22.6% were cutting, 15.6% were strangulation and 7.8% were overdoses. Of the 29 completed suicides on inpatient mental health units, 22% (75.9%) were hanging. Of the 106 reports for suicide attempts/completions by hanging, doors were 40.6% of anchor points, beds were 13.2%, showers were 12.3% and	**Level of Evidence:** Level III B. **Worth to Practice:** The results of this study provide direction in providing a ranking system or hierarchy of the most commonly occurring and dangerous hazards, which can guide environmental interventions to target higher priority ones and have the greatest impact on inpatient suicide rates (e.g. since sheets were used in the bulk of completed suicides by hanging, we should replace sheets with bedding that is harder to use as a lanyard). However, results may differ at non-VA sites. **Strengths/Weakness:** Strengths include reasonably consistent results, sufficient sample size based on the study design (review of secondary data over a large health care system) and drawing fairly definitive conclusions from results. Non-generalizable results are a weakness, since effects might differ at general, non-VA hospital sites (e.g. the majority of patients are men in VA hospitals). Also, information is from reported suicide data so some suicide attempts may have been

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	(PolyAnalyst, Megaputer) to identify key term terms (pertaining to suicide or suicide attempt) in the report text. No conceptual framework noted.				and one author coded each report.	wardrobe/locker doors were 6.6%. Out of the 22 deaths by hanging, door parts were 52.2% of anchor points. For ligatures used in hanging events on inpatient mental health units, 58.5% were sheets/bedding, clothing were 17.0%, belts were 9.4% and shoe laces were 4.7%. Belts were 31.8% of ligatures used in completed suicides. Of 52 cases that involved cutting, 23.1% used razor blades and 17.3% used plastic knives with no deaths for cutting cases. 42% occurred in the patient's bedroom, 28.1% in the bathroom, 8.7% in the general ward, and 21.1% did not list a location.	missed if unreported. **Feasibility:** RCA reviews for suicide and environmental hazards involved can be performed at any setting. The results of this study can be used to guide hazard abatement at other facilities, but effects on inpatient suicide rates may vary/differ at non-VA sites. **Conclusions:** Hanging is the most commonly reported method in inpatient suicide and many objects can be used as ligatures, especially sheets/bedding. Systematic abatement of useable ligature points (prioritizing ones that have resulted in greatest death/injury such as door parts) is a crucial step in increasing patient safety. **Recommendation:** Recommend inclusion of ligatures (particularly sheets/bedding) and ligature points (especially door parts) as a required component of any environmental risk assessment for suicide hazards, with other elements such as belts and razor blades to be included as well.

Definition of abbreviations: Veterans Affairs (VA), Root Cause Analysis (RCA)

