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Delirium and Mental Health History as Predictors of Aggression in Individuals with Dementia in Inpatient Settings

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Abstract

Objectives—Aggressive behaviors by patients with dementia present risk to healthcare workers and patients alike. An information processing model of aggressive behavior, developed to study aggressive behaviors among children, was applied to the study of aggression among older hospital patients with dementia. Hypotheses were that delirium and mental health history or depression history, respectively, would relate to increased risk of aggressive behaviors toward hospital staff.

Method—Electronic medical records were sampled for one year (N=5,008) and screened using the EMERSE search engine and hand review for dementia (n=505) and aggressive behavior in individuals with dementia (n=121). Records were reviewed for presence of a mental health history other than dementia and presence of delirium at the time of aggression.

Results—Results of stepwise logistic regression analyses were that interaction effects representing delirium and either mental health or depression history were associated with greater risk of aggressive behavior. Significant main effects were found for both dementia and mental health or depression history, respectively. Of the lowest risk group, 12% of patients exhibited aggression by comparison to 24%–35% of those with delirium, mental health or depression history, or the combination of these risk factors.

Conclusion—Primary findings were that delirium is the leading correlate of aggressive behaviors in hospitalized patients with dementia, and the effect of delirium or history of mental health diagnosis may lead to increased risk of aggressive behaviors in this setting. Results support the use of the information processing model of aggressive behaviors for studying aggression among patients with dementia.

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Author contributions to the manuscript: T. Wharton planned and led the study, supervised the data acquisition and analysis, and wrote the paper. D. Paulson performed data analyses, wrote the results section and part of the discussion session, and revised the manuscript. L. Macri wrote part of the introductory section and assisted in editing the paper. L. Dubin engaged in data collection and in editing the paper.

Keywords

Alzheimer's; Risk; Injury; Early Identification; Prevention

Incident rates of dementias in the United States are expected to nearly double by 2050. As prevalence of these diseases grows, the utilization of hospital and outpatient healthcare services rises concurrently, with some estimates predicting a 10-fold increase from the year 2000 in hospitalizations related to dementia (Zilberberg & Tjia, 2011). While debates regarding the appropriateness of aggressive medical care and overuse of hospital care permeate the literature, the healthcare system is faced with the pressures of accommodating the challenging needs of these patients. It is well documented that the unfamiliar environment of hospitals, the noise and activity, and the intrusions to personal space that come as a part of the experience may all lead to an escalation of disorientation, confusion, disruptive or combative behaviors, and potentially delirium in individuals with dementia. While it would perhaps be more straightforward to consider disruptive behaviors such as aggression as a single episodic event in these settings, it may be important to consider the histories of the individuals, particularly history of mental health diagnoses, as well as the presence of delirium in patients, as both of these have a documented correlation to combative behavior (Enmarker, Olsen, & Hellzen, 2011; Morgan et al., 2013; Rapoport et al., 2001). The ability to rapidly identify patients who may be more vulnerable to behavioral disruption in a hospital or emergency room setting could provide one more tool to proactively manage potential high risk events.

This paper provides insight into the demographics of a population of patients in a large midwestern hospital expressing aggression and begins to explore relationships between aggression and dementia, delirium, and history of mental health diagnoses. The study examined the electronic medical record for a sample of older adults with dementia who spent at least 24 clock hours in the hospital during an identified year. Incidents of aggression were identified and data regarding delirium states, mental health history, and demographics were examined for relationships. We begin by discussion of the literature regarding dementia and behavioral development, delirium, and theory.

Introduction and Literature Review

Available evidence suggests that 80–85% of all individuals with dementia will develop neuropsychiatric symptoms (NPS) of some kind (Van Dalen-Kok et al., 2015), and between 35–64% of these will develop aggressive or violent behaviors as a result of a complex interaction of internal and external factors (Enmarker et al., 2011; Morgan et al., 2013; Wharton & Ford, 2014). Aggressive incidents and other NPS among dementia patients in the hospital setting contribute significantly to the cost of care for patients (Beeri, Werner, Davidson, & Noy, 2002). The management of dementia and the prevention of aggression in the inpatient setting is critical for cost reasons as well as patient safety and outcomes, yet data regarding prevalence, related factors, and the cumulative effects of mental health history on dementia patients exhibiting aggression are lacking in the literature. There is evidence suggesting poorer nutrition, limited functioning and increased risk of delirium among these

patients, contributing to longer hospital stays and adverse patient outcomes (Gross et al., 2012; Mukadam & Sampson, 2011).

Aggression and Dementia

Aggressive behavior among individuals with dementia can take many forms, including both verbal and physical aggression, with many overlaps that make it difficult to tease out overtly aggressive behaviors from resisting or defensive behaviors (Cipriani, Vedovello, Nuti, & Di Fiorino, 2011). The concept of intention when considering violent or aggressive behavior in dementia patients is complicated, and requires consideration of the communicative and defensive nature of an individual's aggressive acts as it relates to their cognitive impairment (Bostrom, Squires, Mitchell, Sales, & Estabrooks, 2011; Graneheim, Hornsten, & Isaksson, 2012; VandeWeerd, Paveza, Walsh, & Corvin, 2013). Although there is a growing body of research regarding forms of aggression among dementia patients, Ryden's (1988) definition is the most commonly applied in the literature; this definition focuses on acts of physical and verbal assaultive behavior, including threats, hitting, kicking, or any other behavior that results in harming another person in violation of social norms (Cipriani et al., 2011). Different from agitation- defined as behaviors related to discomfort, pain, or to confusion, aggression among dementia patients is defined in this research study as physical action which results in, attempts to, or threatens physical contact, including hitting, kicking, biting, punching, pinching, shoving, grabbing and other threatening behaviors that can cause major, minor or no injuries, regardless of intent (Wharton & Ford, 2014).

