MaineHealth

AI-supported Early Mobilization of Hospitalized Patients

A new approach to centralizing the right care at home

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Disclosures

Anant Vasudevan is a hospitalist at Brigham and Women's Hospital and is on faculty at Harvard Medical School.

Views expressed in this presentation by Anant are his own and are in his capacity at Radial only.

Learning objectives

1) Review the literature supporting the **benefits of home-based post-acute care** and the **impact of early mobilization**

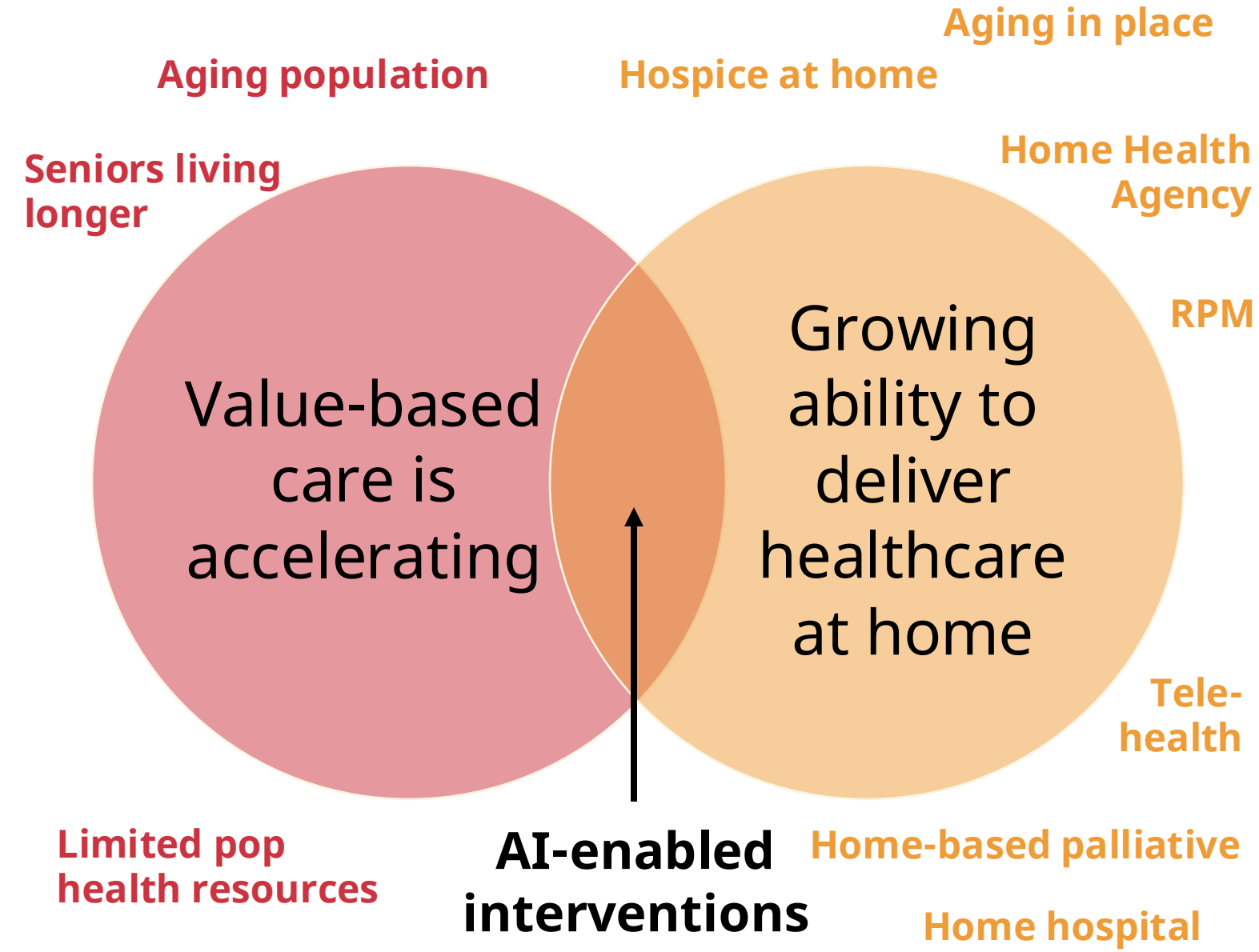
2) Discuss the **partnership between Radial and Maine Medical Center (MMC)**

How **AI tools can identify patients** appropriate for early mobilization

How **workflow innovations like MMC's enhanced PT pathway** can make early mobilization practical and effective

Background

Two trends, one solution?



