Environmental Stressors and Biological Markers of Post-Hospital Syndrome: A Feasibility Study

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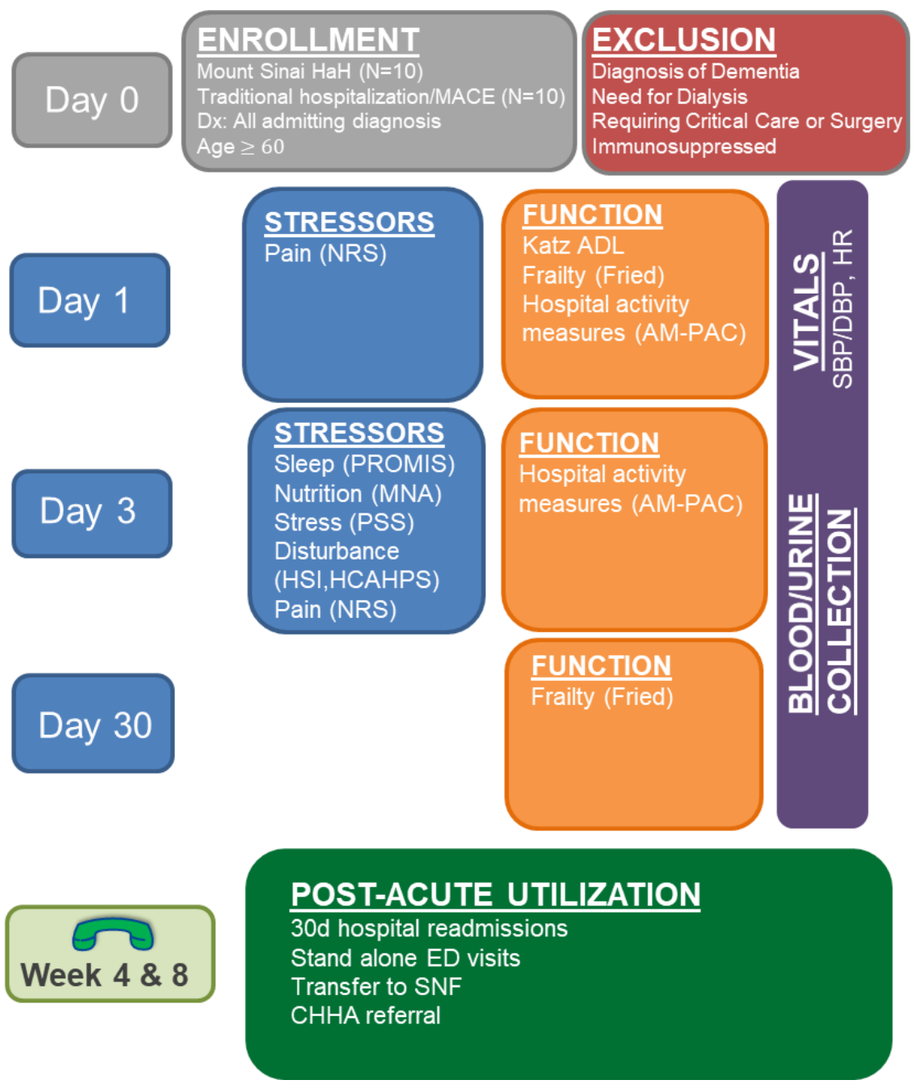
Background

- Post-Hospital Syndrome (PHS) in older adults is characterized by a transient period of heightened vulnerability to adverse outcomes (ED revisits, hospital readmissions, mortality) following hospitalization.
- We hypothesize that: (1) environmental stressors associated with hospitalization (sleep disruption, poor nutrition, mobility restrictions) are linked to biological mechanisms underlying PHS-associated vulnerability; and (2) dysfunction of stress-response systems such as the hypothalamic-pituitary-adrenal (HPA) axis, inflammatory, and metabolic systems are implicated in PHS-associated vulnerability.
- Hospital at home (HaH) provides comparable levels of care to traditional inpatient hospitalization but is associated with reduced lengths of stay, ED revisits, hospital readmissions, and admissions to skilled nursing facilities suggesting that treatment in the home environment may reduce PHS.
- We implemented a feasibility pilot comparing HaH vs traditional geriatric inpatient hospitalization (Mobile Acute Care for the Elderly/MACE), in order to evaluate differences in hospital-induced stress exposures and biological markers of stress.