A number of things have been correlated with dementia in the literature as triggers for aggressive behavior, including delirium, changes in the environment, unidentified needs, excessive noise or activity, and limited privacy or space- all common to the inpatient setting (Enmarker et al., 2011; Kunik et al., 2010; Paveza et al., 1992). Aggressive incidents can often be linked to challenges regarding communication issues or identifiable triggers (Wharton & Ford, 2014). Often, they are correlated with task oriented care such as washing, dressing, or grooming, specifically because it involves a high level of touch between caregiver and patient and can create feelings of discomfort (Enmarker et al., 2011; Hoeffler et al., 2006; Sloane et al., 2004).

Theoretical Framework: Information Processing Model for Development of Aggression

Numerous models of aggressive social behavior exist, though that described by Huesmann (1988) is a developmental model with particular applicability to the study of such behaviors among older adults with neurodegenerative disorders. At its most basic level, this model describes a process by which actors encounter and evaluate social situations, search for and evaluate social scripts based on both cognitive and affective cues, and either revise script selection or enact the behavior. Within this framework, prosocial solutions to social situations are viewed as less direct, more complex, requiring contemplation of future states, and therefore more cognitively demanding to produce. To our knowledge, this model has never been applied to the study of aggressive behaviors among older adults or among individuals with dementia, though clear implications for the enactment of aggressive

behaviors by those with impaired cognition are suggested by this theoretical framework. If prosocial behavior is grounded in the ability to identify and evaluate cognitive and affective cues, it is logical that individuals struggling within an impaired cognitive state would be unable to complete the tasks required appropriately, and would thus produce scripts for behaviors such as aggression in response to misunderstood cues or threats and an inability to contemplate future states.

Delirium, Dementia, & Aggression

Delirium is an acute medical condition that can manifest confusion, disorientation, bizarre or even aggressive behavior. Individuals with dementia are three times as likely as older adults without dementia to develop a delirium, and rates of delirium during hospitalization have been estimated at over 50% (Elie, Cole, Primeau, & Bellavance, 1998; Fick, Agostini, & Inouye, 2002; Gross et al., 2012; Inouye & Ferrucci, 2006). This condition is often brought on by infection of some kind, although polypharmacy or drug interaction may cause an incident of delirium (Fick et al., 2002). A strong link has been made between delirium and both one-year mortality rates and cognitive trajectory, as well as increased cost of care (Gross et al., 2012; Leslie & Inouye, 2011; Leslie, Marcantonio, Zhang, Leo-Summers, & Inouye, 2008). Although there are validated screening tools available, such as the Confusion Assessment Method (CAM), delirium is characterized by a hallmark rapid decline into confusion or disorientation (acute onset), and waxing and waning symptomatology. Overall, factors related to increased risk of delirium are advanced age, preexisting cognitive impairment, medications, substance abuse, severe psychological stress and aging patients in a frail state, with rates of delirium among the overall aging population who present in emergency departments estimated between 10 to 20% (Freter & Rockwood, 2004; Marcantonio, Flacker, Michaels, & Resnick, 2000; Smith & Brechtelsbauer, 2011).

In individuals with dementia, delirium further impairs reasoning and organization in general, and involves confusion related to sensory input from the surrounding environment, thus impairing social reasoning. Huesmann's (1988) theoretical framework posits that selection of an adaptive response to a social stressor requires recruitment of a complex network of prefrontal structures, including the dorsal mediofrontal cortex, lateral prefrontal areas, and anterior insula (Koban & Pourtois, 2014). These cortical areas are vulnerable to neurodegenerative processes associated with dementing disorders (Scahill, Schott, Stevens, Rossor & Fox, 2002; Maillet & Rajan, 2013), as are the white matter projections connecting them (Barber et al, 1999). This synthesis suggests that the social script retrieval process and the evaluation of candidate social scripts may be substantially impaired among older adults with comorbid dementia and delirium. Consistent with this hypothesis, Williamson et al. (2014) found that patients with delirium were 11 times more likely to be aggressive during their hospital stay when compared to the general hospital population. Although their findings examined all patients, rather than a more specific population such as individuals with dementia, it is instructive to consider that if impaired reasoning and interpretation of sensory input is related to such large increases in odds of aggressive behavior, than patients who have the additional cognitive burden of a dementia may be at an increased risk even from these high odds.

History of Mental Health Diagnosis, Dementia, and Aggression

Mental health factors beyond cognitive decline seem to play a role in the context of aggressive behaviors among individuals with dementia. Psychiatric syndromes such as anxiety or depression are more frequent among older adults in inpatient populations, and correlations between a history of mental health treatment and disruptive behavior in the inpatient setting are worth considering, given the currently available evidence. Huesmann's (1988) information processing model of aggression posits the role of mood states in the identification and subsequent enactment of social scripts (responsive behaviors to stimuli). Specifically, Huesmann suggested that overaroused children may over-attend to particular cues while ignoring other informative situational characteristics. In health services research, mood states are often characterized using mental health concepts of which mood and anxiety disorders are the most common. Of particular relevance to the present study is the consistent finding that, across the lifespan, anxiety and depressive symptomatology are both related to elevated threat perceptions (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007; Muris, Luermans, Merckelbach & Mayer, 2000). Consequently, healthy adults with major depressive or anxiety disorders appear less sensitive to positive information, both behaviorally and neurobiologically (van Tol et al, 2012).