Post-acute care at home can benefit the right patients

- For many common conditions, **seniors can achieve the same or better functional outcomes with homecare**[1,2,3]
- Facility post-acute care **may be unnecessary or even harmful** – secondary infections, delirium, venous thromboembolism[4]
- Readmissions data from home health vs. skilled nursing facility is mixed - however, key subpopulations including those with dementia show **similar readmission rates**[5,6]
- **Mortality rates are similar** at home vs. facilities[5,6]
- **Post-acute costs and costs within 60 days of admission are significantly lower with home health** vs. post-acute facility[5]



References:
1. Hutchinson AG, Gooden B, Lyons MC et al., Inpatient rehabilitation did not positively affect 6-month patient-reported outcomes after hip or knee arthroplasty. ANZ J Surg 88 (2018) 1056-1060
2. Huckfeld PJ et al., Less Intense Postacute Care, Better Outcomes For Enrollees In Medicare Advantage Than Those In Fee-For-Service. Health Affairs. 2017; 36(1): 91-100
3. Buhagiar MA, Naylor JM, Harris IA et al., Effect of Inpatient Rehabilitation vs a Monitored Home-Based Program on Mobility in Patients with TKA. JAMA. 2017;317(10):1037-1046.
4. Levinson DR. DHHS OIG Report "Adverse Events in Skilled Nurse Facilities: National Incidence Among Medicare Beneficiaries". 2014.
5. Werner RM, Coe NB, Qi M, Konetzka RT. Patient Outcomes After Hospital Discharge to Home With Home Health Care vs to a Skilled Nursing Facility. JAMA Intern Med. 2019 May 1;179(5):617-623. doi: 10.1001/jamainternmed.2018.7998. PMID: 30855652; PMCID: PMC6503560.
6. Burke RE, Xu Y, Ritter AZ, Werner RM. Postacute care outcomes in home health or skilled nursing facilities in patients with a diagnosis of dementia. Health Serv Res. 2022 Jun;57(3):497-504. doi: 10.1111/1475-6773.13855. Epub 2021 Aug 12. PMID: 34389982; PMCID: PMC9108056.

Mobilized inpatients are more likely to discharge home

- Zhang, et al. (2019)
  - RCTs comprising 2,308 critically ill patients who took part in early mobilization efforts
  - **Discharge to home rates increased in 7 of these RCTs** (RR 1.16, p = 0.046)
- Bergbower, et al. (2019)
  - Prospective, single site study focused on general medicine patients
  - Implemented a multidisciplinary mobility bundle
  - **Discharge to rehabilitation facility inversely associated with use of bundle** (p = 0.001)



References:
1. Zhang L, Hu W, Cai Z, Liu J, Wu J, et al. (2019) Early mobilization of critically ill patients in the intensive care unit: A systematic review and meta-analysis. PLOS ONE 14(10): e0223185. https://doi.org/10.1371/journal.pone.0223185
2. Emily Anne Smith Bergbower, Cole Herbst, Nan Cheng, Alexander Aversano, Katherine Pasqualini, Cierra Hartline, Devorah Hamby-Finkelstein, Colin Brewer, Stephen Benko & Joseph Fuscaldo (2020) A novel early mobility bundle improves length of stay and rates of readmission among hospitalized general medicine patients, Journal of Community Hospital Internal Medicine Perspectives, 10:5, 419-425