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APA Reference: Mills, P. D., Watts, B. V., Miller, S., Kemp, J., Knox, K., DeRosier, J. M., & Bagian, J. P. (2010). A checklist to identify inpatient suicide hazards in Veterans Affairs hospitals. *Joint Commission Journal on Quality & Patient Safety*, *36*(2), 87–93. https://doi.org/10.1016/s1553-7250(10)36015-6							
To examine the implementation and efficacy of a standardized checklist for mental health units to identify suicide hazards in a large health care system.	Quasi-experimental research study. The effect of MHEOCC implementation (and hazard identification/abatement associated with it) was performed by review of checklist data (types and location of each hazard identified along with ratings of severity and probability of occurrence using a risk-level classification chart, where 1 represented minimal risk	Sample population consisted of hazard identification data on each mental health unit in the VA system in a national database maintained by the Center for Excellence. Sample number not listed. Setting: 113 US Department of Veterans Affairs hospitals.	IV: Use of MHEOCC on VA inpatient mental health units. DV: Hazard identification data from VA inpatient mental health units where the MHEOCC was implemented.	Measures for hazard identification data included: 1) Number of identified hazards 2) Frequency of hazard types 3) Number of hazards by location 4) Risk levels 5) Percentage of hazards abated by a facility by the end of 2008 To evaluate the effect of the MHEOCC on identifying and abating hazards on mental health units.	The authors described the relative frequencies of hazards, locations, and used correlational analysis to find associations between hazard classification (which used a risk-level classification chart) and hazard type/location. Analysis was also performed for associations between facility age and size and the amount of hazards identified, as well as hazards abated by the facility at the end of 2008.	The facilities identified and rated 7,642 hazards, with 5,834 (76.3%) of these abated at the end of the 2008. For risk level, 2% (133) of identified hazards were rated as critical, 27% (2,059) were serious, 23.4% (1,781) were moderate, 25.8% (1,965) were minor, 22.1% (1,688) were rated as negligible, and 16 hazards were not rated. Hazards were in multiple locations but the most common places were in bathrooms and bedrooms. The most common type of hazard was anchor points (used in hanging attempts because they could support the weight of a patient) and the second most common were	**Level of Evidence:** Level II B. **Worth to Practice:** The results of this study support the efficacy of the MHEOCC in identifying hazards and provide direction in mitigating hazards (e.g. systematic elimination of more prevalent, higher risk level hazards such as anchor points or risk assessments with greater emphasis on potential weapons). However, hazard data may differ at non-VA sites. **Strengths/Weakness:** Strengths include this study being the first to examine the implementation and effectiveness of using a standardized checklist for mental health units in a large health care system. It also produces reasonably consistent results, has sufficient sample size based on the study design and drawing fairly definitive conclusions from results. For limitations, authors note that it is still too early to say that MHEOCC usage will decrease patient injury and suicides, and that there is no current evidence on this. They also note that there is no evidence to show that the MHEOCC was being used correctly,

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	and 5 denoted critical risk necessitating immediate abatement) submitted by the MSIT from Fall 2007 to Fall 2008 at each mental health unit in the VA system where the MHEOCC was used to a national database maintained by the Center for Excellence located at the VA Medical Center in Canandaigua, New York. No conceptual framework noted.					materials that could be used as weapons. Suffocation (mostly commonly due to plastic liners in trash cans) and poisoning risks (mainly due to cleaning products) were some of the least most common hazards. Correlational analysis showed a positive relationship between facility age and amount of hazards identified but none between facility age and percentage of hazards abated by the end of 2008. There was a strong negative correlation between facility size (number of beds) and ratio of hazards identified per bed, but none between facility size and percentage of hazards abated. In terms of hazard types and risk level, anchor points had the greatest	which can yield and under- or over-identification of hazards, but the sheer number of hazards identified and consistency of results over a large healthcare system make this risk unlikely. Non-generalizable results are a weakness, since effects and hazard data generated may differ at non-VA hospital sites. Also, there is the lack of a control group, which is inherent in almost all studies evaluating suicide prevention measures due to ethical reasons. **Feasibility:** The MHEOCC can be implemented at any mental health unit depending on budget and organizational approval, but sustained effectiveness may vary/differ at non VA sites. Also using the checklist to conduct a hazard assessment every three months with subsequent abatement (quarterly review) needs human capital to sustain this, which may not be possible at all facilities. **Conclusions:** The MHEOCC is effective over a sustained period of time, and can be used to prevent suicide. But further research is needed to examine efficacy in decreasing suicide rates (especially in non-VA settings).

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						association with higher risk-level ratings and suffocation risks were second. For location and risk level, bedrooms has the greatest association with higher risk levels, with bathrooms second.	**Recommendation:** Recommend use of the MHEOCC to identify environmental hazards and use it to provide guidance in abatement of more commonly occurring, higher risk level hazards (e.g. greater emphasis on anchor points and potential weapons in environmental risk assessments, especially in bedrooms and bathrooms).