Consistent with the application of this theoretical framework to older adults, premorbid mental health disorders and a history of aggressive behaviors have been linked with inpatient aggression (Enmarker et al., 2011; Orengo et al., 2008) although evidence suggests that this is not a requirement for the development of such behaviors in all dementia patients. Kunik et al. (2010) found that among a sample of dementia patients with no previous history of aggression or premorbid violence, 41% developed some form of aggressive behaviors over a two year time frame. O'Leary, Jyringi, and Sedler (2005) determined that patients with a history of conduct disorder who also experience some form of dementia are more likely to exhibit aggressive behaviors against caregivers. A study of 181 patients with dementia by Deutsch et al. (1991) found that psychotic delusions (from all causes) were the most often reported associated symptom and a significant predictor of aggression among their sample, but accounted for only 3.5% of variance in their predictive model. Menon et al.(2001) similarly found that depression is commonly associated with aggression among patients with dementia, but this association is not typically addressed in the context of the caregiving setting. O'Leary et al.'s (2005) research determined that among their 181 dementia patient sample, depression was significantly correlated with aggression against a care provider. Finally, Kunik et al.(2010) assessed for the combined effect of depression, pain and strained caregiver relationship on aggression, with the data showing a clear and significant increased risk for aggressive incidents with multiple factors present.

Examination of the proposed information processing model suggests that both delirium and mental health history may relate to the presence of aggressive behaviors toward caregivers by individuals with dementia. The mechanisms described within this framework further suggest that aggression risk may be further escalated by the overlap or co-occurrence of risk factors. Given the evidence supporting relationships between mental health diagnoses, delirium, dementia and aggressive behaviors, it is imperative to examine potential correlations with empirical data. Using electronic medical records (EMR) from a large

public hospital, we sampled older adults within a one-year time frame for the purpose of such analyses. Specifically, this study examines the hypotheses that delirium and dementia would independently (hypotheses 1A and B, respectively) and jointly (hypothesis 2) predict incidence of aggressive behaviors among hospital patients with Alzheimer's disease and other dementias.

Methods

EMRs were reviewed using the EMERSE search tool (Hanauer, Mei, Law, Khanna, & Zheng, 2015) to identify aggressive inpatient incidents among older adults with dementia. Of the 14,080 adults aged 60+ who spent at least 24 hours at the hospital during the one year study time frame, we examined the EMR of the first 4,000 patients and every 10th person through 14,080 who met these criteria (N=5,008). EMERSE (The Electronic Medical Record Search Engine) is a web based tool that was designed to search for patient specific information from the University of Michigan Clinical Data Repository (Hanauer et al., 2015). Using EMERSE, investigators can search keywords without having to review all documents manually. EMERSE generated a heat map of hits for each search term, and those were opened and read individually to identify positive or negative evidence of the search related terms. In this study, we searched for incidents of dementia and aggression in two independent searches, then used EMERSE to search within those groups to narrow results. We then examined the records (hits) manually for incidents of delirium or mental health related issues. Data were entered manually into an SPSS dataset. Data entry was done by the first and fourth authors, and random error checks were conducted throughout the process, where each would randomly select entries of the other and check the data in the medical record for accuracy.

To identify dementia in the record, a search was conducted using EMERSE for record notations of diagnosis, using a range of terms that might be used to identify any type of dementia; credible notations were defined as having been entered by a physician or provider qualified to provide such assessment, or noted as indicated by such a provider by any staff who identified a dementia diagnosis or a suspected dementia in the EMR during the year. Most records contained a notation in the record that the individual had a diagnosis of dementia; however, some records contained notations that there was a suspected diagnosis that could not be confirmed at the time of hospitalization. If the provider was qualified to provide such assessment, or the note indicated that the suspicion was by such a provider (such as a nurse recording instructions from an attending physician), this was recorded in the study database as "suspected." Although there are some limitations in this identification method, we are limited to the information contained in the medical records, and unfortunately, impairments such as dementia are not recorded reliably in intake records for the likely reason that patients do not present to the hospital for dementia- they present for acute illness or injury, and if the diagnosis is not coded correctly for a patient known to the system it may not automatically populate new intake forms; similarly, for new patients who have not been seen in the health system, identification of dementia may be through caregiver report or through collateral contact with other medical systems and entered by the physician providing care in the current instance as suspected or unconfirmed. Additionally, there were many incidents where an outpatient physician had indicated that there was a suspected

dementia, but further testing had not been conducted as of the time of the inpatient encounter; these were recorded in the study database as “suspected.” For the purposes of the analyses in this paper, cases with diagnoses and cases with suspected diagnoses were collapsed into a Yes/No category of dementia presence. The EMR search for dementia generated a sample of 505 older adults with diagnosed or suspected dementia (see Table 2), which is consistent with national estimates of approximately 10% of intaked hospital cases among older adults.

To identify delirium in the record, an EMERSE search was conducted for terms related to delirium; a search was also conducted for descriptions of rapid onset confusion or disorientation, and these records were assessed by two clinical research team members using criteria from the CAM (Inouye, 1998), based on symptom descriptions in the case notes if no explicit notation was present.

Aggression was searched for using EMERSE in the dataset of all older adults, rather than only those with dementia, to ensure that we did not miss incidents, and to provide a larger universe for the search. Identified records were compared to the dementia only dataset, to triangulate our identification of cases of dementia and aggression, although this did not add any additional cases. See Table 1 for search terms used to identify aggressive behaviors in the medical records.