Early mobilization

A common story



- 82-year-old was hospitalized for mild heart failure exacerbation
- Nurses and PTs recognized the importance of early mobilization to maintain her functional status
- Competing priorities posed challenges:
  - **Nurse workload:** One RN was managing care for 5+ patients
  - **PT focus:** Therapists were tasked with prioritizing discharge evaluations over early mobilization
  - **Service demands:** Urgent higher-acuity patients took priority
- Outcome:
  - Patient **progressively became deconditioned**
  - **Developed pneumonia** by day 7
  - Expected hospital stay of 4 days **was extended to 10 days**
  - She **required discharge to a skilled nursing facility**

Question: Could we have improved this outcome by using a solution to help RNs/PTs prioritize the right patients for mobilization at the right time?

What is early mobilization?

*"...the practice of **initiating movement and physical activity as soon as medically appropriate**, typically within 24–48 hours of hospitalization or surgery, to prevent complications, promote recovery, and improve patient outcomes."*

References:
1. Schweickert WD, Pohlman MC, Pohlman AS, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial. Lancet. 2009;373(9678):1874-1882. doi:10.1016/S0140-6736(09)60658-9

Benefits of early mobilization

In addition to higher likelihood of home discharge, early mobilization has other benefits:

- **Physical health**
  - Improved functional outcomes and enhanced recovery at steady state[1,2,3,4,5]
  - Reduced risk of deconditioning[1], venous thromboembolism[4], hospital-acquired pneumonia[5]
- **Clinical-operational benefits:**
  - Reduced inpatient length of stay[2,6]
  - Reduction in 30-day readmission rates[6]
- Improves **emotional and social well-being** of hospitalized patients[7]

References:
1. Zhang L, Hu W, Cai Z, Liu J, Wu J, et al. (2019) Early mobilization of critically ill patients in the intensive care unit: A systematic review and meta-analysis. PLOS ONE 14(10): e0223185. https://doi.org/10.1371/journal.pone.0223185
2. Schaller SJ, Anstey M, Blobner M, et al. Early, goal-directed mobilisation in the surgical intensive care unit: a randomised controlled trial. Lancet. 2016;388(10052):1377-1388. doi:10.1016/S0140-6736(16)31637-3
3. Schweickert WD, Pohlman MC, Pohlman AS, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial. Lancet. 2009;373(9678):1874-1882. doi:10.1016/S0140-6736(09)60658-9
4. Pashikanti, Lavanya MSN, RN; Von Ah, Diane PhD, RN. Impact of Early Mobilization Protocol on the Medical-Surgical Inpatient Population: An Integrated Review of Literature. Clinical Nurse Specialist 26(2):p 87-94, March/April 2012. | DOI: 10.1097/NUR.0b013e31824590e6
5. Stolbrink M, McGowan L, Saman H, Nguyen T, Knightly R, Sharpe J, Reilly H, Jones S, Turner AM. The Early Mobility Bundle: a simple enhancement of therapy which may reduce incidence of hospital-acquired pneumonia and length of hospital stay. J Hosp Infect. 2014 Sep;88(1):34-9. doi: 10.1016/j.jhin.2014.05.006. Epub 2014 Jun 20. PMID: 25063011.
6. Bergbower, E. A. S., Herbst, C., Cheng, N., Aversano, A., Pasqualini, K., Hartline, C., ... Fuscaldo, J. (2020). A novel early mobility bundle improves length of stay and rates of readmission among hospitalized general medicine patients. *Journal of Community Hospital Internal Medicine Perspectives*, *10*(5), 419–425. https://doi.org/10.1080/20009666.2020.1801373
7. Kalisch BJ, Lee S, Dabney BW. Outcomes of inpatient mobilization: a literature review. J Clin Nurs. 2014 Jun;23(11-12):1486-501. doi: 10.1111/jocn.12315. Epub 2013 Sep 13. PMID: 24028657.

