10 Delirium Prevention: Update on Multidisciplinary, Non-drug Prevention of Delirium Among Hospitalized Elderly

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10.1 Introduction

Delirium is a common complication of hospitalized elderly (Inouye et al. 2014). The risk factors for delirium are well understood by hospital care providers (Lee et al. 2013; Cohen and Klein 1958). The focus here will be on non-pharmacological interventions to prevent delirium in non-ICU medical patients for the following reasons: First, the largest patient population is in the general medical wards. Second, the complexity of multicomponent interventions (MCIs) makes them hard to measure since there are many moving parts and disciplines that are not focused on individual clinicians and which vary somewhat from study to study. Lastly, the data from different meta-analyses are not in agreement. Thus, the purpose of this paper is to help clinicians to conceptualize delirium based on risk factors for delirium and the basic principles of MCIs in a way that helps them as an individual clinician "do" their part of the MCI within a supportive hospital system (Bergmann 2005; Clegg et al. 2014).

10.2 Trials of Non-pharmacological Interventions to Prevent Delirium

The 2016 update of the 2007 Cochrane review includes a plethora of new studies assessing the efficacy of pharmacologic treatment and prevention of delirium mostly targeted at critically ill ICU, trauma, and surgery patients (Siddiqui et al. 2007). The review included five additional high-quality RCTs. The reviewers concluded that these seven studies in total provided "moderate quality" evidence for clinically significant effectiveness of multicomponent non-pharmacological interventions (MCI)

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to prevent delirium among the pooled sample of nearly 2000 mostly elderly non-ICU hospital inpatients shown in Table 10.1 (Abizanda et al. 2011; Bonaventura and Zanotti 2007; Hempenius et al. 2013; Jeffs et al. 2013; Lundstrom et al. 2007; Marcantonio et al. 2001; Martinez et al. 2012). The effect sizes of pooled studies of medical patients were slightly larger than for a separate analysis of 22 orthogeriatric hip fracture studies summarized in Table 10.2 (Siddiqui et al. 2007). Of note, the studies excluded dementia patients in whom the overwhelming risk for delirium could wash out more modest gains among cognitively intact patients.

A separate meta-analysis by Hshieh et al. included nonrandomized studies (NRT) if there was a control (synchronous or historical) or matched comparison group and

Table 10.1 Summary of non-pharmacological CTs

First author	Year	*N*=	Interventions	Outcomes
A. *RCTs selected for Cochrane analysis 9*				
Abizanda et al. (2011)	2011		1, 3, 7, 10	1, 7, 13
Bonaventura and Zanotti (2007)	2007		3, 4, 5, 6, 8	1, 6, 8
			10, 11	
Hempenius et al. (2013)	2013		1, 2, 4, 5, 8	1, 2, 4, 5, 10
			9, 10, 11, 13	14
			16, 17, 18, 19	
Jeffs et al.* (2013)	2013		4, 10	1, 2, 3, 5, 6
Lundstrom et al.* (2007)	2006		1, 2, 3, 8, 9	1, 3, 4, 5, 6, 9
			10, 11, 12, 13	11, 12
			14, 16, 19	
Marcantonio et al. (2001)	2001		1	1, 2, 3, 5, 6, 11, 13
Martinez et al.* (2012)	2012		3, 4, 5, 6	1, 3, 4, 6
B. *Studies included in JAMA analysis*17*				
Andro et al. (2012)	2012	256	4, 5, 8, 10	1
Babine et al. (2013)	2013	516	4, 5, 8, 10, 11	4
Bo et al. (2009)	2009	252	4, 8, 10, 11	1, 6
Bogardus et al. (2003)	2003	705	4, 5, 8, 10, 11	5
Caplan and Harper (2007)	2007	37	4, 5, 8	1, 4, 5, 6, 7, 8
Chen et al.** (2011)	2011	179	4, 10	1, 6, 7, 8
Holt et al. (2013)	2013	362	4, 5, 8, 10	1, 5, 6
Inouye et al. (1999)	1999	852	4, 5, 8, 10, 11	1, 6, 7, 8
Kratz (2008)	2008	137	4, 5, 8, 10, 11	1
Stenvall et al.** (2007)	2007	199	5, 10, 11	4, 6
Vidan et al. (2009)	2009	542	4, 5, 8, 10, 11	1, 6, 7