To identify history of mental health diagnoses, a search string for EMERSE (see Table 1) was generated for any mental health diagnoses notated in the EMR within the past year. It became evident that using search terms related to mental health provider was more reliable than terms related to mental health diagnosis. Broad use of screeners using psychological related terms complicated the search results by reducing the specificity of findings, while searching for the provider returned results that narrowed to what we were looking for. For example, a search for depression returned a host of unrelated hits such as lists of screeners containing the term in instructions, however a search for psych* returned files that contained information related to psychiatry, psychology, or psychological related items or concerns, which narrowed the search considerably (see Table 1). Data extraction included anything identified in the record as psychologically related, including schizophreniform disorders, mood disorders and other Axis I disorders, and addiction disorders, for example. The larger category of mental health history includes all identified histories of any type, while the variable identifying depression was exclusive to mentions of depression or bipolar disorders anywhere in the year time frame of the EMR search.

The searches done with EMERSE were time limited to a one-year frame, and searches for diagnoses of dementia and mental health history scanned the entire year for any appropriate record as described above. It is possible that records were missed that should have been included but did not identify either of these things within the identified time frame snapshot of records, which would lead to an under-reporting of cases. Data used for analyses are from either the admission with most recent aggression or most recent admit within the time frame if no aggression occurred.

Results

Demographics for the sample are presented in Table 3. Patients who demonstrated aggression were similar to those who did not demonstrate aggression with respect to racial identification ($X^2=5.28$, $p=.26$), gender ($X^2=.69$, $p=.41$), and age ($t_{(df=503)}=.85$, $p=.40$). Records of those patients who exhibited aggressive behavior were more likely to indicate history of both mental health treatment ($X^2=11.41$, $p=.001$), and treatment for a mood disorder ($X^2=5.45$, $p=.02$).

The primary research questions were addressed using a pair of stepwise logistic regression analyses. In both analyses, demographic variables were entered in the first step (age, minority status, and gender) followed by either depression history or mental health history and delirium at most recent admit. The third step included the interaction of those two variables. The first stepwise logistic regression (see Table 4) examined the hypothesis that aggressive behavior would be predicted by the combination of depression history and delirium at most recent admit. Demographic variables were not significant predictors in the first step. In the second step, depression history emerged as a significant predictor ($B=-.54$, $SE=.23$, $Wald=5.62$, $p=.02$, $Exp(B)=1.72$). In the third step, aggressive behavior was significantly predicted by the interaction of depression history and delirium ($B=-.96$, $SE=.46$, $Wald=4.24$, $p=.04$, $Exp(B)=.39$). Significant main effects also existed for depression history ($B=1.10$, $SE=.36$, $Wald=9.42$, $p=.002$) and delirium at most recent admit ($B=.84$, $SE=.33$, $Wald=6.35$, $p=.01$, $Exp(B)=2.31$).

A similar pattern was observed when depression history was replaced with the broader category of mental health history. Demographic variables were not significantly predictive of aggressive behavior in the first step. In the second step, incidence of aggressive behavior was significantly predicted by mental health history ($B=.74$, $SE=.22$, $Wald=11.53$, $p=.001$, $Exp(B)=2.09$), but not by delirium at most recent admit ($B=.21$, $SE=.21$, $Wald=.94$, $p=.33$, $Exp(B)=1.23$). In the third step, incidence of aggressive behavior was predicted by the interaction of mental health history and delirium ($B=-1.16$, $SE=.44$, $Wald=6.96$, $p=.008$, $Exp(B)=.313$), and by the independent main effects of mental health history ($B=1.39$, $SE=.34$, $Wald=16.88$, $p<.001$, $Exp(B)=4.01$) and delirium at most recent admit ($B=.85$, $SE=.33$, $Wald=6.56$, $p=.01$, $Exp(B)=2.34$).

To help clarify the effect, the sample was split by depression history. Among people with no depression history, the relationship was significant whereby 12% of patients without delirium and 24% of those with delirium demonstrated aggression ($X^2=6.55$, $p=.01$). By contrast, among patients with histories of depression, 28% of those without and 26% of those with delirium demonstrated aggression; a negligible and non-significant relationship ($X^2=.15$, $p=.70$).

A similar effect emerged when the sample was split by mental health history. Among those without a mental health history, delirium increased the base rate of aggressive behavior from 12% to 24% ($X^2=6.70$, $p=.01$). Among patients with a mental health history, 35% without and 28% with delirium demonstrated aggressive behaviors ($X^2=1.20$, $p=.27$).

Discussion

The primary finding of this study is that dementia patients with either mental health treatment histories, or delirium, or both, were at increased risk for aggressive behaviors during their inpatient stay. Ten percent of the sampled records (n=505) had a diagnosed or suspected dementia noted. Approximately 25% (n=121) of these had reports of aggressive incidents in their medical record. Sixty-one percent (n=74) of aggression incidents occurred during delirium states. Demographic variables did not emerge as predictors of aggressive behaviors in this sample. Of critical relevance to the care of older adults in hospital settings, fewer than one-third of the known dementia patients were given cognitive screens to assess their current status. When aggressive behaviors appeared, less than half had a screener attempted to assess current status; if formal assessment of delirium occurred, it was not reliably documented in the EMR, despite documentation of either rapid decline into classic symptoms or a clinical observation and description of delirium.

Overall, these findings support the application of Huesmann's information processing model to the study of aggressive behaviors by older adults with dementia. It appears that delirium is the leading correlate of aggressive behaviors in hospitalized patients with dementia, and the effect of delirium or a history of mental health diagnosis such as depression or anxiety may lead to increased probability of aggressive behaviors in this setting. Interestingly, the combination of delirium and mental health history was not associated with significantly higher probability of aggressive behaviors than were either delirium or mental health history independently. This suggests that these risk factors may share the common mechanism described by the information processing model. Future research should seek to replicate these results and to further examine hypotheses derived from this model.

