# Development of the Sydney Falls Risk Screening Tool: phase two

**Presented by**
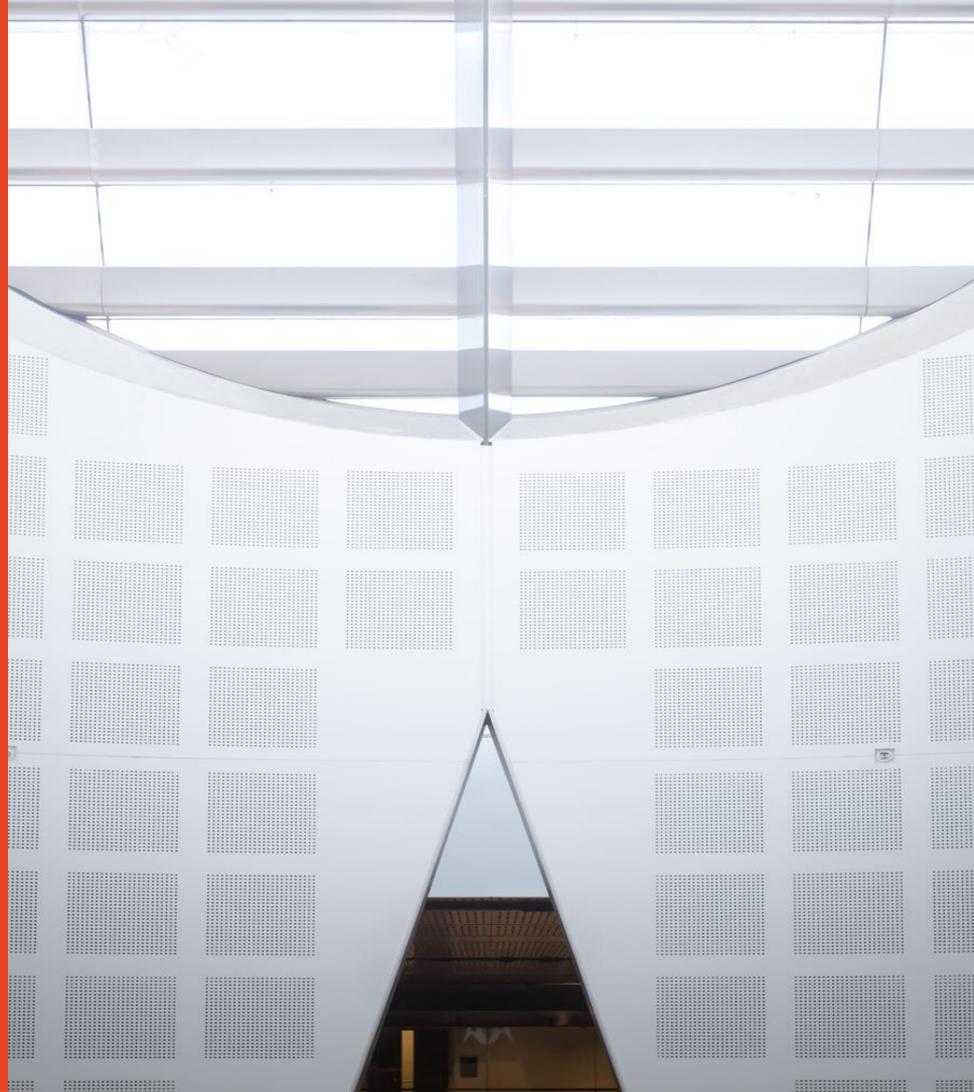
Duncan McKechnie

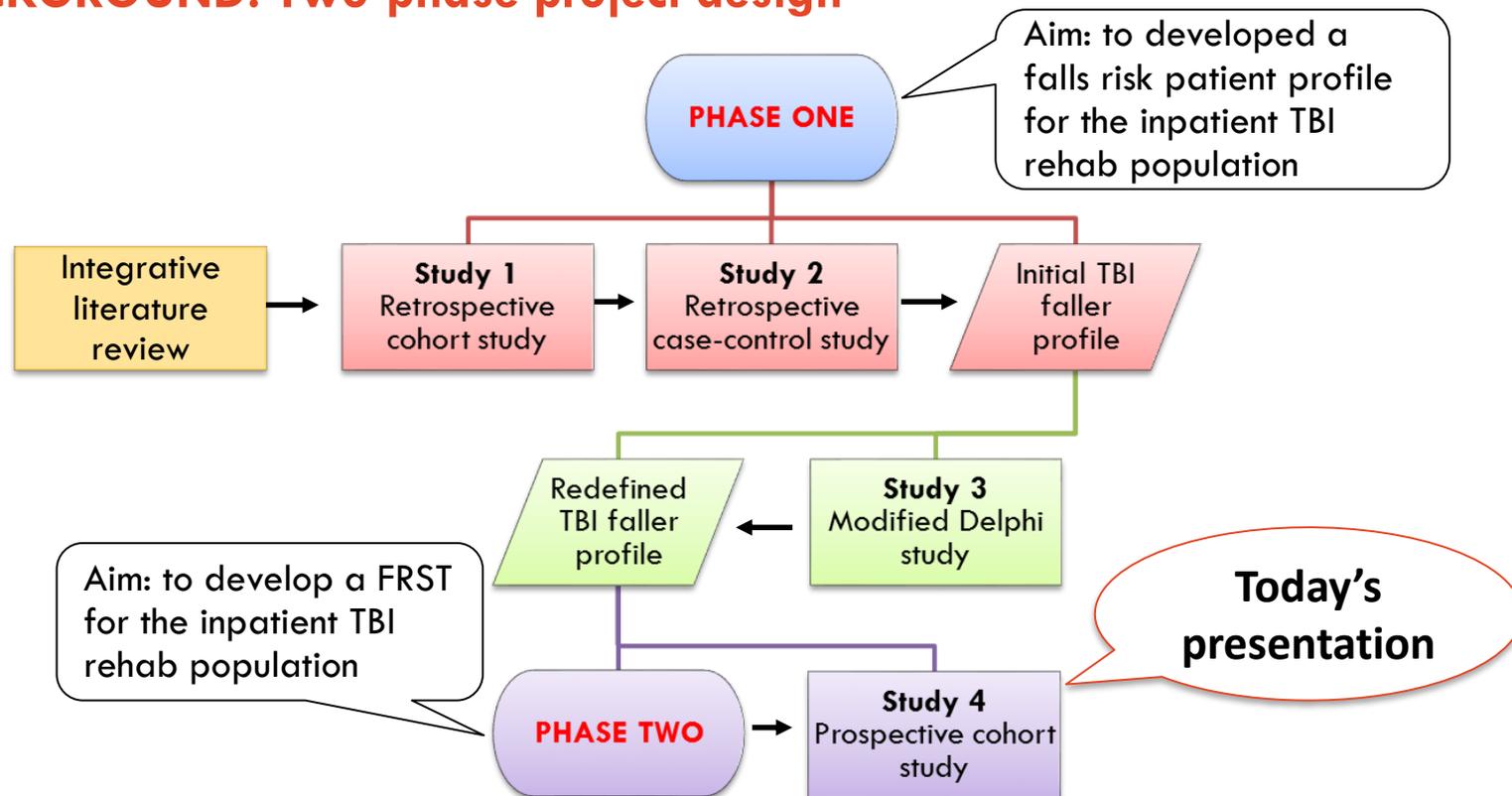**Co-investigators**

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# BACKGROUND: Two-phase project design

# METHODS: Multisite prospective cohort study

- 18-month prospective cohort study in 3 metropolitan brain injury rehabilitation units ($n = 140$)

- 41 (29%) patients fell (nonfaller-to-faller ratio = 2.4:1)

- Data collected at admission and at time of first fall

## Analysis

1. Univariate logistic regression examining 21 independent variables THEN

2. Backward elimination AND elastic net ($\lambda_{min}$ and $\lambda_{1se}$) logistic regression to identify significant predictors THEN

3. Hierarchical logistic regression used to identify final tool items

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# METHODS: Multisite prospective cohort study