Interventions: 1. Individual care plan, 2. Check lists, protocols, 3. Staff education, 4. Reorientation, 5. Sensory deprivation, 6. Familiar objects, 7. Cognitive stimulation, 8. Nutrition, hydration, 9. Search for infection, 10. Mobilization, 11. Sleep hygiene, 12. Multidisciplinary team care, 13. CGA, 14. Oxygenation, 15. Electrolytes, 16. Pain, 17. Polypharmacy, medication review, 18. Mood, 19. Bowel and bladder

Outcomes reported: 1. Delirium incidence, 2. Delirium severity, 3. Delirium duration, 4. Falls, 5. DC to LTC/NH, 6. LOS, 7. Decreased ADL, 8. Decreased cognition, 9. Pressure ulcers, 10. Mental health, 11. Inpatient mortality, 12. 2-month mortality, 13. Medical complications, 14. Surgical complications

* Means this citation was included in the Cochrane (Siddiqui) meta-analysis

** Means this study was included in both the Cochrane (Siddiqui) and the JAMA (Hsieh) meta-analyses

Table 10.2 Meta-analysis of clinical trials of multicomponent interventions to prevent delirium in hospitalized elderly medical patients

	Cochrane 2016 review of RCTs $N = 7$[a]				JAMA 2015 review of NRTs $N = 11$[b]			
Outcomes	# Studies	# Subjects	RR	CI	# Studies	# Subjects	RR	CI
Incident delirium	**4**	**1365**	**0.63**	**0.43, 0.92**[c]	**11**	**2022**	**0.47**	**0.38, 0.58**[c]
LOS	3	1335	0.04	−0.44, 0.52	10	1820	−0.16	−0.97, 0.64
Cognitive decline	1	60	9.10	7.20, 11.00[c]	3	896	0.97	−0.46,2.41
Falls	**1**	**287**	**0.11**	**0.01, 2.03**	**4**	**519**	**0.38**	**0.25, 0.60**[c]
ADL decline	1	341	1.15	0.91, 1.47	4	524	0.57	−0.03, 1.18
Institutionalization	1	648	0.96	0.88, 1.06	4	619	0.95	0.71, 1.26
Citations								

[a]RCTs: Abizanda, Bonaventura, Hempenius, Jeffs, Lundstrom, Marcantonio, Martinez
[b]NRT: Bo, Caplan, Chen, Holt, Inouye, Jeffs, Martinez, Lundstrom, Vidan
[c]Statistically significant

the studies met other standard criteria of quality (Hshieh et al. 2015). Three of the Cochrane randomized studies were included among the 14 chosen for meta-analysis (Jeffs et al. 2013; Lundstrom et al. 2007; Martinez et al. 2012; Andro et al. 2012; Babine et al. 2013; Bo et al. 2009; Bogardus et al. 2003; Caplan and Harper 2007; Chen et al. 2011; Holt et al. 2013; Inouye et al. 1999). Table 10.1 lists the studies, the sample sizes, and the non-pharmacological multicomponent interventions (MCI) that were implemented and which outcome measures were reported for these two meta-analyses.

Table 10.2 shows the shared end points reported by RCTs and NRTs. All studies reported incidence of delirium, but they used different protocols for surveillance, as well as different validated assessment tools. The RCTs reported a pooled RR 0.69 (0.59–0.81) for incident delirium for MCI (Siddiqui et al. 2007). The NRTs reported a pooled RR 0.47 (0.38–0.58) reduction in incidence of delirium (Hshieh et al. 2015). Four RCTs considered the duration of delirium, and two recorded severity. Six of seven RCTs reported hospital length of stay, RR 0.01 (−0.48, 0.51). Five of 11 NRTs reported similar results, RR −0.16 (−0.97, 0.64). Three RCTs and no NRTs reported hospital mortality. Four RCTs and four NRTs reported changes in measures of functional status at discharge or at some later date. The confidence intervals indicated no statistical significance in the pooled analyses for reduction in functional impairment or, depending on the study, the degree of functional impairment or improvement at discharge.