One challenge experienced by both clinicians working with older adults with dementia and researchers studying these populations is difficulty identifying comorbid delirium and moderate to severe dementia (Fick, Agostini, & Inouye, 2002; Inouye, Foreman, Mion, Katz, & Cooney, 2001). On the surface, these disorders share many characteristics including disorientation, confusion, memory impairment, and dysexecutive symptoms, and information provided by patients, family members, and formal caregivers often mischaracterizes symptom progression. These findings underscore the importance of routine delirium screening, particularly in this vulnerable population (Morandi et al., 2012).

The primary limitation of this study is related to the consistency of available related data in the electronic medical records. There are a number of factors that may contribute to the development of aggressive behaviors in individuals with dementia in this setting that we were unable to reliably capture in the dataset, including anticholinergic burden, Charlson index score, degree of cognitive impairment, possibility of hypoglycemia, pain levels, or presence of infection. As mentioned above, scores from cognitive screens were inconsistently reported; assessments of functioning from scales such as the Charlson comorbidity index, anticholinergic burden, or glycemic related issues were infrequent, and pain levels were rarely discussed in clinical summary notes. Pain is a well-established comorbid correlation to aggressive behaviors (Morgan et al., 2013). Although mentions of pain and need for medications for such were often present, and it generally appeared that

pain was adequately treated *in situ*, we were unable to identify a consistent means of distinguishing anything beyond presence or absence, and in the presence of acute onset confusion and disorientation, it was often unclear in the record whether medical staff felt that pain was real or perceived. Our data extraction attempted to collect information regarding infections and reasons for delirium states, but this was inconsistently reported in the EMR and we were reluctant to extrapolate from medication records on this point, although it would have theoretically been possible (for example, antibiotics would imply an infection); given the number of possible off-label reasons for prescribing it was inappropriate to make guesses at the intentions of such dosing unless explicitly recorded.

An additional shortcoming of the data is the unavailability of documentation regarding direct responses to aggressive behaviors, such as restraints, use of antipsychotic medications, or presence of sitters. Although we were able to identify whether medications were given while in the hospital, it was often unclear the temporal relationship between the prescriptions being written by the physician and the enactment of behavior (for example, some physicians may have written PRN orders for pain or other needs for most patients in a unit); additionally, records related to sitters and non-pharmacological interventions were recorded in paper files that were kept by floor nursing staff on each unit, and often were included only in summary form in discharge records, if at all, making direct relationships to behavior or dosing of medications impossible to assess. Although we were able to search a large number of records using EMERSE, time limits prevented us from examining the entire population of older adults during the identified year, and we cannot know what we might have found in a larger sample, although there is reason to believe that our sampled population is representative. Had it been available in a reliable format, inclusion of pain data, comorbid chronic disease data, and use of restraints, sitters, and other nonpharmacological interventions could have allowed for interesting insights.

Recent evidence suggests that low-cost, nonpharmacological interventions and hospital based programs such as the Hospital Elder Life Programs (HELP) may be the most effective intervention for managing disruptive behaviors and preventing delirium (Gitlin, Kales, & Lyketsos, 2012; Gitlin, Marx, Stanley, & Hodgson, 2015; Kales, Gitlin, & Lyketsos, 2014; Leslie & Inouye, 2011), and assessments for the presence of an existing mental health diagnosis or the current presence of a delirium are straightforward procedures that are done in intake settings, though inconsistently. Healthcare outcomes for this vulnerable patient population may be improved by the use of systematic and routine assessment for cognitive status. Additionally, clear benefits result from consistently training hospital staff in the use of nonpharmacological interventions for NPI symptoms of dementia, particularly given the poor evidence of psychopharmacological efficacy in this domain and the reality that pharmacological intervention for delirium is only cautiously recommended in this age group. These actions could subsequently reduce the incidence of aggressive behaviors in the inpatient setting and thus improve hospital safety for patients and staff. Other benefits may include reduced dependence on physical or chemical restraint of older adults, reduced costs for patient care of individuals exhibiting aggressive behaviors, and improvement of long-term patient outcomes that rely on evidence-based interventions.