Definition of abbreviations: Mental Health Environment of Care Checklist (MHEOCC), Veterans Affairs (VA), Multidisciplinary Safety Inspection Team (MSIT)

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APA Reference: Mohl, A., Stulz, N., Martin, A., Eigenmann, F., Hepp, U., Husler, J., & Beer, J. H. (2012). The "suicide guard rail": A minimal structural intervention in hospitals reduces suicide jumps. *BMC Research Notes, 5*, 408. doi:10.1186/1756-0500-5-408							
To examine the effectiveness of a minimal structural intervention in preventing suicides by jumping at a Swiss teaching hospital.	Non-experimental research study to examine the intervention (a metal guard rail installed at each of the 1,240 hospital windows that mainly provided a psychological deterrent). Retrospective review of secondary data from police records and patient charts from the hospital from January 1995 to December 2010 was performed. No conceptual framework noted.	Sample consisted of police records and patient charts from the hospital from January 1995 to December 2010. Sample number not listed. The setting was a Swiss teaching hospital (the Cantonal Hospital in Baden).	IV: Review of police records and patient charts from the hospital. DV: Suicide jump data before and after installation of the minimal structural intervention.	Measurement of suicide jump data included counts of suicides via jumping out of hospital windows pre and post-implementation across all patient cases.	To analyze the difference in suicide jump counts before and after implementation, Chi-squared statistics was performed with control for the number of patient cases treated in the hospital and number of inpatient days pre and post-implementation of intervention.	In the 114 month pre-implementation period, 10 counts of suicide by jumping out of hospital windows happened among 119,269 inpatient cases and this was reduced to 2 counts among 104,435 cases in the 78 month post-implementation period. There was a statistically significant reduction of suicide jumps after implementation when the number of inpatient cases was controlled and statistical significance was almost reached when controlling for inpatient days.	**Level of Evidence:** Level III-B **Worth to Practice:** Results of this study provide support and guidance for the implementation of structural interventions in preventing suicide jumps among patients who not only suffer from mental health conditions, but general hospital patients with somatic disorders. **Strengths/Weakness:** Findings align with previous research demonstrating efficacy of structural interventions in reducing suicide jumps. Other strengths include that the study produced reasonably consistent results, made fairly definitive conclusions and recommendations. However, there is a lack of a control group, which may be due to ethical reasons and is common among nearly all similar suicide prevention studies. In addition, it is not known whether there were patients who simply postponed their suicide attempt until after discharge. **Feasibility:** This minimal structural intervention can be implemented in any high-rise facility with patients that

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							could potentially have suicidal ideation, but feasibility depends on the setting's financial resources and approval from organizational members. **Conclusions:** Even with minimal structural interventions, suicide jumps can be prevented among psychiatric patients in addition to general hospital patients with somatic diagnoses. However, further research is needed to determine the efficacy of minimal structural interventions in preventing suicide jumps. **Recommendation:** Use of minimal structural interventions are supported in preventing suicide jumps among psychiatric patients in addition to general hospital patients with somatic diagnoses. Recommend use of interventions such as the suicide guard rail in windows at any high-rise facility (with potentially suicide patients) to abate jumping-related suicide hazards.

