Supplementary Material
CONTENTS

List of Supplementary Tables

Supplementary Table S1  Summary of findings from a priori literature review evaluating what patient factors influence nursing home placement (institutionalization) after acute hospitalization for stroke

Supplementary Table S2  Distribution of patient risk factors of the 1335 patients included in analysis per individual hospital (n [%] unless otherwise stated).

Supplementary Table S3  Breakdown of the type of inpatient complications recorded and the proportion of patients recorded with each

Supplementary Table S4  Variables used to inform multiple imputation of missing data

Supplementary Table S5  Comparison of patient characteristics between complete cases and those with at least one missing variable

Supplementary Table S6  Multiple logistic regression complete case analysis for new nursing home placement after hospitalization for stroke (n=972)

List of Supplementary Figures

Supplementary Figure S1  Flow chart of cases included for the analysis, illustrating the reasons for exclusion.

Supplementary Figure S2  Stacked bar chart showing the proportion of patients that were discharged either to a nursing home (red), back home (blue), to an interim/rehabilitation setting
(grey) or died as an inpatient (white), per hospital. H1 to H8 represent hospitals 1 to 8 inclusively.

**Supplementary Figure S3** Model estimates of new nursing home placement odds ratio for each hospital and hospital type. Horizontal line represents an odds ratio of 1 for reference hospital 1; its green colour represents that it is a tertiary hospital. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S4** Model estimates of new nursing home placement odds ratio for each hospital against size of hospital (represented as number of total hospital beds). Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the size of hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S5** Model estimates of new nursing home placement odds ratio for each hospital against hospital stroke volume (mean number of stroke patients admitted and treated in each hospital per month). Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the stroke volume of hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S6** Model estimates of new nursing home placement odds ratio for each hospital against distance to neurosurgical facilities (in miles). Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line illustrates that neurosurgery was available onsite at hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S7** Model estimates of new nursing home placement odds ratio for each hospital against presence of vascular surgery onsite. Horizontal line represents an odds ratio of 1 for reference hospital 1; its blue colour represents that it does not have a vascular surgery onsite. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S8** Model estimates of new nursing home placement odds ratio for each hospital against number of senior doctors per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the senior doctor staffing level for the hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease,
complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S9** Model estimates of new nursing home placement odds ratio for each hospital against number of junior doctors per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the junior doctor staffing level for hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S10** Model estimates of new nursing home placement odds ratio for each hospital against number of nurses per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the nurse staffing levels for hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S11** Model estimates of new nursing home placement odds ratio for each hospital against number of occupational therapists per five bed days. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the staffing levels of occupational therapists in hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S12** Model estimates of new nursing home placement odds ratio for each hospital against the number of physiotherapists per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the staffing levels of physiotherapists in hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S13** Model estimates of new nursing home placement odds ratio for each hospital against the number of speech and language therapists per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the staffing levels of speech and language therapists in hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

**Supplementary Figure S14** Model estimates of new nursing home placement odds ratio for each hospital against the number of dieticians per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the staffing levels of dieticians in hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease,
Supplementary Figure S15 Model estimates of new nursing home placement odds ratio for each hospital against number of hospital beds per CT scanner. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the number of hospital beds per CT scanner in hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

Supplementary Figure S16 Model estimates of new nursing home placement odds ratio for each hospital against number of stroke unit beds per 100 admissions. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the number of stroke unit beds for hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

Supplementary Figure S17 Model estimates of new nursing home placement odds ratio for each hospital against number of non-stroke patients treated daily on the stroke unit per five beds. Horizontal line represents an odds ratio of 1 for hospital 1. Vertical line represents the number of non-stroke patients treated daily on the stroke unit of hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

Supplementary Figure S18 Model estimates of new nursing home placement odds ratio for each hospital against number of patients with stroke treated daily outside the stroke unit per five beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the number of patients with stroke treated outside the stroke unit per five beds for hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

Supplementary Figure S19 Model estimates of new nursing home placement odds ratio for each hospital against presence of early supported discharge (ESD) policy. Horizontal line represents an odds ratio of 1 for reference hospital 1; its blue colour represents that it does not have an ESD policy. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.