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References

- Bar-Haim Y, Lamy D, Pergamin L, Bakermans-Kranenburg MJ, van Ijzendoorn M. Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin*. 2007; 133(1):1–24. [PubMed: 17201568]
- Barber R, Scheltens P, Gholkar A, Ballard C, McKeith I, Ince P, ... O'Brien J. White matter lesions on magnetic resonance imaging in dementia with Lewy bodies, Alzheimer's disease, vascular dementia, and normal aging. *Journal of Neurology, Neurosurgery & Psychiatry*. 1999; 67(1):66–72.
- Beeri M, Werner P, Davidson M, Noy S. The cost of behavioral and psychological symptoms of dementia (BPSD) in community dwelling Alzheimer's disease patients. *International Journal of Geriatric Psychiatry*. 2002; 17(5):403–408. DOI: 10.1002/gps.490 [PubMed: 11994927]
- Bostrom A, Squires J, Mitchell A, Sales A, Estabrooks C. Workplace aggression experienced by frontline staff in dementia care. *Journal of Clinical Nursing*. 2011; 21:1453–1465. DOI: 10.1111/j.1365-2702.2011.03924.x [PubMed: 22151034]
- Cipriani G, Vedovello M, Nuti A, Di Fiorino M. Aggressive behavior in patients with dementia: Correlates and management. *Geriatrics & Gerontology International*. 2011; 11(4):408–13. DOI: 10.1111/j.1447-0594.2011.00730.x [PubMed: 21843201]
- Deutsch LH, Bylsma FW, Rovner BW, Steele C, Folstein MF. Psychosis and physical aggression in probable Alzheimer's disease. *The American Journal of Psychiatry*. 1991; 148(9):1159–1163. DOI: 10.1176/ajp.148.9.1159 [PubMed: 1882992]
- Elie M, Cole M, Primeau F, Bellavance F. Delirium risk factors in elderly hospitalized patients. *Journal of General Internal Medicine*. 1998; 13(3):204–212. DOI: 10.1046/j.1525-1497.1998.00047.x [PubMed: 9541379]
- Enmarker I, Olsen R, Hellzen O. Management of person with dementia with aggressive and violent behaviour: A systematic literature review. *International Journal of Older People Nursing*. 2011; 6(2):153–62. DOI: 10.1111/j.1748-3743.2010.00235.x [PubMed: 21539720]
- Fick D, Agostini J, Inouye S. Delirium superimposed on dementia: A systematic review. *Journal of the American Geriatrics Society*. 2002; 50(10):1723–1732. DOI: 10.1046/j.1532-5415.2002.50468.x [PubMed: 12366629]
- Freter S, Rockwood K. Diagnosis and prevention of delirium in elderly people. *The Canadian Alzheimer Disease Review*. 2004; 6(2):4–9.
- Gitlin L, Kales H, Lyketsos C. Managing behavioral symptoms in dementia using nonpharmacologic approaches: An overview. *Journal of the American Medical Association*. 2012; 308(19):2020–2029. DOI: 10.1001/jama.2012.36918.Managing [PubMed: 23168825]
- Gitlin L, Marx K, Stanley I, Hodgson N. Translating evidence-based dementia caregiving interventions into practice: State-of-the-science and next steps. *The Gerontologist*. 2015; 55(2):210–226. DOI: 10.1093/geront/gnu123 [PubMed: 26035597]
- Graneheim U, Hornsten A, Isaksson U. Female caregivers' perceptions of reasons for violent behaviour among nursing home residents. *Journal of Psychiatric and Mental Health Nursing*. 2012; 19:154–161. DOI: 10.1111/j.1365-2850.2011.01768x [PubMed: 22070673]
- Gross AL, Jones R, Habtemariam D, Fong T, Tommet D, Quach L, ... Inouye S. Delirium and long-term cognitive trajectory among persons with dementia. *Archives of Internal Medicine*. 2012; 172(17):1. doi: 10.1001/archinternmed.2012.3203
- Hanauer D, Mei Q, Law J, Khanna R, Zheng K. Supporting information retrieval from electronic health records: A report of University of Michigan's nine-year experience in developing and using the Electronic Medical Record Search Engine (EMERSE). *Journal of Biomedical Informatics*. 2015; 55:290–300. DOI: 10.1016/j.jbi.2015.05.003 [PubMed: 25979153]
- Hoeffler B, Talerico KA, Rasin J, Mitchell CM, Stewart BJ, McKenzie D, ... Sloane PD. Assisting cognitively impaired nursing home residents with bathing: Effects of two bathing interventions on

- caregiving. *The Gerontologist*. 2006; 46(4):524–532. DOI: 10.1093/geront/46.4.524 [PubMed: 16921006]
- Huesmann LR. An information processing model for the development of aggression. *Aggressive Behavior*. 1988; 14:13–24.
- Inouye S. Delirium in hospitalized older patients: Recognition and risk factors. *Journal of Geriatric Psychiatry and Neurology*. 1998; 11:118–125. DOI: 10.1177/089198879801100302 [PubMed: 9894730]
- Inouye S, Ferrucci L. Elucidating the pathophysiology of delirium and the interrelationship of delirium and dementia. *The Journals of Gerontology. Series A, Biological Sciences & Medical Sciences*. 2006; 61(12):1277.doi: 10.1093/gerona/61.12.1277
- Inouye SK, Foreman MD, Mion LC, Katz KH, Cooney LM. Nurses' recognition of delirium and its symptoms. *Archives of Internal Medicine*. 2001; 161(20):2467–2473. [PubMed: 11700159]
- Kales H, Gitlin L, Lyketsos C. Management of neuropsychiatric symptoms of dementia in clinical settings: Recommendations from a multidisciplinary expert panel. *Journal of the American Geriatrics Society*. 2014; 62(4):762–769. DOI: 10.1111/jgs.12730 [PubMed: 24635665]
- Koban L, Pourtois G. Brain systems underlying the affective and social monitoring of actions: An integrative review. *Neuroscience & Biobehavioral Reviews*. 2014; 46(1):71–84. [PubMed: 24681006]
- Kunik M, Snow A, Davila J, Steele A, Balasubramanyam V, Doody R, ... Morgan R. Causes of aggressive behavior in patients with dementia. *Journal of Clinical Psychiatry*. 2010; 71(9):1145–1152. doi:0.4088/JCP.08m04703oli. [PubMed: 20361896]
- Leslie D, Inouye S. The importance of delirium: Economic and societal costs. *Journal of the American Geriatrics Society*. 2011; 59(Suppl 2):1–5. DOI: 10.1111/j.1532-5415.2011.03671.x [PubMed: 21226673]
- Leslie D, Marcantonio E, Zhang Y, Leo-Summers L, Inouye S. One-year health care costs associated with delirium in the elderly. *Archives of Internal Medicine*. 2008; 168(1):27–32. DOI: 10.1001/archinternmed.2007.4.One-Year [PubMed: 18195192]
- Maillet D, Rajah N. Association between prefrontal activity and volume change in prefrontal and medial temporal lobes in aging and dementia: A review. *Ageing Research Reviews*. 2013; 12(2): 479–489. [PubMed: 23183352]
- Marcantonio E, Flacker J, Michaels M, Resnick N. Delirium is independently associated with poor functional recovery after hip fracture. *Journal of the American Geriatrics Society*. 2000; 48(6): 618–624. DOI: 10.1111/j.1532-5415.2000.tb04718.x [PubMed: 10855596]
- Menon A, Gruber-Baldini A, Hebel JR, Kaup B, Loreck D, Zimmerman SI, ... Magaziner J. Relationship between aggressive behaviors and depression among nursing home residents with dementia. *International Journal of Geriatric Psychiatry*. 2001; 16:139–146. DOI: 10.1002/1099-1166 [PubMed: 11241718]
- Morandi A, McCurley J, Vasilevskis EE, Fick DM, Bellelli G, Lee P, ... MacLulich A. Tools to detect delirium superimposed on dementia: A systematic review. *Journal of the American Geriatrics Society*. 2012; 60(11):2005–2013. [PubMed: 23039270]
- Morgan R, Sail K, Snow AL, Davila J, Fouladi N, Kunik M. Modeling causes of aggressive behavior in patients with dementia. *The Gerontologist*. 2013; 53(5):738–47. DOI: 10.1093/geront/gns129 [PubMed: 23103521]
- Mukadam N, Sampson E. A systematic review of the prevalence, associations and outcomes of dementia in older general hospital inpatients. *International Psychogeriatrics*. 2011; 23(3):344–355. DOI: 10.1017/s1041610210001717 [PubMed: 20716393]
- Muris P, Luermans J, Merckelbach H, Mayer B. “Danger is lurking everywhere”. The relationship between anxiety and threat perception abnormalities in normal children. *Journal of Behavior Therapy and Experimental Psychiatry*. 2000; 31(2):123–136. [PubMed: 11132116]
- O’Leary D, Jyringi D, Sedler M. Childhood conduct problems, stages of Alzheimer’s disease, and physical aggression against caregivers. *International Journal of Geriatric Psychiatry*. 2005; 20:401–405. DOI: 10.1002/gps.1293 [PubMed: 15852459]