Table 10.3 summarizes the findings of both analyses for outcomes of MCI. For comparison of effect sizes, the pooled results of pharmacological trials to prevent delirium among non-ICU medical patients were RR 0.73 (0.33, 1.59) among 916 patients treated with prophylactic antipsychotics (olanzapine and haloperidol) and RR 0.68 (0.17, 2.62) among 113 patients treated prophylactically with donepezil (Siddiqui et al. 2007). These results suggest that MCI may be as or more effective than drug prophylaxis in preventing delirium among medical inpatients.

Multicomponent non-pharmacological interventions can vary markedly from one another, and so pooling them to assess effectiveness as a general approach hides important differences among them. The analysts attempt to control for unmeasurable variability by using appropriate statistical adjustments. For example, LOS determinations were analyzed using random effects models to adjust for

Table 10.3 Meta-analysis of outcomes of multicomponent interventions (Cochrane review)

Outcome measure	Pooled *N*=	RR	CI
QOL: mental health	246	0.88	0.64, 1.20[a]
UTI incident	260	1.20	0.45, 3.20
Cardiovascular event	260	1.13	0.78, 1.65
12-month mortality	199	0.85	0.46, 1 .56[a]
Inpatient mortality	859	0.90	0.56, 1.43[a]
Pressure ulcers	457	0.48	0.26, 0.89
Falls	746	0.57	0.16, 2.01
Depression	149	0.70	−0.44, 1.84[a]
Return to indep living	1116	0.95	0.85, 1.06[a]
ADL performance	341	1.15	0.91, 1.47[a]
Cognitive status	30	9.10	7.20, 11.00[a]

[a]Attributable to severity of illness, frailty, and multimorbidity and unlikely to be affected by brief inpatient intervention

unmeasured and uncontrollable institutional variability in discharging practices (Siddiqui et al. 2007; Hshieh et al. 2015). It may be that each component within a bundled intervention might affect different specific outcomes. Alternatively it is difficult to determine whether bundled interventions are additive, multiplicative, or just redundant. It is methodologically almost impossible to tease out what component in a bundle made a difference vs. the entirety of the approach to care.

The components of non-pharmacological delirium prevention are directed to modifying known risk factors for delirium. The NICE working group proposed a streamlined list of risk factors: age over 65 years, cognitive impairment, hip fracture, and severe illness (Young et al. 2010). None of these risk factors can be modified. Other lists of risk factors include mixtures of patient, disease, and environmental factors. Risk factors for delirium include age; dementia; severity of illness; polypharmacy especially use of sedatives, hypnotics, and opiates; immobility as a manifestation of frailty; immobility due to the illness; and immobilization due to treatment. De facto restraints on movement include hospital equipment designed for maximization of caregiver efficiency such as electric adjustable height beds with rails, tables and portable equipment on wheels, and multiple non-integrated auditory alarms and sleep deprivation due to hospital routines. In the context of patient weakness, pain, sleep deprivation, and preexisting sensory deficits, environmental factors have been treated as fixed and not as risk factors to be ameliorated. However, this may be changing (Wong et al. 2014). Figure 10.1 organizes risk factors by whether they are intrinsic to the patient (host), the disease or injury that brought the patient to the hospital (agent), and the hospital environment. Arrows show possible pathways of host, agent, and environment feedback that result in delirium.

The classical epidemiological triangle presumes that disease is the result of a susceptible host encountering a virulent agent due to an environment or vector that brings them into contact. Prevention can happen at any accessible link in the system. By dividing the MCI model this way, it allows the clinician to conceptualize the items in the boxes as either “intrinsic” (host and agent) or “extrinsic” (hospital).

