Supplementary Online Content

Mudge AM, McRae P, Banks M, et al. Effect of a ward-based program on hospital-associated complications and length of stay for older inpatients: the cluster randomized CHERISH trial. *JAMA Intern Med.* Published online January 10, 2022. doi:10.1001/jamainternmed.2021.7556

This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Process Measures Used to Understand Current Care and Inform Improvements on Intervention Wards
Measures were undertaken by the trained site facilitator, and written reports summarizing findings at ward level were prepared in collaboration with the expert facilitators and discussed at the multidisciplinary work group meetings to inform opportunities for improvement.

Measure and description	Comments
Semi-structured patient interviews with ten randomly selected older inpatients provided a mixture of quantitative and qualitative data[1]. Questions included the perceived importance of mobility, nutrition and cognitive and social engagement; whether they had received advice about these key principles from their clinical team; what made it easier and harder to engage in each of the key principles; and suggestions for local improvement.	This measure ensures that the older patient perspective is considered by the multidisciplinary work group. Quantitative data were summarized as proportions. Qualitative data were analyzed using content analysis to identify barriers and enablers to each principle, supported by illustrative patient quotes.
Mealtime audits of one breakfast, lunch and dinner on each ward within a two week period, observing all patients (of any age) who received a meal (excluded patients who were nil by mouth, on full enteral or parenteral nutrition, or absent from the ward) [2]. Observations included mealtime preparation (tray table in reach, patient position at time meal arrived), mealtime assistance (whether required assistance with meal set up and/of feeding occurred within10 minutes of meal arrival), mealtime interruptions, and visual estimation of proportion of meal eaten	Data were summarized as proportions across all meals and compared graphically between meals to identify local variations in practice which may inform opportunities for improvement. For example, if the audit showed high rates of medical interruption at breakfast then ward round times may require review; if there were low rates of assistance at lunch time then nursing meal breaks may require review. Interpretation of each ward's data relied on the tacit knowledge of the multidisciplinary work group.
Behavioral mapping during one daytime 8 hour period was undertaken to systematically observe the physical, cognitive and social activities of all patients (of any age) who were present on the ward for at least 50% of observations[3,4]. All patients in a room were observed for a 2-minute period before moving to the next room, and when all rooms had been observed the observations recommenced in the same room order. Depending on the ward layout, this provided 2-4 observations per patient per hour. A structured observation tool with a pre-defined hierarchy of activities (e.g. for physical activity: lie in bed, sit in bed, sit on edge of bed, sit in chair, stand, walk) was used to record the highest level of activity for each observation period for each patient.	Data were summarized as the proportion of observations at each level of activity averaged across all inpatients. Reflections on patterns of physical, cognitive and social activities can inform potential areas for improvement. For example, reviewing the proportion of time spent standing or walking compared to the time spent lying down might motivate staff to support more mobility activities; the proportion of time spent resting or sleeping during the day compared to time spent reading, talking, watching TV or playing games or puzzles might inform opportunities for more meaningful cognitive activities; and the time spent alone compared to with staff or visitors might inform review of visiting hours or family engagement opportunities.

1. Lee-Steere K, Liddle J, Mudge A, Bennett S, McRae P, Barrimore S. "You've got to keep moving, keep going": understanding older patients' experiences and perceptions of delirium and non-pharmacological delirium prevention strategies in the acute hospital setting. *J Clin Nurs.* 2020;29(13-14):2363-2377.

2. Young A, Allia A, Jolliffe L, et al. Assisted or Protected Mealtimes? Exploring the impact of hospital mealtime practices on meal intake. *J Adv Nurs.* 2016;72(7):1616-1625.

3. Mudge AM, McRae P, McHugh K, et al. Poor mobility in hospitalized adults of all ages. *J Hosp Med.* 2016;11(4):289-291.

4. Kuys S, Dolecka U, Guard A. Activity level of hospital medical inpatients: an observational study. *Arch Gerontol Geriatr.* 2012;55(2):417-421.

eTable 2. Program Logic

INPUTS	INTERVENTION COMPONENTS	PROGRAM GOALS	OUTCOMES
• Eat Walk Engage site facilitator (EWE-SF) trained and mentored by expert facilitator • Ward-based multidisciplinary work group (MDWG) • Structured interviews and care process measures • Trained Eat Walk Engage assistant (EWE-MPA)	Under guidance of the EWE-SF, the MDWG: • develops shared improvement goals pertaining to the key principles • identifies local barriers and enablers • clarifies team roles and identifies opportunities for improvement • initiates small cycle improvements with re-evaluation	Higher proportion of older patients achieve: • Early and adequate nutrition and hydration • Early mobility and independence • Meaningful cognitive and social engagement	Reduced hospital-associated complications (HAC-OP) ⇩ Reduced length of stay Reduced facility discharge Reduced 6 month readmission and mortality

eTable 3. Participant Characteristics by Ward
Ward I1 to I4 were intervention wards, and C1 to C4 were control wards.