- Orengo C, Khan J, Kunik M, Snow AL, Morgan R, Steele A, ... Graham D. Aggression in individuals newly diagnosed with dementia. *American Journal of Alzheimer's Disease & Other Dementias*. 2008; 23(3):227–232. DOI: 10.1177/1533317507313373
- Paveza G, Cohen D, Eisdorfer C, Freels S, Semla T, Ashford J, ... Levy P. Severe family violence and Alzheimer's disease: Prevalence and risk factors. *The Gerontologist*. 1992; 32(4):493–497. DOI: 10.1093/geront/32.4.493 [PubMed: 1427252]
- Rapoport MJ, Van Reekum R, Freedman M, Streiner D, Simard M, Clarke D, ... Conn D. Relationship of psychosis to aggression, apathy and function in dementia. *International Journal of Geriatric Psychiatry*. 2001; 16(2):123–130. DOI: 10.1002/1099-1166(200102) [PubMed: 11241716]
- Ryden M. Aggressive behavior in persons with dementia living in the community. *The Alzheimers Disorder and Associated Disorders: International Journal*. 1988; 2(4):342–355. DOI: 10.1097/00002093-198802040-00003
- Scahill RI, Schott JM, Stevens JM, Rossor MN, Fox NC. Mapping the evolution of regional atrophy in Alzheimer's disease: Unbiased analysis of fluid-registered serial MRI. *Proceedings of the National Academy of Sciences*. 2002; 99(7):4703–4707.
- Sloane PD, Hoeffler B, Mitchell M, McKenzie D, Barrick L, Rader J, ... Koch GG. Effect of person-centered showering and the towel bath on bathing-associated aggression, agitation, and discomfort in nursing home residents with dementia: A randomized, controlled trial. *Journal of the American Geriatrics Society*. 2004; 52(11):1795–1804. DOI: 10.1111/j.1532-5415.2004.52501.x [PubMed: 15507054]
- Smith, D., Brechtelsbauer, D. *Textbook of Family Medicine*. 8. Philadelphia, PA: Saunders Elsevier; 2011. Delirium and dementia.
- Van Dalen-Kok A, Pieper M, de Waal M, Lukas A, Husebo B, Achterberg W. Association between pain, neuropsychiatric symptoms, and physical function in dementia: A systematic review and meta-analysis. *BMC Geriatrics*. 2015; 15(1)doi: 10.1186/s12877-015-0048-6
- van Tol M, Demenescu LR, van der Wee NJA, Kortekaas R, Marjan N, Den Boer JA, ... Veltman DJ. Functional magnetic resonance imaging correlates of emotional word encoding and recognition in depression and anxiety disorders. *Biological Psychiatry*. 2012; 71(7):593–602. [PubMed: 22206877]
- VandeWeerd C, Paveza G, Walsh M, Corvin J. Physical mistreatment in persons with Alzheimer's disease. *Journal of Aging Research*. 2013; :1–10. Epub Advan. DOI: 10.1155/2013/920324
- Wharton T, Ford B. What is known about dementia care recipient violence and aggression against caregivers? *Journal of Gerontological Social Work*. 2014; 57:460–477. DOI: 10.1080/01634372.2014.882466 [PubMed: 24593178]
- Williamson R, Lauricella K, Browning A, Tierney E, Chen J, Joseph S, Hamilton B. Patient factors associated with incidents of aggression in a general inpatient setting. *Journal of Clinical Nursing*. 2014; 23(7–8):1144–1152. DOI: 10.1111/jocn.12294 [PubMed: 24341873]
- Zilberberg M, Tjia J. Growth in dementia-associated hospitalization among the oldest old in the United States: Implications for ethical health services planning. *Archives of Internal Medicine*. 2011; 171(20):1850–1851. DOI: 10.1002/gps.2627.6 [PubMed: 22083572]