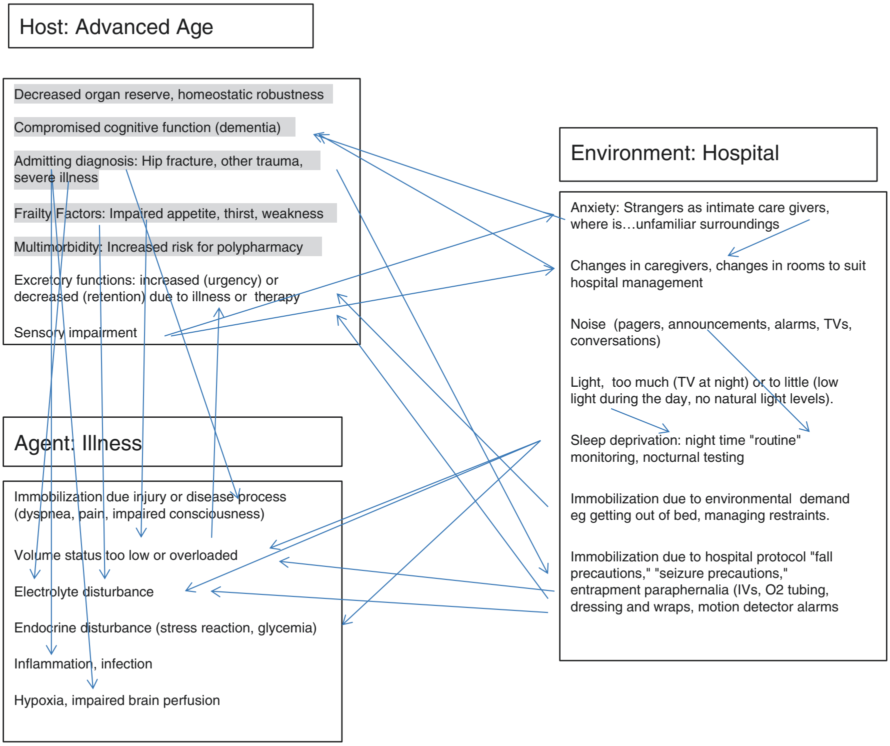

Fig. 10.1 Interaction of host, agent and environment in the etiology of hospital-acquired delirium in elderly medical inpatients

Rather than approach delirium as this overwhelming "multifactorial" complex situation, the clinicians can first focus on individual items as they can control. For example, a clinician can make sure that all the intrinsic items in "agent" are treated optimally. Next, the clinician can identify "extrinsic" items in "hospital" and then work with nursing staff and others to alleviate or fix these. By doing this, we can deconstruct delirium to identify what we can control and what we cannot. Host characteristics such as age, frailty, and cognitive impairment cannot be modified in the context of an acute hospitalization but drugs, changes in rooming and staffing, and intrusive monitoring can be (Otremba et al. 2016). Sensory deficits can be ameliorated by using hearing and visual aids. We can treat the illness and we can change the environment.

10.3 Why Are We Not Convinced?

The RCTs have been reasonably consistent in showing about a 30% reduction in incidence of delirium. But delirium researchers have confessed a certain amount of despair that this has not translated into improved longer-term outcomes with regard to functional status, cognitive status, and return to independent living. Teale and Young (Teale and Young 2015) concisely detailed the methodological difficulties in establishing the effectiveness of delirium prevention. The first difficulty is case identification. In addition to under ascertainment and biased ascertainment, even using standard diagnostic tools, single institution studies may not be comparable or representative of all cases. For example, hypoactive delirium is under diagnosed without intensive case finding (De and Wand 2015; Albrecht et al. 2015). Frailty must be measured in studies of delirium prevention. Measures of frailty are also not universally standardized though the phenotype is readily recognized (Malmstron et al. 2014; Theou et al. 2013). To study care processes is inherently more difficult than comparing a single intervention such as a drug. Studying a care process intervention such as MCI adds additional measurement problems. A case in point, the hip fracture studies vary by whether all hip fracture patients are geographically cohorted (Watne et al. 2014) or roomed throughout the hospital with standing order sets and MDT rounds (SteelFisher et al. 2013). Does it make any difference? To measure the dose of an MCI intervention in a geographically scattered sample is difficult, requiring extensive observation and documentation. Because a study protocol changes the routines of shifts of caregivers and therefore also affects the supervisors' job, maintaining consistency is difficult. Establishing a geographic unit is probably essential to program delivery, but the organizational barriers are high. A recent review by Inouye et al. into failures of HELP sites identified high-level leadership as the key to program survival and effectiveness (SteelFisher et al. 2013).

