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### **Predictive performance of the Hester Davis Scale for fall risk (HDS) at Henry Ford Jackson Hospital (HFJH)**

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## Background

- Henry Ford Health’s strategic plan includes the goal: “Zero Harm and 100 Reliability” using the Highly Reliable Organization (HRO) framework
- Patient falls are a nurse sensitive indicator, and the most common adverse event in hospitals
- One fall in three causes harm; from minor to severe
- Most falls are anticipated physiological falls, which are preventable
- Henry Ford Health, including HFJH, adopted the HDS Fall Risk Tool in August of 2018
- Variable fall rates and challenges with HDS implementation sparked our team to replicate and expand upon the Kaiser (2020) study<sup>2</sup>

## HDS Fall Risk Tool and Research Study

- Risk factors were chosen after researching fall tools and analyzing falls on their neuroscience unit
- The original research was a prospective study to validate the HDS on a neuroscience unit
- HDS includes nine scored categories; there are four risk levels: universal, low, moderate and high
- Distinct care plans are required at each risk level, as well as all categories scored 2 or above
- Interrater reliability was established by RN’s scoring two case studies
- Multiple statistics, including sensitivity and specificity were generated
- Age, Medications, and Electrolytes categories did not obtain significance
- Over a 29-month period, fall rates decreased 21%, injuries decreased 59%
- To date, limited additional research has been published

## Aims

- Conduct inter-rater reliability
- Validate HDS at HFJH
- Perform sensitivity (true positive rate), specificity (true negative rate), and strength of predictability (Area Under the Curve)
- Analyze all HDS categories for fall prediction efficacy
- Examine fall trends at our hospital since adopting HDS

## Methods

- Retrospective matched-pairs of fallers and non-fallers over calendar years 2019-2021
- Included high volume inpatient medical, surgical, and acuity adaptable units (6, 7NW, 7S, 4T, 5T, 6T, 7T)
- 415 first time fallers matched to 427 non-fallers
- Inter-rater reliability methodology:
  - Four study members independently scored 23 randomly generated non-falling cases
  - Specific HDS definitions were used for scoring

## Statistical Analyses

- Inter-rater reliability analysis used Intraclass Correlation Coefficient (ICC), produces a value in the range of 0-1.0, similar to Cohens-Kappa
- Means: Scores of fallers vs non-fallers were generated using Independent Samples T-Test
- T tests and Chi-Square tests were performed on all HDS categories
- Sensitivities and specificities were generated at every potential cut point
- Objective measures of strength of predictability (Area Under the Curve) were generated on all individual components and total HDS score
- Fall rates and fall with injury rates from 2019-2023 were compared (Rates calculated per 1,000 patient days)

## Outcomes

- Original HDS study inter-rater reliability =0.90; our ICC = 0.787
- Mean HDS score for fallers was significantly higher than non-fallers (20.13 vs 15.85, p < 0.001, independent samples t-test)

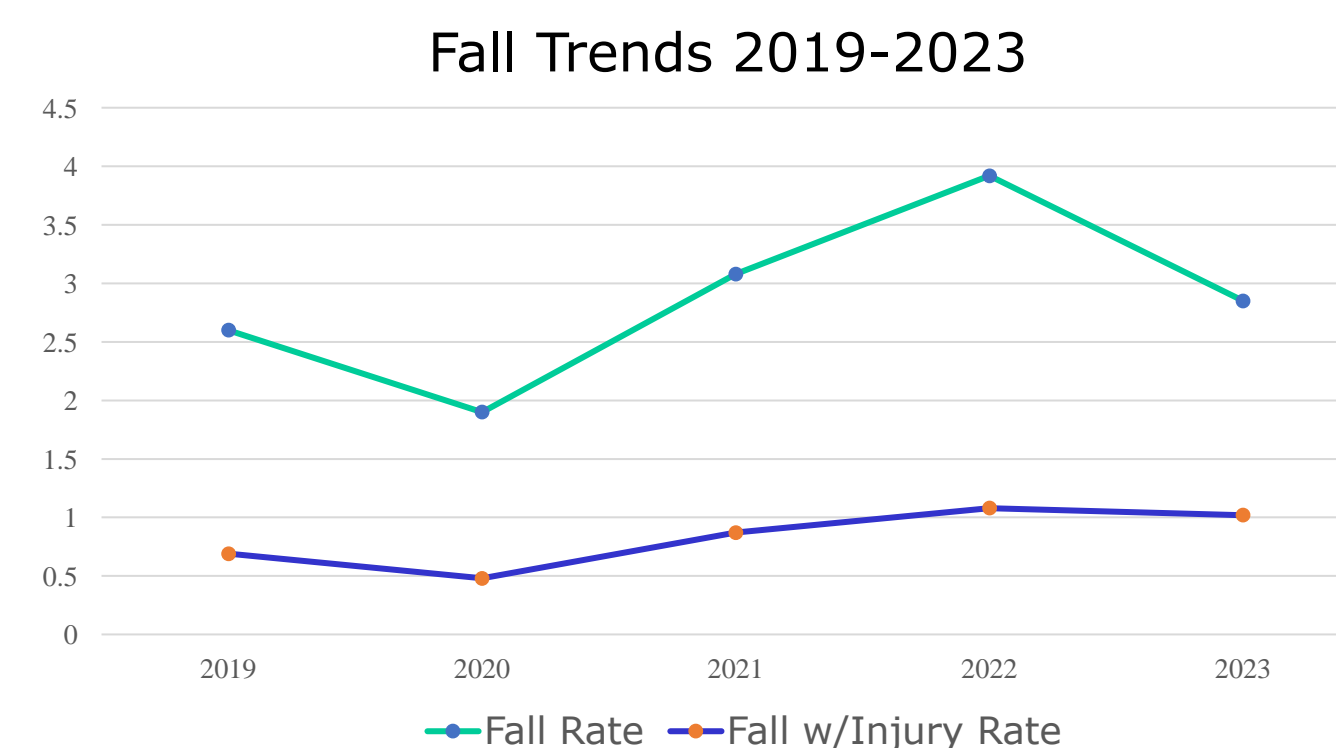


Figure 1. Fall trends from 2019 to 2023

HDS Categories	AUC
Behavior	.645
Total HDS Score	.621
Mobility	.605
Last Fall	.592
Mental Status	.587
Toileting	.583
Communication	.554
Medications	.538
Electrolytes	.511
Age	.494

Figure 2. Hester Davis categories Area Under the Curve analysis

Study	HDS Cutoff	Sensitivity	Specificity
Original HDS	7	100%	24.90%
Kaiser	7	90.10%	12.10%
Walsh	7	96.9%	9.60%
Original HDS	10	90.90%	47.10%
Kaiser	10	76.50%	33.10%
Walsh	10	91.10%	22.00%

Figure 1. Sensitivity and specificity comparison between original HDS study, Kaiser study, and Walsh study

## Implications

- Faller and non-faller means were both at the high-risk level; HDS did not discriminate who was at risk to fall
- Most inpatients qualify for resource intense care plans including fall mats and fall alarms
- Low specificity indicates limited ability to exclude patients at low risk for falling in our setting
- No components achieved significance at the 0.7 or above level (AUC); however, categories with higher AUC’s (behavior, toileting, and mobility) corresponded with noted fall occurrence trends
- Positive trends in fall and fall with injury rates in 2020 were erased by 2022, indicating process instability
- Fall risk appraisal is complex and achieving high reliability in fall prevention is an ongoing challenge

## References

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