Risks of early mobilization

Paton, et al. (2023)

- **Majority of studies/RCTs have shown the benefits previously mentioned**
- In a review of 15 RCTs from 11 countries with 2,703 patients:
  - Improved physical function as shown by patient-reported outcome measures
  - No significant change in hospitalization rates
  - Secondary outcomes of adverse events (defined as O_2 desaturation, cardiac arrhythmia, hemodynamic instability, falls, dislodgement of attachments) possibly increased
  - Limitations: Authors acknowledge that only 5 of 15 RCTs sufficiently measured adverse events, results were possibly skewed by a single 750-patient study, 6-month outcomes are subject to survivor bias especially in patients with critical illness

References:
Paton M, Chan S, Tipping CJ, Stratton A, Serpa Neto A, Lane R, Young PJ, Romero L, Broadley T, Hodgson CL. The Effect of Mobilization at 6 Months after Critical Illness - Meta-Analysis. NEJM Evid. 2023 Feb;2(2):EVIDoa2200234. doi: 10.1056/EVIDoa2200234. Epub 2022 Dec 20. PMID: 38320036.

Barriers to mobilizing patients



Recent study employed the Patient Mobilization Attitudes and Beliefs Survey:

- Surveyed 568 inpatient PT, OT, RNs in 8 hospitals of varying sizes across 2 states
- **Top 5 perceived barriers to mobilization** of hospital patients:
  - **Inadequate time** to mobilize all patients
  - Lack of understanding of **when and how to refer to therapy** staff
  - Inadequate knowledge on **when it is safe** to mobilize patients
  - Low confidence in **ability to mobilize** patients
  - Lack of training on **methods of safe mobilization**

References:
1. Crooks E, Rampley T, Weeks DL, Billings C, Stengem D, Rangel T. Perceived Barriers to Patient Mobilization Among Therapy and Nursing Acute Care Staff: A Multi-Site Survey Study. Arch Phys Med Rehabil. 2024 Feb;105(2):243-250. doi: 10.1016/j.apmr.2023.06.018. Epub 2023 Jul 9. PMID: 37429536.

Barriers to mobilizing patients

Other studies noted the following:

- Unsurprisingly, training in mobilization was **highly correlated with confidence**[1]
- **PTs report more training and more confidence** in mobilization as compared with other disciplines[1]
- In multiple studies, **RNs expressed less comfort** than PTs with mobilization[1,2]
- **Patient/family resistance** to mobilization in the hospital[1,3]



References:
1. Hoyer EH, Brotman DJ, Chan KS, Needham DM. Barriers to early mobility of hospitalized general medicine patients: survey development and results. Am J Phys Med Rehabil. 2015 Apr;94(4):304-12. doi: 10.1097/PHM.0000000000000185. PMID: 25133615; PMCID: PMC4344426.
2. Crooks E, Rampley T, Weeks DL, Billings C, Stengem D, Rangel T. Perceived Barriers to Patient Mobilization Among Therapy and Nursing Acute Care Staff: A Multi-Site Survey Study. Arch Phys Med Rehabil. 2024 Feb;105(2):243-250. doi: 10.1016/j.apmr.2023.06.018. Epub 2023 Jul 9. PMID: 37429536.
3. Adsett JA, McRae PJ, Mudge AM. Staff-Perceived Barriers to Patient Mobilization Vary by Hospital, Discipline, and Experience: A Multisite Cross-Sectional Survey. Arch Phys Med Rehabil. 2024 Sep 26:S0003-9993(24)01254-1. doi: 10.1016/j.apmr.2024.09.004. Epub ahead of print. PMID: 39332514.

Elements of successful early mobilization programs



- **Multidisciplinary collaboration**, particularly between RN, PT, and OT
- **Processes and algorithms** to promote early and regular mobility
- **Role-delineated protocols** that provides mechanisms for team members to question orders such as “bed rest”
- **Accurate monitoring and documentation**

Key limitation:
Lack of a standard geriatric-specific guideline for promoting mobility

Reference:
Smart DA, Dermody G, Coronado ME, Wilson M. Mobility Programs for the Hospitalized Older Adult: A Scoping Review. Gerontol Geriatr Med. 2018 Nov 1;4:2333721418808146. doi: 10.1177/2333721418808146. PMID: 30450367; PMCID: PMC6236485.

