

# So, What If Something Happens (SWISH): An International Multi-centre Retrospective Cohort Study of Escalations Back to Hospital during Hospital at Home Admissions

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## Background

Hospital-at-home (HaH) delivers hospital-level care at home and is safe, effective, and acceptable internationally.

Patient safety concerns remain, particularly around unplanned clinical deterioration during HaH episodes, since existing measures (mortality, post-discharge readmission) are low-frequency or fail to capture in-episode risk.

Unplanned escalation events (return to hospital with overnight stay) offer a standardized, meaningful safety outcome to assess clinical risk detection, response, and outcomes in HaH.

### Study Aims

- Describe the rate, reasons, and characteristics of unplanned escalations across three HaH units in different countries.
- Identify risk factors associated with unplanned escalations to inform safer implementation and monitoring of HaH programs.

## Methods

A multi-centre, retrospective study from January 1 to December 31, 2023, across three HaH units: Epworth Hospital (Australia), Mass General Brigham (USA), and National University Health System (Singapore).

All HaH patients during this period were included, except those with day admissions <24 hours (e.g., single IV therapy, procedural changes). Patients were identified via electronic health records.

**Primary outcome:** Unplanned escalation (return to brick-and-mortar hospital for  $\geq 1$  one night).

**Secondary outcomes:** Planned escalations, pre- and post-escalation mortality.

## Results

Escalation rates were consistent across international sites (6 - 7%), most often due to deterioration of the primary condition.

Table 1. Demographics

| Characteristic                                              | TOTAL<br>n = 3114 | EPW<br>n = 558 | MGB<br>n =1515 | NUHS<br>n =1041 |
|-------------------------------------------------------------|-------------------|----------------|----------------|-----------------|
| <b>Age, %</b>                                               |                   |                |                |                 |
| 85 or older                                                 | 20                | 15             | 28             | 11              |
| 65-84                                                       | 41                | 38             | 45             | 38              |
| Less than 65                                                | 39                | 47             | 27             | 51              |
| Median patient age if under 85                              | 65                | 63             | 70             | 61              |
| <b>Male, %</b>                                              | 45                | 44             | 42             | 50              |
| <b>Living in a nursing home, %</b>                          | 1                 | 5              | 0              | 0               |
| <b>SES, %</b>                                               |                   |                |                |                 |
| Lower SES                                                   | 77                | 11             | 88             | 96              |
| Higher SES                                                  | 23                | 89             | 11             | 4               |
| <b>Point of entry, %</b>                                    |                   |                |                |                 |
| ED                                                          | 27                | 25             | 31             | 23              |
| Ward                                                        | 64                | 64             | 69             | 57              |
| Direct Residence                                            | 8                 | 11             | 0              | 20              |
| <b>Primary condition treated in HaH, %</b>                  |                   |                |                |                 |
| Infection                                                   | 65                | 66             | 54             | 79              |
| Heart Failure                                               | 9                 | 2              | 17             | 17              |
| COPD/Asthma                                                 | 8                 | 0              | 16             | 0               |
| Surgery                                                     | 6                 | 27             | 2              | 1               |
| Other                                                       | 12                | 4              | 11             | 18              |
| <b>Service line, %</b>                                      |                   |                |                |                 |
| Medicine                                                    | 89                | 56             | 100            | 92              |
| Surgery                                                     | 9                 | 41             | 0              | 4               |
| Oncology                                                    | 1                 | 2              | 0              | 3               |
| OBGYN                                                       | 0                 | 0              | 0              | 1               |
| Other                                                       | 0                 | 1              | 0              | 0               |
| <b>Major Comorbid Conditions, %</b>                         |                   |                |                |                 |
| Heart Failure                                               | 22                | 11             | 38             | 4               |
| COPD/Asthma                                                 | 23                | 18             | 35             | 9               |
| Diabetes                                                    | 32                | 19             | 33             | 38              |
| Stroke                                                      | 8                 | 6              | 8              | 8               |
| Dementia                                                    | 4                 | 6              | 2              | 5               |
| Cancer                                                      | 31                | 34             | 42             | 14              |
| <b>Median number of nights in the hospital prior to HaH</b> | 1                 | 3              | 1              | 1               |
| <b>Median number of nights treated in HaH</b>               | 5                 | 7              | 4              | 4               |