As shown in Table 10.3, well-done studies that investigated whether delirium prevention in the hospital improves outcomes weeks and months later report disappointing results, but that should not be taken on face value. Some delirium resolves promptly, some resolves never in life. How this relates to one episode of hospital care is not direct or obvious. Orthogeriatric units have been more widely adopted in Europe than in the USA. These units cohort elderly hip fracture patients for more consistent delivery of MCI. Table 10.4 summarizes the findings reported for the orthogeriatric units (Siddiqui et al. 2007). Both Tables 10.3 and 10.4 are inconclusive. The host and agent factors present from the start of care may not be easily changed and may be what explains post-hospital outcomes regardless of medical intervention. The further out from an acute illness, the more likely other factors are driving the outcomes. As argued by Teale and Young (Teale and Young 2015), long-term outcomes are more likely to be due to the disease and the underlying and unmeasured frailty of the host. The only study that specifically examined frailty as a risk factor, the original report on the HELP intervention in 1999, reported all of the substantial benefit in reduced incidence, and improved functional outcome was seen among the non-frail subjects (Bogardus et al. 2003).

Delirium is a sentinel event in the natural history of frailty. We presently have no effective interventions to reverse established frailty, so studies of delirium should upfront stratify patients using a validated assessment of premorbid frailty. There are numbers of assessment tools that have been validated and tested against one another (Malmstron et al. 2014; Theou et al. 2013). Frailty assessments can be completed with patients or by proxy in a few minutes. Looking again at Fig. 10.1, the known

Table 10.4 Outcomes of 22 geriatric units for the care of surgical/hip fracture patients

Outcome	RR	Confidence intervals
Delirium incidence	0.98	0.79–1.22
Delirium severity	1.50	−1.00–4.00
Delirium duration	−1.00	−2.04–0.04
Hospital LOS	**3.00**	**1.94–4.06**
Adverse events	0.96	0.76–1.23
Pressure ulcers	0.38	−6.10–1.41
Falls	1.30	0.61–2.77
Inpatient mortality	0.56	0.21–1.47
Care Home at 4 months	1.06	0.58–1.91
Care Home at 12 months	0.86	0.47–1.59
ADL decline at 4 months	1.00	−0.70–2.70
New dementia year	2.26	0.60–8.49

Abstracted from Siddiqui et al. 2016

risk factors for delirium are highly prevalent in frail patients even when they are not acutely ill. The essential features of frailty including weakness, falls, fatigue, and poor appetite make hospitals as usual riskier for frail patients. At the same time, hospitals are intensely risk averse. US hospitals do not routinely screen for delirium but they do screen all patients for fall risk (Lindquist and Sendelbach 2007; Corsovini et al. 2009). Since the risk factors are the same, it would seem no more difficult to identify "delirium-risk" patients on admission. Thus, high-risk patients can be preferentially assigned to specialized delirium nursing units, ACE (Acute Care of the Elderly) or GEM (Geriatric Evaluation and Management) units. Low-risk patients can be admitted to the general population and intermediate-risk patients, and the "vulnerable" elderly could be cohorted close to the ACE unit or managed by MCI teams with orders consistent with ACE protocols. This approach has been tried with some success but without the rigorous design required by meta-analytics (Avendano-Cespedes et al. 2016; Gentric et al. 2007; Tay and Chan 2013; Pitkala et al. 2008; Bakker et al. 2014; Flood et al. 2013).