Supplementary Figure S20 Model estimates of new nursing home placement odds ratio for each hospital against mean Index of Multiple Deprivation (IMD) score of the counties in which the hospital services, with 95% confidence intervals. Horizontal line represents an odds ratio of 1 for reference hospital 1; its blue colour represents that hospital 1 is located in a county.
with an IMD mean score of 13.89. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
### Supplementary Table S1  Summary of findings from a priori literature review evaluating what patient factors influence nursing home placement (institutionalization) after acute hospitalization for stroke

| Independent Variable | Association | Frequency of studies reporting association | Studies |
|----------------------|-------------|-------------------------------------------|---------|
| **Age**              | Older age, more likely institutionalized | 9/11 | 1-8 |
|                      | No association | 2/11 | 9-10 |
| **Sex**              | Female sex, more likely institutionalized | 2/7 | 4,11 |
|                      | No association | 5/7 | 4-7, 11 |
| **Caregiver availability** | Presence of caregiver before stroke, more likely institutionalized | 1/1 | 1 |
|                      | Living with others before stroke, less likely institutionalized | 1/3 | 12 |
|                      | Living with others before stroke, no association | 2/3 | 9-10 |
|                      | Marital status, no association | 2/2 | 7,10 |
| **Race/ethnicity**   | White vs. non-whites, less likely institutionalized | 1/3 | 5 |
|                      | Blacks and Hispanics vs. white, less likely institutionalized | 1/3 | 13 |
|                      | No association | 1/3 | 10 |
| **Pathological stroke type** | Haemorrhagic stroke vs. ischaemic (or specific subtypes), more likely institutionalized | 2/5 | 1,8 |
|                      | No association | 3/5 | 9-10, 14 |
| **Pathological cause of stroke** | Large artery atherosclerosis or cardio-embolism vs. small vessel occlusion, more likely institutionalized | 1/1 | 1 |
| **Anatomical site of stroke** | Total anterior circulation stroke, more likely institutionalized | 2/2 | 3,12 |
| **Stroke Severity**  | Higher severity, more likely institutionalized | 7/7 | 1-2,6,8-10 |
| **Post-Stroke Functional Status** | Poor functional status, more likely institutionalized | 2/3 | 5-6 |
| Independent Variable   | Association                                                                 | Frequency of studies reporting association | Studies |
|------------------------|------------------------------------------------------------------------------|--------------------------------------------|---------|
|                        | No association                                                               | 1/3                                        | 10      |
|                        | Cognitive impairment, more likely institutionalized                          | 1/1                                        | 7       |
| Diabetes Mellitus      | Diabetes mellitus, more likely institutionalized                             | 1/2                                        | 1       |
|                        | No association                                                               | 1/2                                        | 7       |
| Previous stroke/TIA    | Previous stroke, more likely institutionalized                               | 2/2                                        | 1,8     |
|                        | Previous TIA, no association                                                 | 2/2                                        | 7,12    |
| Cardiovascular Disease | Presence of cardiovascular disease, more likely institutionalized            | 1/4                                        | 6       |
|                        | Presence of cardiovascular disease, less likely institutionalized             | 1/4                                        | 1       |
|                        | No association                                                               | 2/4                                        | 7,10    |
| Other comorbid conditions | Hip fracture or dementia, more likely institutionalized                       | 2/2                                        | 8,10    |
|                        | Hypertension or depression or cancer or atrial fibrillation, no association   | 4/4                                        | 7,8,10,12 |
| Complications          | Presence of complication, more likely institutionalized                      | 2/3                                        | 3,15    |
|                        | No association                                                               | 1/3                                        | 16      |
| Other patient characteristics | Longer AHLOS, more likely institutionalized                                 | 1/1                                        | 7       |
|                        | Institutionalization prior to stroke, more likely institutionalized           | 1/2                                        | 4,12    |
|                        | Pre-stroke accommodation, direction not reported                             | 1/2                                        | 4       |
|                        | Smoking, more likely institutionalized                                        | 1/2                                        | 1       |
|                        | Smoking, less likely institutionalized                                        | 1/2                                        | 6       |
Use of anticoagulants and antiplatelet drugs prior to stroke, more likely institutionalized 1/1 6

Higher iScore, more likely institutionalized 1/1 17

Socioeconomic status, educational attainment, BMI, functional status prior to stroke, aphasia, dysphagia, no association 5/5 6-7,9-10,18

AHLOS, acute hospital length of stay; BMI, body mass index; TIA, transient ischaemic attack.