4. Variable predictive strength examined using inclusion frequency during bootstrapped (1000 iterations with replacement) regression modeling

5. Developed tool's clinical validity was compared to the Ontario Modified STRATIFY (Sydney Scoring) falls risk screening tool

## STUDY COHORT: Multisite prospective cohort study

|  | Nonfallers (n = 99) | Fallers (n = 41) | p-Value |
|---|---|---|---|
| Sex (male), n (%) | 83 (84) | 30 (73) | .145 |
| Age, mean | 38.6 | 42.6 | .148 |
| Acute LOS (days), mean | 45 | 53 | .126 |
| Rehabilitation LOS (days), mean | 57 | 154 | .001 |
| Rehab admission GCS score, median | 15 | 14 | <.001 |
| Admitted in PTA (yes), n (%) | 70 (71) | 40 (98) | <.001 |
| Admission FIM total score, mean | 72.3 | 34.8 | .001 |
| Interquartile range | 40-106 | 18-48 |  |
| Admission STRATIFY score, mean | 14.4 | 23.6 | .001 |

## RESULTS: Univariate logistic regression

| | Nonfallers % | Fallers % | p-Value | Unknown on admission, % | Present at time of 1st fall, % |
|---|---|---|---|---|---|
| **Fall since admission to H.** | 8 | 22 | .019 | - | - |
| **Impaired cognition** | 80 | 100 | .001 | - | 85 |
| Impaired memory | 75 | 100 | .001 | 12 | 78 |
| Impaired orientation | 43 | 89 | .001 | 12 | 66 |
| Confusion | 47 | 89 | .001 | 12 | 63 |
| Impaired insight | 62 | 97 | .005 | 12 | 83 |
| **Impaired mobility** | 62 | 95 | .002 | - | 93 |
| Ataxic/uncoordinated gait | 39 | 86 | .001 | 24 | 73 |
| Impaired balance | 54 | 94 | .003 | 21 | 90 |
| Hemiparesis | 22 | 46 | .003 | 7 | 49 |
| Dizziness | 8 | 42 | .001 | 46 | 7 |
| **Mobility aid** | 43 | 93 | .001 | - | 76 |
| *Assistance required for:* | | | | | |
| mobility | 64 | 95 | .002 | - | 85 |
| transfers | 61 | 95 | .002 | - | 83 |
| toileting | 62 | 95 | .004 | - | 83 |
| **Incontinence** | 38 | 85 | .001 | - | 63 |
| **Neurobehaviours** | 43 | 78 | .001 | - | 81 |
| Noncompliance | 35 | 63 | .002 | - | 66 |
| Impulsivity | 39 | 78 | .001 | - | 78 |
| **Impaired communication** | 30 | 46 | .056 | - | 20 |
| **Visual impairment** | 30 | 83 | .003 | 54 | 34 |

## RESULTS: Elastic net and backward elimination regression

| | Bootstrapped penalized regression (Elastic Net) | | | | Backward elimination | |
|---|---|---|---|---|---|---|
| | $\lambda_{min}$ OR | Inclusion frequency | $\lambda_{1se}$ OR | Inclusion frequency | OR | Inclusion frequency |
| Mobility aid | 3.78 | 100% | 1.83 | 100% | 14.4 | 97% |
| Impaired orientation | 1.88 | 97% | 1.33 | 95% | 3.19 | 80% |
| Incontinence | 1.97 | 96% | 1.48 | 96% | | |
| Impulsivity | 1.94 | 95% | 1.32 | 94% | 3.65 | 51% |
| Fall since admission | 1.67 | 93% | | | 3.24 | 61% |
| Dizziness | 1.30 | 81% | | | | |
| Visual impairment | 1.02 | 72% | | | | |
| Impaired insight | 1.05 | 68% | | | | |
| Neurobehaviour | 1.15 | 67% | 1.13 | 74% | | |
| Confusion | 1.09 | 67% | 1.10 | 74% | | |
| Impaired balance | 1.24 | 66% | 1.03 | 55% | | |