10.4 If You Cannot Modify the Host, Modify the Environment

The idea of a specialized acute care of elderly hospital unit has been investigated as a way to bring to bear all findings of delirium studies and fall studies (Ahmed and Pearce 2010; Lafont et al. 2011). The essential character of an ACE that differentiates it from usual acute hospital units is that it superficially resembles a VA GEM rehabilitation unit, an inpatient mental health or other intermediate care unit. The critical components of an ACE unit, however, are that it is targeted to high medical acuity patients, those at highest risk for delirium and for falls. The multidisciplinary teams, usually led by a geriatrician, are not consultants. They are physically present and rounding on a geographically discreet unit of anywhere from 10 to 48 beds. There are formal rounds and the daily processes of care are unit based and nurse led. This has a significant impact on adherence to principles of care and may represent the best shot at maximizing the dose of environmental MDI (Fletcher et al. 2007). For example, the key requirement for early mobilization goes directly against some nurses' training to promote comfort and institutional pressure to enforce a "culture of safety." In a fascinating mixed-method study, Doherty-King and Bowers reported, "For all nurses, acutely ill patients are limited to bed mobility. Once physiologically stable, getting up to a chair or ambulation can be considered" (Doherty-King and Bowers 2010). They conclude that the cultural norm for hospital nurses does not consider mobilization to be part of routine care. Ambulation is considered a safety measure to prevent complications such as DVT and pressure ulcers, a way to monitor progress toward discharge and for compliance with doctors' orders. These investigators found that the best predictor of nurses' decisions about mobilizing patients had to do with unit expectations, the microculture of each nursing unit.

Ahmed et al. reviewed reports of ACE unit outcomes and found increased or neutral initial costs in five RCTs. Some have reported cost savings (Avendano-Cespedes et al. 2016; Flood et al. 2013). Outcomes of LOS and readmission were neutral or better; functional outcomes were neutral or better. These trials did not report on delirium outcomes. However, two (Covinsky et al. 1997; Counsell et al. 2000) of five RCTs reported increased caregiver job satisfaction. Studies with weaker designs have also reported this (Benedict et al. 2006; Palmer 2003; Flaherty et al. 2003). Few studies of ACE units have reported delirium outcomes. Several early studies varied but were generally positive (Flaherty et al. 2003; Allen et al. 2003; Aspelund et al. 2000). More recent studies report variable effect sizes. A study in Spain compared ACE to usual care and reported a parallel group $N = 50$ blinded prospective trial 27% reduction in delirium incidence (Avendano-Cespedes et al. 2016). A Swiss study reported a pre-post design study $N = 739$ with RR reduction of 73% overall and 66% among patients with dementia (Gentric et al. 2007). The underlying rates however were quite low in both groups, so these estimates are likely unstable. Bo et al. (2009) and Vidan et al. (2009) reported NRTs with results as shown in Table 10.2. Treating delirium in designated delirium units may be effective for improved immediate- and short-term results (Tay and Chan 2013; Pitkala et al. 2008). Studies show neutral or decreased cost of delirium care in several different health systems (SteelFisher et al. 2013; Lindquist and Sendelbach 2007; Corsovini et al. 2009; Avendano-Cespedes et al. 2016; Aspelund et al. 2000).

10.5 Where from Here?

Because of study design differences among the many published reports, it is difficult to pull out clear lessons, especially those that will be persuasive to hospital managers. Future studies should begin with routine assessment on admission for known delirium risk factors including validated measures of frailty. By correctly classifying hospitalized elderly as fit, vulnerable, or frail, that is, high, moderate, or low risk for delirium outcome, studies would then be able to stratify patients by risk level. This would accomplish two things. First, it would establish whether benefit from intervention is linked to risk that would permit better allocation of patients to designated units in practice. If MCI interventions can be standardized between sites, as was done with the HELP programs, pooled data would be more informative. We routinely risk stratify patients for adverse events in surgery, for tolerance of chemotherapy, for alcohol withdrawal, and for falls. In deciding how to apply these tools, we use published data, the evidence, to calculate patients' risk to benefit ratio of invasive or toxic treatments. Looking again at Fig. 10.1, the hospital environment is an agent of delirium. Redesigning environments and choosing different care protocols for high-, moderate-, and low-risk patients are really a decision about patient-centered vs. hospital-centered care.