Study Design



Candidate Biomarkers

Inflammation
CRP
IL-1b
IL-6
IL-8
IL-10
TNF-a
TNFR1

Gluconeogenesis & Catabolism
Glucose
BUN
Pre-albumin

HPA & ANS
Cortisol
Epinephrine
Norepinephrine

Thrombosis
Fibrinogen

Figure 1. In-person visits on hospital days 1 & 3 (Day 1 & 3) and 30 days after admission (Day 30) were made to evaluate functional status and environmental stressors and collect blood and urine samples. Phone calls at weeks 4 and 8 after admission were performed to track clinical outcomes.

NRS = Numeric Rating Scale
PROMIS = PROMIS Sleep Disturbance Survey
MNA = Nestle Mini Nutritional Assessment
PSS = Perceived Stress Scale
HSI = Hospital Stress Index
HCAHPS = Hospital Consumer Assessment of Health Care Providers and Systems

Results

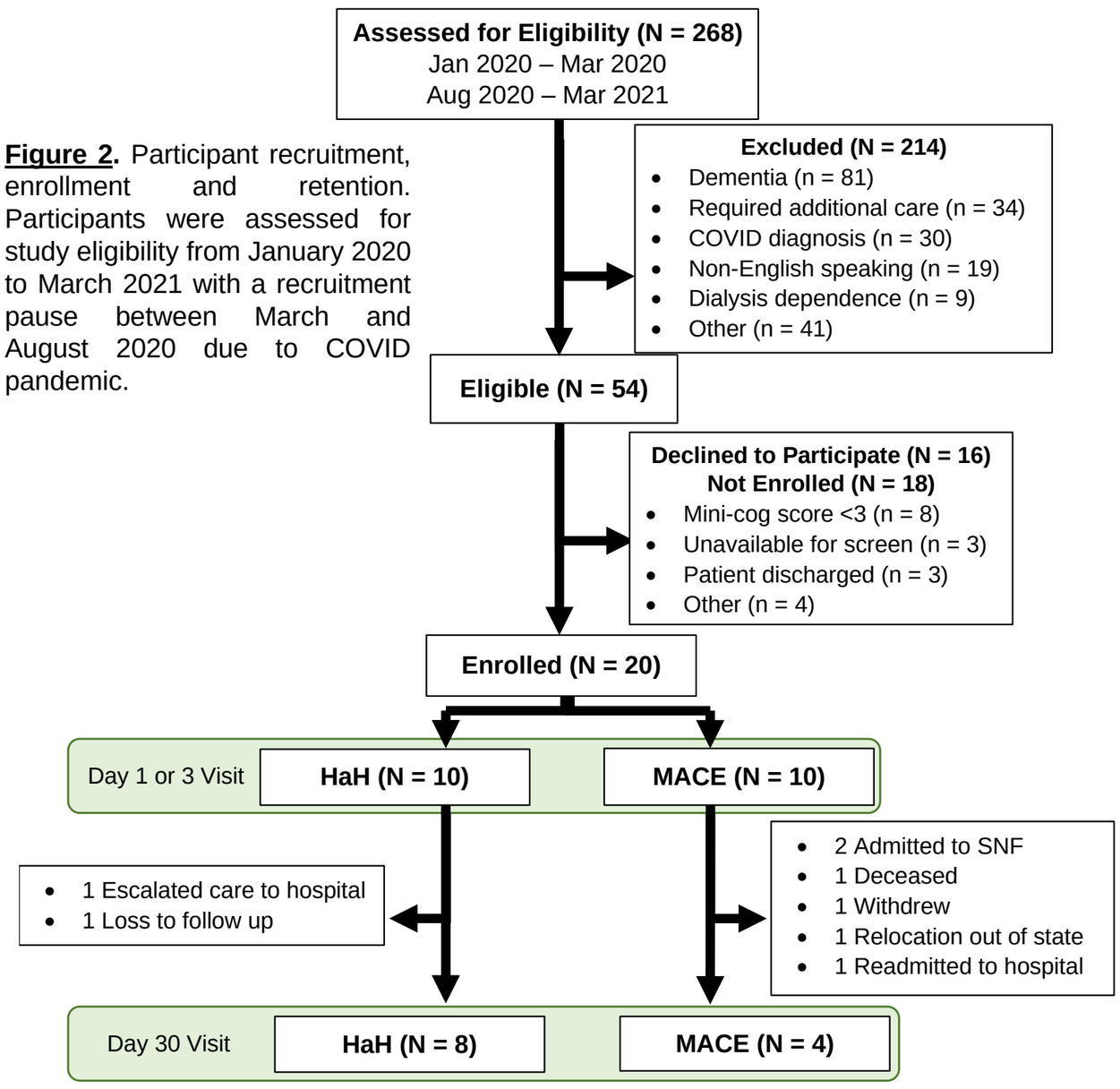


Figure 2. Participant recruitment, enrollment and retention. Participants were assessed for study eligibility from January 2020 to March 2021 with a recruitment pause between March and August 2020 due to COVID pandemic.

Feasibility

Determined by adherence of ≥80% of enrolled participants who were available to be approached (e.g. not deceased, admitted to skilled nursing facility, readmitted to hospital) in completing study procedures.

- 100% (19/19) completed a Day 1 or 3 visit
- 92% (12/13) completed a Day 30 visit
- 84% (16/19) completed a Day 1 or 3 blood collection

Biological Markers

Day 3 Serum Prealbumin Correlation

	Pearson Correlation	p
Changes in Meals	0.678	**0.031**
AMPAC Day 3	0.644	**0.045**

Table 4. Serum prealbumin level positively correlated with meal intake and mobility and transfer score on hospital day 3.

Sleep

		GROUP HaH (n = 9)	MACE (n = 8)	p
Sleep Disturbance Level	No sleep distress	7	4	**0.034**
	Mild sleep distress	2	0	
	Moderate sleep distress	0	4	
Disturbed by procedures	Unbothered by procedures	8	1	**0.003**