The path forward

- **Standardize the identification** of inpatients appropriate for early mobilization
- **Leverage an objective approach to prioritize patients** appropriate for early mobilization
- Facilitate **multidisciplinary workflows to identify which patients**:
    - **Can** be mobilized by an RN
    - **Need** a PT eval and/or intervention
    - **Could benefit** from a focused, intense PT plan such as the Enhanced PT Initiative at MMC

Key point: Could an AI-supported solution accomplish these goals?



Introducing Radial

Radial

National Institutes of Health

National Science Foundation

Right patient, right care, right time

- Next-generation **decision support to centralize more of the right care in the home**
- Integrates **a variety of data sources**
- Provides **longitudinal context**
- Facilitates **real-time decision support**
- Translates statistical insights into plain language that can **drive multidisciplinary consensus**
- Enables **more timely care coordination**

AI-driven decision support to centralize care at home

SDOH
focused interventions for social risk

Placement
reduce excess SNF/IRF stays

Readmissions
readmissions avoidance

Palliative
timely referrals to palliative care



SNF LOS
optimize SNF length of stay

Hospice
optimize hospice utilization

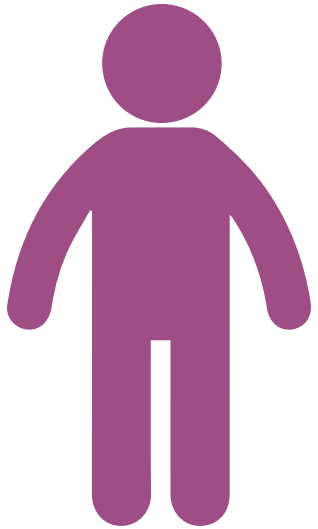
SNF 3DW
identify patients for SNF 3-day waiver

Placement: AI-supported risk stratification for next site of care

Radial automatically identifies these patients on hospital day one



“No uncertainty”
Skilled Nursing Facility
Inpatient Rehab



“On the border”
At risk of unnecessary facility-based post-acute stay



“No uncertainty”
Home with Skilled Nursing and/or PT services

Placement: AI-supported risk stratification for next site of care

Result: **safely shift discharge dispositions in favor of homecare, reducing readmissions, hospital length of stay, and total cost of care**



“No uncertainty”
Skilled Nursing Facility
Inpatient Rehab



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“No uncertainty”
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Key data inputs

Clinical	Functional	Social
• Reason for current hospitalization • Recent ED visits and hospital stays • Recent stays at facility-based rehab • Outpatient/office visits • Readmissions including source	• Durable Medical Equipment • Age and frailty scores • Long-duration hospital stays • Musculoskeletal hospitalizations • Evidence of decline in function	• Housing instability • Medicaid eligibility • Lives at nursing home • Cognitive impairment • Member uses ED instead of PCP

… and many more (these are representative examples)

Data sources

Claims



Outpatient
Primary care
Specialist
Retail clinic
ED
Inpatient
Post-acute
Pharmacy
DME

Epic



Real-time data

SDOH



ADI
CDC/ATSDR
SVI
Z-codes

Introducing MaineHealth

MaineHealth Maine Medical Center



By Medic454 - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=50203371

- MaineHealth is an **8-hospital health system** serving Maine and parts of New Hampshire
- **MaineHealth Maine Medical Center** has recently consolidated sites in Portland, Biddeford, and Sanford
- 900 beds ranging from community hospital to tertiary referral center and **the only Level One Trauma Center in the State of Maine**
- Maine Medical Center is **part of MaineHealth ACO, which covers 300,000 members**