# RESULTS: Hierarchical regression

| Model 1 | Model 2 | Model 3 | Model 4 | | Model 10 |
|---|---|---|---|---|---|
| Mobility aid | Mobility aid | Mobility aid | Mobility aid | | Mobility aid |
| Orientation | Orientation | Orientation | Orientation | | Orientation |
| | Incontinence | Incontinence | Incontinence | | Incontinence |
| | | Impulsive | Impulsive | | Impulsive |
| | | | Fall since ad | ⇨ | Fall since ad |
| | | | | | Behaviour |
| | | | | | Confusion |
| | | | | | Balance |
| | | | | | Insight |
| | | | | | Dizziness |
| | | | | | Visual |
| OCT: <.001 | OCT: .24 | OCT: .01 | **OCT: .04** | | OCT: .79 |
| McF: 0.27 | McF: 0.28 | McF: 0.32 | **McF: 0.34** | ⇨ | McF: 0.37 |
| AUC: 0.83 | AUC: 0.84 | AUC: 0.86 | **AUC: 0.87** | | AUC: 0.89 |

(*Note:* first 4 and last of 10 models shown)

# RESULTS: Risk factor item weighting and tool cut-off score

| Risk factor items | OR | Unweighted Coefficients | Weighted coefficients |
|---|---|---|---|
| A prescribed mobility aid | 9.13 | 2.21 | 22 |
| Fall since admission | 4.41 | 1.48 | 15 |
| Impaired orientation | 3.83 | 1.34 | 13 |
| Impulsive behaviour | 3.32 | 1.20 | 12 |
| Incontinence | 1.93 | 0.66 | 7 |

≥ 33 indicates patient is a high falls risk

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## The Sydney Falls Risk Screening Tool (SFRST)

Falls risk scoring not completed for completely immobilised patients including:

- ☐  patients in a minimally responsive state;
- ☐  patients with extremely severe motor impairment; or
- ☐  patients with tetraplegia.

Rate as low falls risk and continue periodic re-screening for risk of falling.

| Risk factors | Score if YES | Date |
|---|---|---|
| **1. History of falls**<br>Has the patient fallen since admission to hospital? | 15 | |
| **2. Mobility aid**<br>Is the patient prescribed a mobility aid?<br>Such as wheelchair, frame, crutch/s or walking stick. | 22 | |
| **3. Cognition**<br>Is the patient disorientated?<br>Poor awareness of environment including time, place and person. | 13 | |
| **4. Behaviour**<br>Is the patient displaying impulsive behaviour?<br>Risk taking and spontaneous actions occurring without recognition<br>of consequence or impairment or assistance required for<br>activities such as mobility or toileting. | 12 | |
| **5. Altered elimination**<br>Is the patient incontinent of urine and/or faeces? | 7 | |
| ≥ 33 indicates patient is a high falls risk | **Total score** | |

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# THE SYDNEY FALLS RISK SCREENING TOOL (SFRST)

| Risk factor items | Score |
|---|---|
| **1. History of falls**<br>Has the patient fallen since admission to hospital? | 15 |
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# SFRST CLINICAL VALIDITY AND COMPARISON TO ONTARIO MODIFIED STRATIFY (Sydney Scoring) FRST

|  | Weighted SFRST | STRATIFY | *p*-Value |
|---|---|---|---|
| Cut-off score | ≥ 33 | ≥ 9 | |
| Sensitivity | 90% | 98% | .25 |
| Specificity | 64% | 26% | <.001 |
| PPV | 49% | 35% | .057 |
| NPV | 94% | 96% | .637 |
| Accuracy | 71% | 47% | <.001 |
| Youden index | 0.54 | 0.24 | .005 |
| AUC | 0.87 | 0.80 | .037 |

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# WHERE TO FROM HERE

➕ Designing a validation study using a larger sample size

➕ Trial tool in mixed general patient populations

**ORIGINAL ARTICLE**

WILEY *Journal of* **Clinical Nursing**

## Development of the Sydney Falls Risk Screening Tool in brain injury rehabilitation: A multisite prospective cohort study

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