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APA Reference: Watts, B. V., Shiner, B., Young-Xu, Y., & Mills, P. D. (2017). Sustained effectiveness of the Mental Health Environment of Care Checklist to decrease inpatient suicide. *Psychiatric Services*, *68*(4), 405–407. https://doi.org/10.1176/appi.ps.201600080							
To examine whether the effect of the MHEOCC) in decreasing suicide on VA inpatient mental health units is sustained.	Non-experimental research study. Retrospective review of secondary data. Relevant RCA reports from VA hospitals were identified (through "suicide" in the incident field or using PolyAnalyst 6 for key terms such as suicide in the report text) and reviewed to obtain the cases of completed suicides on inpatient mental health units from January 1999 to October 30,	Sample population consisted of RCA records of completed inpatient suicides on VA mental health units. Sample number not listed. Setting: 150 US Department of Veterans Affairs hospitals.	IV: Use of Mental Health Environment of Care Checklist (MHEOCC) and the passage of time during which it is used on VA inpatient mental health units. DV: Suicide rates on VA inpatient mental health units where the MHEOCC was implemented.	Measures for suicide rates included: 1) Rate of inpatient mental health suicide per 100,000 inpatient mental health admissions and 2) Rate of suicide per one million bed-days of inpatient mental health care. To evaluate whether the effect of the MHEOCC on inpatient suicides on mental health units was sustained.	Poisson maximized sequential probability ratio test (maxSPRT) approach to repeatedly test whether inpatient suicide rates during the continuation phase (2011-2015) were significantly higher than the reference rate (rate of inpatient suicide during implementation phase [2008-2010]).	Suicide rate on inpatient mental health units prior to the MHEOCC was 4.2 suicides per 100,000 admissions or 2.72 suicides per million bed-days of care. After implementation, the rates were 0.74 suicides per 100,000 admissions or 0.69 suicides per million bed-days of care. Use of the checklist was associated with a sustained reduction in the number of suicides over a period of greater than seven years. When initial implementation of the MHEOCC (2008–2010) is compared with the continuation period (2011–2015), it seems that the effect on suicides on VA	**Level of Evidence:** Level III B. **Worth to Practice:** The results of this study support the efficacy of the MHEOCC over a sustained period of time and offer guidance in increasing sustainability of mental health interventions (changes to physical environment or architecture are more likely to be sustained), since the MHEOCC involves physical changes to the care environment or architecture after hazards are identified. **Strengths/Weakness:** Strengths include reasonably consistent results, sufficient sample size based on the study design and drawing fairly definitive conclusions from results. Non-generalizable results are a weakness, since effects might differ at general, non-VA hospital sites. Also, there is the lack of a control group, which is inherent in almost all studies evaluating suicide prevention measures due to ethical reasons. **Feasibility:** The MHEOCC can be implemented at any mental health unit depending on budget and

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	2015 to examine impact of implementing the MHEOCC preimplementation (2001-2007), implementation (2008-2010) and continuation (2011-2015). Data on bed-days of care and number of mental health admissions were obtained for roughly the same period (2000-2015) through administrative data sets to determine suicide rates. No conceptual framework.					inpatient mental health units was not only sustained, but perhaps even enhanced. Except for 2012 when there was one inpatient suicide, there were no other suicides during the continuation phase. Inpatient suicide rates remained at levels equal to or lower than the rate during the implementation period. The trend suggests that the suicide rate continues to decline since implementation of the checklist.	organizational approval, but sustained effectiveness may vary/differ at non VA sites. **Conclusions:** The MHEOCC is effective over a sustained period of time, and can be used to prevent suicide. But further research is needed to examine efficacy in decreasing suicide rates (especially in non-VA settings). **Recommendation:** Recommend use of the MHEOCC to prevent suicide via identification of environmental hazards (alongside existing measures such as environmental safeguards, suicide risk assessment, etc.) and use it to offer guidance in increasing sustainability of mental health interventions (changing care environments after identifying hazards).

Definition of abbreviations: Mental Health Environment of Care Checklist (MHEOCC), Root Cause Analysis (RCA), Veterans Affairs (VA)