Clinical-operational goals at MMC

Priorities

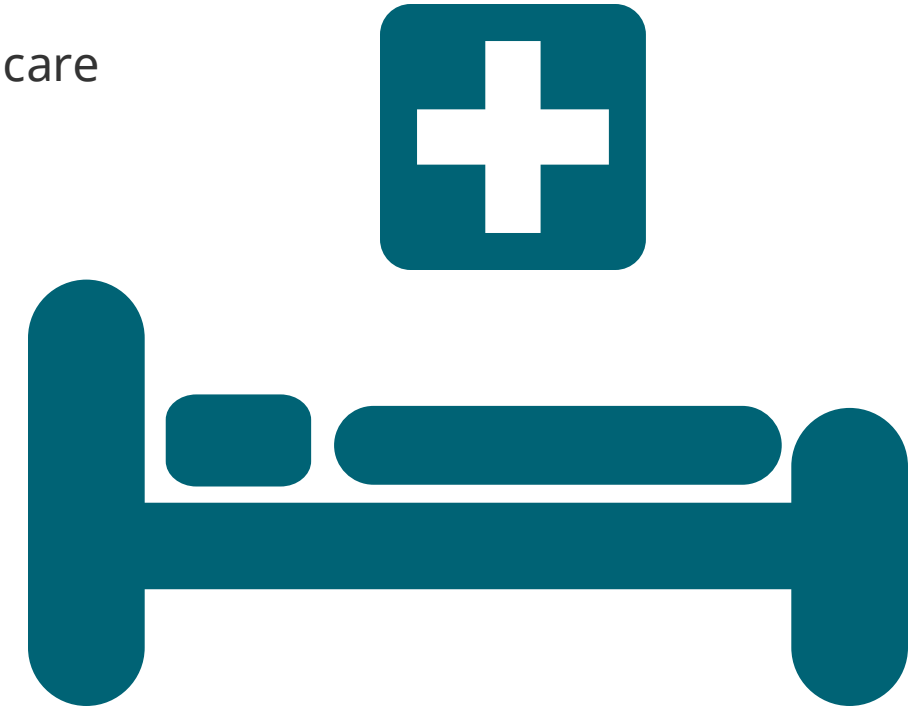
- **Reduce** inpatient length of stay
- **Improve** throughput of patients
- **Strive for continuous improvement** of inpatient quality of care
  - **Increased mobilization** of patients
  - **Reduced readmissions**

Challenges

- **Highly constrained** post-acute rehabilitation bed availability
- **Limited rehabilitation staff** for Enhanced Therapy Program
- **Multiple competing priorities** within Care Management

Improved early mobilization is a common thread

- **Enhancing early mobilization addresses multiple MMC priorities:**
  - Reduce in-hospital falls, avoid development of pressure injuries
  - Shorten hospital length of stay
  - Reduce avoidable discharges to facility-based post-acute care
  - Improve success in the home setting



Early mobilization at MMC

Current approach to early mobilization at MMC



Nursing has embraced mobilization for **all** our patients, to the extent that is possible



Nursing staff collaborates with Therapy Team to **develop and implement mobility goals for all patients**



Mobility goals are KPIs on multiple nursing units

Workflow innovation: Enhanced Therapy Pathway

Initially developed during pandemic, when discharge to post-acute rehabilitation was next to impossible

Identifies patients who could be appropriate for more intensive Therapy intervention in the inpatient setting

Goal is to provide adequate OT/PT in the inpatient setting to get patients home, rather than to rehab facilities

As service capacity is constrained, generally utilized for patients with barriers to being accepted at SNFs

Future Directions
Potential to expand ETP capacity, in collaboration with our Rehabilitation Partners



Radial x Maine Medical Center collaboration

- Underlying questions:
  - **Can an AI tool prioritize more of the right candidates for early mobilization?**
  - Can an AI-based tool **identify these candidates early enough** that discharge planning teams can review them close to the start of a hospitalization?
  - Can an AI-supported approach **improve hospital throughput, centralize more of the right care at home, and improve quality of care**?