Table 2. Unplanned Escalation Outcomes

| Characteristic                                                                   | TOTAL<br>n = 3114 | EPW<br>n = 558 | MGB<br>n =1515 | NUHS<br>n =1041 |
|----------------------------------------------------------------------------------|-------------------|----------------|----------------|-----------------|
| <b>Unplanned Escalation, %</b>                                                   | 6                 | 6              | 7              | 7               |
| <b>Deterioration of existing condition for which the patient was admitted, %</b> | 54                | 53             | 46             | 66              |
| Deterioration due to new condition                                               | 32                | 35             | 40             | 18              |
| Social/Environmental                                                             | 4                 | 6              | 5              | 1               |
| Patient/Caregiver preference                                                     | 13                | 3              | 6              | 15              |
| Nonadherence                                                                     | 1                 | 0              | 2              | 0               |
| Other                                                                            | 1                 | 3              | 0              | 0               |
| <b>Reasons for deterioration, %</b>                                              | <b>n = 173</b>    | <b>n = 30</b>  | <b>n = 86</b>  | <b>n = 57</b>   |
| Haemodynamic instability                                                         | 22                | 10             | 23             | 26              |
| Bleed                                                                            | 1                 | 0              | 1              | 0               |
| Suspected TIA/CVA                                                                | 4                 | 0              | 1              | 11              |
| Chest pain                                                                       | 4                 | 10             | 3              | 2               |
| Arrhythmia                                                                       | 4                 | 0              | 3              | 7               |
| Altered mental status                                                            | 10                | 0              | 13             | 11              |
| SOB                                                                              | 19                | 13             | 19             | 21              |
| Fall                                                                             | 9                 | 10             | 8              | 9               |
| Biochemical abnormality                                                          | 10                | 3              | 14             | 9               |
| Other pain                                                                       | 7                 | 10             | 9              | 2               |
| Worsening infection                                                              | 6                 | 33             | 0              | 0               |
| Other                                                                            | 5                 | 10             | 5              | 4               |
| <b>Escalation during weekend (2000 Friday-0800 Monday), %</b>                    | 24                | 21             | 26             | 22              |
| <b>Destination of escalation, %</b>                                              |                   |                |                |                 |
| ED                                                                               | 75                | 44             | 90             | 68              |
| Ward                                                                             | 25                | 56             | 10             | 32              |
| ICU                                                                              | 0                 | 0              | 0              | 0               |
| <b>Subsequent transfer to ICU within 24 hours of escalation, %</b>               | 2                 | 0              | 3              | 1               |
| <b>Subsequent return to HaH after escalation, %</b>                              | 24                | 41             | 20             | 21              |
| <b>Median number of nights in HaH prior to escalation</b>                        | 4                 | 8              | 4              | 1               |
| <b>Median number of nights in hospital prior to return to HaH</b>                | 2                 | 4              | 1              | 1.5             |
| <b>Median number of further nights in HaH</b>                                    | 7                 | 14             | 5              | 5               |
| <b>Second escalation? %</b>                                                      | 3                 | 1              | 1              | 0               |
| <b>Death in hospital after escalation, %</b>                                     | 4                 | 12             | 1              | 6               |

Table 3. Risk Factors for Unplanned Escalation

| Characteristic                                                               | Unplanned Escalation<br>n = 201 | No escalation<br>n = 2859 | Adj OR (95% CI)            |
|------------------------------------------------------------------------------|---------------------------------|---------------------------|----------------------------|
| <b>Age, %</b>                                                                |                                 |                           |                            |
| 85 or older                                                                  | 25                              | 20                        | Ref                        |
| 65-84                                                                        | 49                              | 41                        | 0.93 (0.64 - 1.37)         |
| Less than 65                                                                 | 26                              | 40                        | <b>0.61 (0.38 - 0.96)*</b> |
| <b>Male, %</b>                                                               | 51                              | 44                        | 1.32 (0.98 - 1.79)         |
| <b>Lower SES, %</b>                                                          | 77                              | 77                        | 1.18 (0.81 - 1.77)         |
| <b>Point of entry, %</b>                                                     |                                 |                           |                            |
| Ward                                                                         | 70                              | 64                        | Ref                        |
| ED                                                                           | 22                              | 28                        | 0.91 (0.62 - 1.32)         |
| Direct                                                                       | 8                               | 8                         | 1.37 (0.76 - 2.37)         |
| <b>Primary condition treated in HaH, %</b>                                   |                                 |                           |                            |
| Infection                                                                    | 63                              | 64                        | Ref                        |
| Heart Failure                                                                | 10                              | 9                         | 0.79 (0.45 - 1.34)         |
| COPD/Asthma                                                                  | 10                              | 8                         | 0.83 (0.45 - 1.44)         |
| Surgery                                                                      | 6                               | 6                         | 1.64 (0.81 - 3.1)          |
| Other                                                                        | 10                              | 12                        | 0.81 (0.47 - 1.3)          |
| <b>Major Comorbid Conditions, %</b>                                          |                                 |                           |                            |
| Heart Failure                                                                | 31                              | 21                        | 1.3 (0.86 - 1.95)          |
| COPD/Asthma                                                                  | 24                              | 23                        | 1.08 (0.75 - 1.53)         |
| Diabetes                                                                     | 43                              | 31                        | <b>1.39 (1.02 - 1.89)*</b> |
| Stroke                                                                       | 14                              | 7                         | <b>1.76 (1.12 - 2.69)*</b> |
| Dementia                                                                     | 5                               | 4                         | 1.25 (0.6 - 2.4)           |
| Cancer                                                                       | 33                              | 31                        | 0.99 (0.71 - 1.36)         |
| <b>Mean (95% CI) Number of different types of treatments provided in HaH</b> | 2.88 (2.64 - 3.11)              | 2.60 (2.55 - 2.66)        | 1.09 (0.97 - 1.22)         |
| <b>Mean (95% CI) Number of nights treated in HaH</b>                         | 7.72 (6.45 - 8.98)              | 6.59 (6.34 - 6.84)        | 1.01 (0.99 - 1.03)         |
| <b>Mean (95% CI) Number of nights in the hospital prior to HaH</b>           | 3.93 (3.07 - 4.79)              | 2.83 (2.60 - 3.06)        | 1.02 (1 - 1.04)            |

\*statistically significant difference between unplanned escalations and no escalation

## Discussion

- A standardized definition of unplanned escalation provides a reliable patient safety benchmark for HaH programs, with consistent rates across international units reflecting a shared threshold of acceptable risk.
- Escalation due to deterioration of the existing condition was most prominent. Escalation due to caregiver preference demonstrates the need to further study caregiver supportive measures.
- Return to HaH after escalation appears valuable for the majority of patients.
- Patients with diabetes or stroke had a higher risk of unplanned escalation, while those under 65 years had a lower risk. No other demographic or treatment factors were significant.
- Broader validation across international and rural HaH settings is needed to confirm the applicability of this measure.