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APA Reference: Watts, B. V., Young-Xu, Y., Mills, P. D., DeRosier, J. M., Kemp, J., Shiner, B., & Duncan, W. E. (2012). Examination of the effectiveness of the Mental Health Environment of Care Checklist in reducing suicide on inpatient mental health units. *Archives of General Psychiatry, 69*(6), 588–592.							
To evaluate the effect of implementing a MHEOCC and its associated process of identification and abatement of environmental hazards on inpatient suicides in the VHA.	Non-experimental descriptive study. The effect of MHEOCC implementation (and the hazard abatement process associated with it) in VHA inpatient psychiatric units was examined by measuring change in suicide rate before and after the intervention. To obtain the cases of completed suicides on inpatient	Sample population consisted of RCAs of completed inpatient suicides on VHA mental health units. Sample number unspecified. The setting was all inpatient mental health units in VHA hospitals.	IV: Use of the MHEOCC on VHA inpatient mental health units. DV: Occurrence of suicides on VHA inpatient mental health units where the MHEOCC was implemented and hazard abatement was completed.	Measures for occurrences of suicides included: 1) Number of completed suicides 2) Rate of inpatient mental health suicide per 100,000 inpatient mental health admissions and 3) Rate of suicide per one million bed-days of inpatient mental health care.	Several approaches were used in statistical analysis. Segmented Poisson regression analysis of interrupted time series (which included all observed suicide rates from 46 quarters) to study change in suicide rates pre and post MHEOCC implementation and observe trends. The proportion of quarters with any suicide was studied using the Fisher exact test, then an exact logistic regression. The	22 suicides occurred prior to implementation (1999-2007) and 3 occurred after (2008-2011). Suicide rate was 2.64 per 100,000 inpatient mental health admissions before use and decreased to 0.87 afterwards. The rate of suicide was 2.08 per 1 million bed days before implementation of the MHEOCC, and it decreased to 0.79 after implementation. The exact logistic regression showed that implementation of the MHEOCC was associated with a significant 87% reduction in the likelihood of having a suicide occur in a quarter. Poisson regression analysis found a significant	**Level of Evidence:** Level III B. **Worth to Practice:** Study findings support the efficacy of the MHEOCC in decreasing inpatient suicide rates with subsequent identification and abatement of environmental hazards which can guide suicide prevention guidelines (as well as give direction on intervention development/implementation in this realm). **Strengths/Weakness:** Strengths include reasonably consistent results, drawing fairly definitive conclusions from results and implementing the intervention over a large healthcare system. A weakness is the lack of a control group, which is inherent in almost all studies evaluating suicide prevention measures due to ethical reasons. Another is non-generalizable results, since effects might differ at non-VHA hospital sites. **Feasibility:**.Barriers such as cost can impede implementation of the MHEOCC, and it remains to be seen whether such interventions can be

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	mental health units in the VHA database, all relevant RCA reports from VA hospitals between January 1, 1999 and March 31, 2011 were identified (through "suicide" or "suicide attempt" in the incident field or using PolyAnalyst natural language software for key terms such as suicide and self-harm in the report text) and manually reviewed. Data for number of admissions				Poisson distribution was used to study the number of suicide occurrences (because inpatient suicide happens rarely but has many opportunities to occur) as a rate (per 100,000 admissions or 1 million bed care days). Rate ratios (RRs) and 95% CIs were calculated to represent the strength of association between MHEOCC implementation and suicide rates.	decrease of 62% in suicide rates associated with MHEOCC implementation and a visible trend in decreasing suicide rates.	implemented outside the VHA. If barriers are addressed and organization approval is obtained, the MHEOCC can be implemented on any mental health unit but effects may vary/differ at non VHA sites. Also using the checklist to conduct a hazard assessment every three months with subsequent abatement needs human capital to sustain this, which may not be possible at all facilities. In addition, engineering personnel can forget about hazard abatement when making repairs, which can result in the undoing of hazards which were previously abated. **Conclusions:** Use of the checklist was associated with a significant decrease in inpatient suicide rates on VHA mental health units. Despite weaknesses/limitations, MHEOCC use successfully detected and mitigated hazards, which appear to have decreased suicides across a large healthcare system and authors advocate for considering its use in even non-VHA psychiatric units. **Recommendation:** The MHEOCC checklist appears to be an evidence-based intervention to prevent suicide by identifying and abating

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	and bed days per quarter from these units for the same time period were obtained from VHA administrative data sets to determine suicide rates. No conceptual framework noted.						environmental hazards, and it's use is recommended as such along with breakaway structures to abate the most commonly identified hazards found.

Definition of abbreviations: Mental Health Environment of Care Checklist (MHEOCC), Root Cause Analysis (RCA), Veterans Health Administration (VHA).