Table 1

Search Strings for EMERSE

	Search terms*	Exclusions
Aggression	violen * violent threat * punch * fight * slap inappropri * disinhibit * “need * restrain *” nonredirectable “non-redirectable” combative * combative “escalating physical contact” threaten hit aggress *	“aggressively managed” “HIT panel” “aggressive IV” “life threatening” “aggressive therapy” “aggressive treatment” “punch biopsy” “life threatening problem” “life-threatening problem” “aggressive hydration” “aggressive risk factor” “aggressive medical” “HIT assay” “ceiling punches” “aggressive anticoag *” “aggressive osseous” “fight infection” “aggressive diuresis” “aggressive bowel” “aggressive spirometry” “aggressive IS” “aggressive fluid” “aggressive appearing” “no blink to threat” “aggressive pulmonary” “threatening, please call 9-1-1”
Dementia	Alz “cog * impair *” Lewy AZ frontotemporal “fronto-temporal” Alzheimer * dement *	“no cognitive impairment” demential
Mental Health	psychotherapist therapist Psych Psychiatrist Psychiatry Geropsych Psychologist Psychology Neuropsych Neuropsychology “Social Work” “Social worker” “Substance Abuse” “Substance Use” “Alcoholics Anonymous” “AA” “A.A.” “Narcotics Anonymous” ^“NA” “^N.A.” “Couples therapy” Psychotherapy “Group therapy” Detox “Therapy group” Counseling Councilor “mental health” sad * depres * grief	

* After each search was run, heat map hit links to records were opened and read to identify positive or negative evidence of aggression, dementia, and/or mental health related documentation.

Table 2

Records Screened (1/31/2012 to 2/1/2013)

Total adults age 60+	14,080
Total sample of records screened	5,008
Total individuals with dementia in sample (diagnosed or suspected)	505

Table 3

Demographics

	Individuals w/dementia (N=505)	W/O aggressive behavior (N=384)	With aggressive behavior (N=121)	Comparison χ^2 or (t)
% of total records screened (N=5008)	10%	7.7% 76.0% of individuals w/dementia	2.4% 24% of individuals w/dementia	
Mean age at admission (range 60–89)	78	78.3 (SD=7.8)	77.6 (SD=7.8)	(.85)
Race				.83
Caucasian/White	80.4% (n=406)	81.2% (n=311)	78.5% (n=95)	
African-American/Black	12.5% (n=63)	11.7% (n=45)	14.9% (n=18)	
Hispanic/Latino/Asian/Other/Unknown	7% (n=35)	8% (n=7)	6.6% (n=8)	
% Female	52.9% (n=267)	53.9% (n=207)	49.6% (n=60)	.69
Delirium at most recent admission	52.3% (n=264)	51.0% (n=196)	56.2% (n=68)	.98
Depression history	35.6% (n=196)	38.6% (n=143)	51.4% (n=53)	5.45*
MH history of any kind	45.3% (n=229)	41.1% (n=158)	58.7% (n=71)	11.41**

*
 $p < .05$;**
 $p = .001$

Table 4

Results of a stepwise logistic regression predicting report of aggressive behavior based on delirium and either mental health history or depression.

Mental Health History and Delirium												
	Step 1				Step 2				Step 3			
	B	SE	Wald	Exp(B)	B	SE	Wald	Exp(B)	B	SE	Wald	Exp(B)
Age	-0.01	0.01	0.65	0.99	-0.01	0.01	0.16	0.99	-0.01	0.01	0.29	0.99
Minority	0.17	0.26	0.42	1.18	0.30	0.26	1.25	1.34	0.29	0.27	1.18	1.34
Gender	-0.17	0.21	0.68	0.84	-0.23	0.21	1.13	0.80	-0.23	2.10	1.14	0.80
MH History					0.74 *	0.22	11.53	2.09	1.39 *	0.34	16.88	4.01
Delirium					0.21	0.21	0.94	1.23	0.85 *	0.33	6.56	2.34
MH *Delirium									-1.16 *	0.44	6.96	0.31
Constant	-0.25	1.06	0.06	0.78	-1.15	1.10	1.09	0.32	-1.38	1.12	1.50	0.25
Depression and Delirium												
	Step 1				Step 2				Step 3			
	B	SE	Wald	Exp(B)	B	SE	Wald	Exp(B)	B	SE	Wald	Exp(B)
Age	0.00	0.02	0.04	1.00	0.00	0.02	0.00	1.00	0.00	0.02	0.01	1.00
Minority	0.09	0.28	0.10	1.09	0.19	0.29	0.46	1.21	0.18	0.29	0.40	1.20
Gender	-0.15	0.22	0.46	0.86	-0.20	0.23	0.80	0.82	-0.21	0.23	0.86	0.81
Depression					0.54 *	0.23	5.62	1.72	1.10 *	0.36	9.42	3.01
Delirium					0.36	0.23	2.52	1.44	0.84 *	0.33	6.35	2.31
Dep. * Delirium									-0.96 *	0.46	4.24	0.39
Constant	-0.98	1.16	0.73	0.37	-1.69	1.19	2.02	0.18	-1.80	1.21	2.22	0.17
* p<.05												

* $p < .05$