Cui bono? If we have carefully conducted trials of stratifying patients on risk for delirium that cohorts high-risk patients in geographically designated ACE units, moderate-risk patients in step-down MCI care, and low-risk patients to the general hospital, we may discover which patients benefit and how much by which model of MCI. The usual metrics of hospital risk reduction can be applied. These include not only delirium but exacerbations of CHF, pneumonia, UTIs, falls, medical complications, LOS, readmissions, and discharges to long-term care. It would also permit tracking the metrics of patient satisfaction, family satisfaction, and staff satisfaction. Several studies have reported increased provider satisfaction (Covinsky et al. 1997; Counsell et al. 2000; Benedict et al. 2006; Palmer 2003; Flaherty et al. 2003) and on family and patient satisfaction with care (Covinsky et al. 1997; Counsell et al. 2000)

Healthcare organizations pay attention to satisfaction metrics (Lee et al. 2013). Healthcare organizations invest in staff development and training, and staff turnover is a metric of how well the management has built morale. Nurse retention depends not only on pay scales and accommodating schedules. Caregivers who feel membership on an expert team may be less likely to leave. Systems can be redesigned to change what is done physically to the patient, changes in the immediate sensory surround of the patient, and reorganizing the chains of communication so that care providers interact differently with each other to distribute care tasks (Tay and Chan 2013; Covinsky et al. 1997; Flaherty et al. 2003). This requires a top-down investment in implementation such as training, education, and sharing management decisions. It requires continuous self-monitoring within the work group. There must be structures for sustaining the culture (Tay and Chan 2013).

Modifying an entire hospital or floor or wing or cluster of beds to reduce the toxicity of a normal hospital floor will have necessarily a different effect than individualizing care that does not change the surround. Elements of environmental redesign include establishing normal diurnal activity and light levels. Noise reduction requires reengineering communication to eliminate overhead announcements, the content of which is mostly distressing. There are established guidelines for acceptable noise levels during the day. It is not just the decibels but also the quality of the sounds that require redesign. Soundproofing can muffle hallway conversation. Redesigning monitoring technology such as motion detectors, vital signs monitors and IV pump alarms would reduce alarm fatigue on the staff and noise pollution for the patients. Airplane style disposable headphones can eliminate the competition between TVs on different stations. By designing accommodations to facilitate direct line of sight observation for nursing staff, the impetus for restraints is reduced. Bundled protocols for mobilization, activities, feeding, and assessments require nurses and other caregivers to remember and change gears on a bed-by-bed basis. It would be difficult if not impossible to deliver each of these interventions to individual patients scattered throughout the hospital. Environmental interventions cannot be as effective on room-by-room basis. There is more likely to be inconsistent adherence which has been shown to be critical to effectiveness (Aspelund et al. 2000). The best known and evaluated program is the HELP, Hospital Elder Life Program. The HELP group has had the ability to implement the program in over 100 different hospitals and has the most extensive experience with how and when MCI works and when it fails. In all cases the key to sustaining delirium prevention programs is buy-in from hospital and nursing leadership and having physician champions visible daily on the floors (Wong et al. 2014).

10.6 Summary

This narrative review has drawn heavily on the best and most comprehensive analytic reviews of trials of MCI for delirium prevention and management over the past 25 years. There is cause for hope in that the methodologically strongest studies support a 30% reduction of incident delirium among hospitalized elders. However, there are great disparities in measures, outcomes, and interventions. The improvement in post-hospital outcomes has been more difficult to establish. As geriatricians we see the clustering of syndromes among the same types of patients who have been identified as frail. Frailty is at the core of risk factors for delirium, but we have no ways to reverse it. Using the metaphor of the epidemiologic triangle of host, agent, and environment, we can view the hospital as either the agent or the environment inducing delirium vulnerable elderly. With all the caveats about heterogeneity of studies, redesigned patient care practices and hospital environments appear to be effective in preventing delirium. These measures appear to be at least cost neutral and to improve patient, family, and staff morale. Future studies should stratify patients on delirium risk as a means to admit them to appropriate hospital units. If investigators can agree on a set of assessments and standardize environmental designs, we will have the means to conduct the multicenter trials that are needed to prove or disprove the value of specialized acute care of the elderly.

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