Design of MMC x Radial collaboration

Care Management



Secure chat

Inpatient Care Team

Primary Radial user

RN case manager, hospitalist, PT/OT, RN Director

Reflections on Placement decision support module



Pre-implementation awareness was key for care management, nursing, provider, and therapy teams



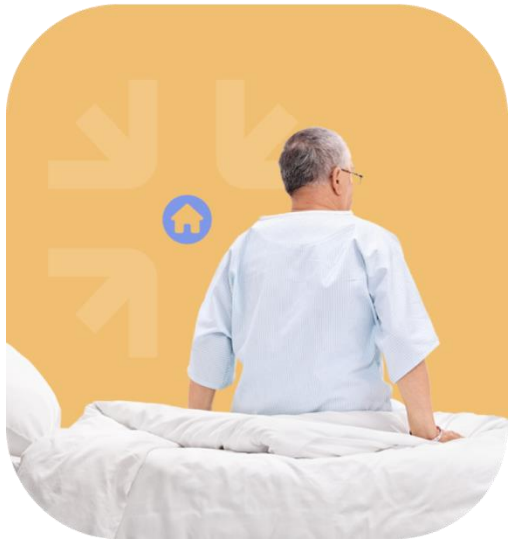
Radial Placement recommendations have been well received by the clinical teams



Actionable patients are identified for both early mobilization and consideration for Enhanced Therapy Pathway

Case study #1: reinforcing home-first care plan

- 94-year-old man hospitalized after an episode of unresponsiveness
- He presented to the emergency department at MMC from home
- Last hospital stay was 1 year ago for seizure; history of cardiovascular disease
- Flagged on Day 1 by Placement as “on the border” with the following insights:
  - Patient is a potential candidate for home discharge
  - Most recent admission resulted in discharge home with no 30-day readmission
  - This is the patient's first hospitalization in over a year
- Review of his utilization history in Placement shows that he follows up consistently with his PCP and various specialists



Successful early mobilization and discharge to home

- User collaborated with inpatient team to reinforce plan of care for home discharge and encourage early mobilization soon after patient was prioritized by Radial Placement
- Neurology subsequently determined that the unresponsiveness was due to a seizure
- Electrophysiologist evaluated the patient for consideration of pacer for sick sinus syndrome
- OT recommended discharge home with skilled services
- The patient was discharged home with home health services on day 4 with no readmission

Result: successful early mobilization, successful discharge home with services, short hospital length of stay, no readmission

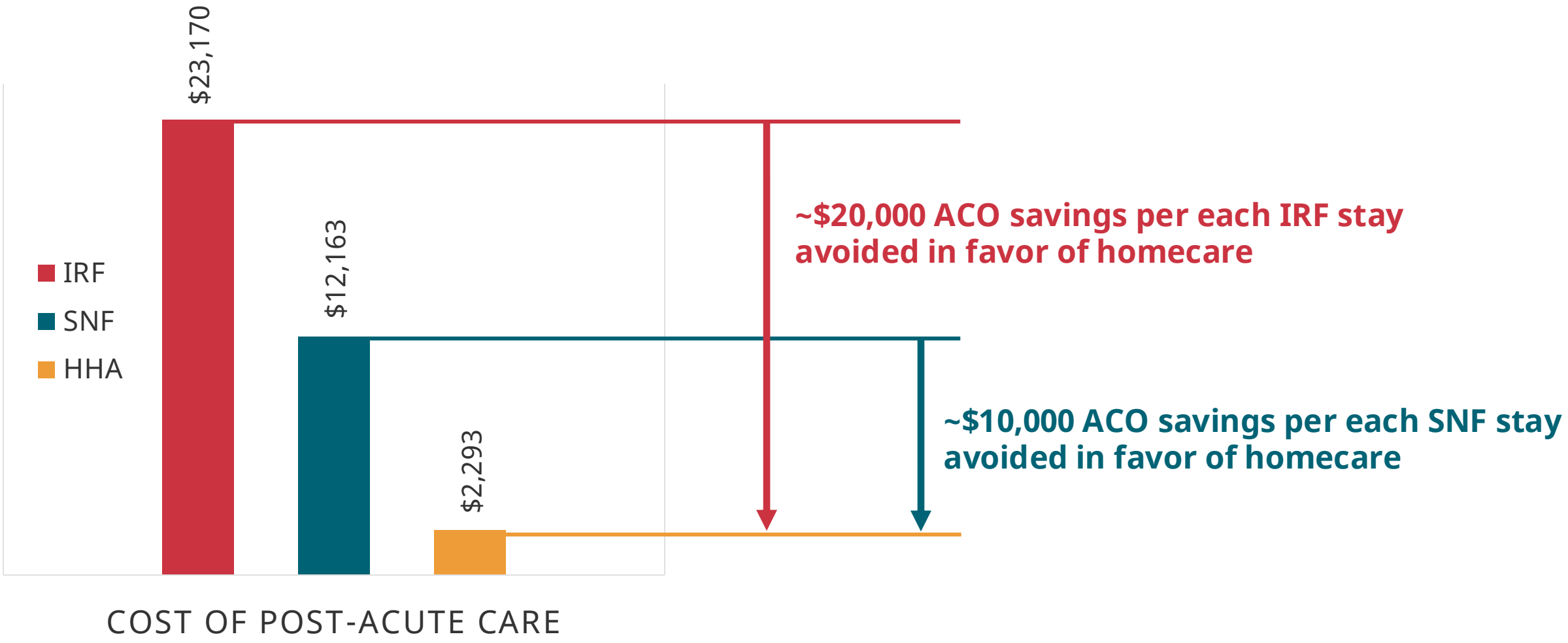
Case study #2: discrepant therapy recommendations