	Bothered by procedures	1	7	

Table 1. MACE patients were more likely to report sleep distress and being woken up in the middle of the night for procedures (e.g. check vitals, administer medications) between hospital days 1 and 3.

Nutrition

Changes in amount eaten		GROUP HaH (n = 9)	MACE (n = 8)	p
Meals and meal size	Less	2	4	0.074
	Same	6	1	
	More	1	3	
Dairy	Less	0	3	**0.023**
	Same	8	2	
	More	1	3	
Beans or eggs	Less	1	5	**0.027**
	Same	8	2	
	More	0	1	
Meat, fish, or poultry	Less	3	3	0.149
	Same	6	2	
	More	0	2	
Fruits or vegetables	Less	1	4	**0.025**
	Same	8	2	
	More	0	2	

Table 2. MACE patients were more likely to report nutritional intake changes in meals both in quantity and content between hospital days 1 and 3 compared to prehospitalization baseline.

Mobility and Transfer Ability

		N	Mean (Std. dev)	p
AMPAC Day 1	HaH	10	17.40 (6.275)	0.920
	MACE	9	17.11 (6.009)	
AMPAC Day 3	HaH	9	17.78 (6.888)	0.357
	MACE	8	14.50 (7.329)	
Day 1 to Day 3 Change	HaH	9	0.55 (1.42)	**0.012**
	MACE	7	-2.57 (2.82)	

Table 3. MACE patients reported decreased mobility and transfer (Activity Measure for Post Acute Care scores) between hospital days 1 and 3 compared to HaH patients.

Conclusion

- In this pilot study, HaH patients reported less sleep disturbance, fewer changes to nutritional intake, and retained mobility and transfer ability compared to patients that experienced traditional hospitalization.
- Serum prealbumin level on hospital day 3 may be a correlate of nutritional intake and biomarker of ambulatory and transfer ability.
- This pilot study demonstrates the feasibility of a larger, adequately powered trial to definitively quantify hospital-induced stress exposures and identify their effects on multisystem dysfunctions and impacts on PHS in vulnerable older adults.

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