Participant characteristics	I1 Medical n=61	I2 Orthopedic n=49	I3 Surgical n=86	I4 Respiratory n=69	C1 Medical n=94	C2 Respiratory n=49	C3 Surgical n=68	C4 Medical n=63
Age, mean (SD)	78.5 (8.5)	76.1 (6.7)	74.9 (6.6)	74.7 (7.0)	79.5 (7.9)	75.9 (7.0)	73.8 (6.9)	82.0 (8.5)
Female, No. (%)	28 (45.9)	17 (34.7)	40 (46.5)	39 (56.5)	50 (53.2)	23 (46.9)	34 (50.0)	38 (60.3)
Living in community, No. (%)	57 (93.4)	49 (100)	85 (98.8)	69 (100)	85 (90.4)	47 (95.9)	68 (100)	58 (92.1)
Elective admission, No. (%)	1 (1.6)	29 (59.2)	32 (37.2)	4 (5.8)	1 (1.1)	1 (2.0)	20 (29.4)	4 (6.3)
Surgical procedure, No. (%)	0 (0)	46 (93.9)	41 (47.7)	0 (0)	0 (0)	2 (4.9)	28 (41.2)	0 (0)
Frailty index, mean (SD)	0.28 (0.13)	0.15 (0.10)	0.21 (0.13)	0.26 (0.13)	0.31 (0.17)	0.21 (0.11)	0.21 (0.12)	0.38 (0.16)
Charlson comorbidity score, median (IQR)	2 (1,4)	1 (0,2)	2 (1,4)	2 (1,3)	2 (1,3)	3 (1,4)	2 (1,4)	2 (1,3)
Number of medications at admission, mean (SD)	8.0 (3.9)	5.5 (3.0)	5.6 (3.8)	9.8 (5.0)	9.5 (5.2)	7.4 (4.1)	6.0 (4.1)	8.7 (4.4)
Dependent in any basic ADL two weeks before admission, No. (%)	9 (14.8)	5 (10.2)	8 (9.3)	15 (21.7)	30 (31.9)	6 (12.2)	6 (8.8)	39 (61.9)
Dependent in any instrumental ADL two weeks prior to admission, No. (%)	48 (78.7)	21 (42.9)	55 (64.0)	47 (68.1)	73 (77.7)	27 (55.1)	39 (58.1)	55 (87.3)
Urinary incontinence two weeks before admission, No. (%)	20 (32.8)	9 (18.4)	11 (12.9)	22 (31.9)	16 (17.0)	5 (10.2)	11 (16.2)	21 (33.3)
Fecal incontinence two weeks before admission, No. (%)	14 (14.8)	2 (4.1)	8 (9.3)	9 (13.0)	14 (14.9)	0 (0)	5 (7.4)	20 (31.7)
Any hospital admission in past 6 months, No. (%)	26 (42.6)	17 (34.7)	38 (44.2)	32 (46.4)	47 (50.0)	23 (46.9)	35 (51.5)	32 (50.8)
Fall in past 6 months, No. (%)	34 (55.7)	17 (34.7)	17 (19.8)	20 (29.0)	49 (52.1)	12 (24.5)	19 (27.9)	34 (54.0)
Malnutrition risk (Malnutrition Screening Tool score 2 or more), No. (%)	28 (45.9)	7 (14.3)	34 (39.5)	27 (39.1)	42 (44.7)	18 (36.7)	29 (42.6)	32 (50.8)
SPMSQ score at admission, mean (SD)	6.7 (2.5)	9.4 (1.7)	8.3 (1.4)	8.3 (1.5)	6.5 (2.2)	9.2 (1.0)	8.1 (1.8)	5.9 (2.6)

eTable 4. Length of Stay Difference Between Intervention and Control Participants by Preplanned Subgroups
Estimated adjusted mean difference from Bayesian modelling of discharge, adjusted for hospital (cluster), age, gender, comorbidities, functional and cognitive status at admission and elective status. P values reported for interaction between intervention status and subgroup level.

Subgroup	Median LOS intervention (days)	Median LOS control (days)	Estimated adjusted mean difference (95% credible interval)	P for interaction
<75 years	6	7	-0.02 (-0.81 to 0.87)	*
75 years or older	6	7	0.39 (-0.44 to 1.30)	0.48
Non-frail	6	7	0.15 (-0.48 to 0.89)	*
Mildly frail	7	7	0.02 (-0.81 to 0.96)	0.33
Frail	7	7	-0.02 (-0.74 to 0.74)	0.68
Hospital 1	6	6	0.20 (-0.69 to 1.22)	*
Hospital 2	5	7	1.38 (0.05 to 3.12)	0.005
Hospital 3	6.5	7	-1.12 (-1.99 to -0.05)	0.40
Hospital 4	6	9	0.55 (-0.52 to 1.91)	0.09

eTable 5. Proportion of Intervention and Control Participants With Any of the Five Hospital-Associated Complications (HAC-OP), by Preplanned Subgroups

Adjusted odds ratios from logistic regression modelling adjusted for hospital (cluster), age, gender, comorbidities, functional and cognitive status at admission and elective status. P values reported for interaction between intervention status and subgroup level.

Subgroup	No. (%) with any HAC-OP in intervention group	No. (%) with any HAC-OP in control group	Adjusted OR (95% confidence interval)	P for interaction
<75 years	45 (36)	38 (40)	0.92 (0.53 to 1.59)	*
75 years or older	70 (57)	91 (59)	1.21 (0.74 to 2.01)	0.41
Non-frail	61 (41)	39 (35)	1.13 (0.69 to 1.84)	*
Mildly frail	34 (49)	48 (59)	0.90 (0.50 to 1.62)	0.50
Frail	20 (65)	42 (75)	1.32 (0.55 to 3.12)	0.75
Hospital 1	34 (62)	46 (55)	1.34 (0.70 to 2.57)	*
Hospital 2	20 (44)	8 (20)	1.18 (0.53 to 2.66)	0.81
Hospital 3	30 (38)	27 (43)	0.85 (0.47 to 1.54)	0.27
Hospital 4	31 (46)	48 (77)	1.07 (0.59 to 1.96)	0.59