- 78-year-old man admitted to an inpatient unit at MMC
- Flagged on Day 1 by Radial Placement as “on the border,” and subsequent conflicting therapy evaluations reinforce the validity of this conclusion:
  - PT recommended SNF, stating the patient requires supervised rehab sessions to regain balance and strength
  - OT recommended homecare, stating local home health agency has capacity to provide visits as often as daily
- Radial user pointed out the discrepant PT and OT evaluations to the inpatient team, facilitating collaboration around discharge planning and mobilization



Final discharge plan: home with home health visits and PCP follow-up scheduled within 48 hours. A great outcome that was aligned with preferences of patient and family.

A post-acute savings opportunity worth $2.5 million/yr



Key takeaways

Lessons learned

We are seeing encouraging early results with Radial's Placement AI-supported tool:

Early mobilization

Emphasizing for care teams, patients, and families the benefits of discharge to home instead of facility post-acute care

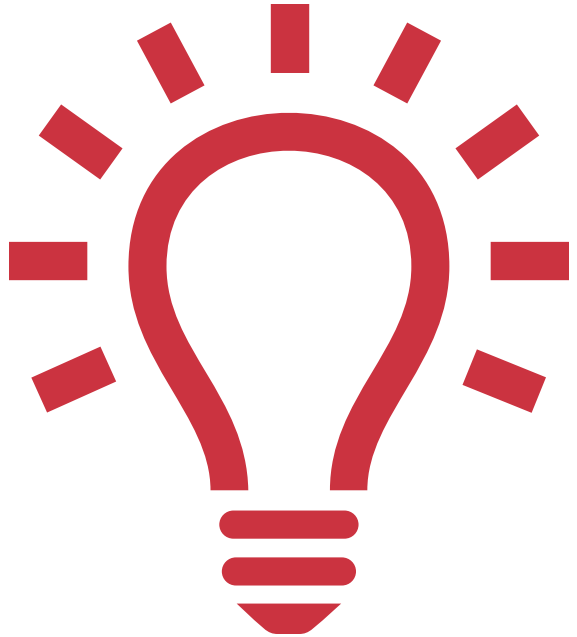
We find that Radial Placement recommendations are most effective if communicated to inpatient care teams prior to the first evaluation by Therapy team

It is essential to have an assigned staff member who is responsible for using the technology daily – it only takes a few minutes but consistency is required

Future directions

Our early results suggest utility of a similar approach for other MMC and VBC priorities:

- Other care transitions, e.g., to end-of-life care, other home-based care modalities
- Other care settings, e.g., ambulatory interventions
- To facilitate specific care pathways, e.g. SDOH
- To interventions going beyond just the VBC population





Q&A