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## Supplementary Table S2

Distribution of patient risk factors of the 1335 patients included in analysis per individual hospital (n [%] unless otherwise stated).

| Variables                          | Hospital 1 | Hospital 2 | Hospital 3 | Hospital 4 | Hospital 5 | Hospital 6 | Hospital 7 | Hospital 8 | P  |
|------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|----|
| Age, y, median (IQR)*              | 76 (65 to 83) | 83 (80 to 90) | 78 (68 to 84) | 74 (69 to 82) | 76 (67 to 83) | 75 (66 to 82) | 78 (65 to 85) | 78 (67 to 86) | 0.09 |
| Sex, female†                       | 97 (46)    | 5 (50)     | 107 (53)   | 32 (51)    | 143 (44)   | 76 (45)    | 83 (45)    | 91 (54)    | 0.33 |
| Haemorrhagic stroke†               | 20 (10)    | 0 (0)      | 20 (10)    | 4 (8)      | 26 (8)     | 16 (10)    | 17 (9)     | 9 (5)      | 0.70 |
| Pre-stroke mRS ≥3†                 | 7 (6)      | 2 (20)     | 30 (16)    | -          | 35 (11)    | 12 (9)     | 11 (6)     | 18 (11)    | 0.04 |
| Discharge mRS ≥ 3†                 | 37 (24)    | 7 (70)     | 79 (42)    | -          | 68 (22)    | 44 (37)    | 52 (30)    | 77 (45)    | <0.001 |
| TACS†                             | 9 (5)      | 0 (0)      | 25 (13)    | 5 (11)     | 13 (4)     | 11 (7)     | 27 (17)    | 19 (11)    | <0.001 |
| No brain lateralization†           | 34 (17)    | 2 (20)     | 11 (6)     | 5 (8)      | 78 (24)    | 1 (1)      | 18 (10)    | 7 (4)      | <0.001 |
| Diabetes mellitus†                 | 28 (13)    | 1 (10)     | 33 (16)    | 7 (11)     | 51 (16)    | 38 (23)    | 33 (18)    | 30 (18)    | 0.29 |
| Myocardial infarction/ischemic heart disease† | 30 (14) | 1 (10) | 54 (27) | 15 (24) | 68 (21) | 45 (27) | 29 (16) | 56 (33) | <0.001 |
| Previous stroke†                   | 31 (15)    | 1 (10)     | 32 (16)    | 8 (13)     | 68 (21)    | 35 (21)    | 44 (24)    | 32 (19)    | 0.18 |
| Dementia†                          | 13 (6)     | 1 (10)     | 13 (6)     | 0 (0)      | 17 (5)     | 10 (6)     | 11 (6)     | 8 (5)      | 0.66 |
| Prior use of anticoagulants or anti-platelets† | 76 (44) | 6 (60) | 94 (53) | 33 (52) | 151 (48) | 88 (52) | 92 (51) | 81 (48) | 0.69 |
| Complication†                      | 49 (23)    | 3 (30)     | 20 (10)    | 19 (30)    | 92 (28)    | 50 (30)    | 43 (23)    | 31 (18)    | <0.001 |
| AHLOS, days, median (IQR)*         | 7 (4 to 16) | 30 (17 to 39) | 8 (5 to 22) | 10 (4 to 27) | 6 (4 to 11) | 9 (5 to 21) | 11 (6 to 23) | 7 (3 to 20) | <0.001 |

AHLOS, acute hospital length of stay; IQR, interquartile range; mRS, modified Rankin Scale; TACS, total anterior circulation syndrome; y, years.

* Kruskal-Wallis rank sum test
† $\chi^2$ test
**Supplementary Table S3** Breakdown of the type of inpatient complications recorded and the proportion of patients recorded with each

| Complication Type   | Number of patients | Percentage of total study population (n=1335) | Percentage of patients with complication recorded (n=307) |
|---------------------|--------------------|-----------------------------------------------|----------------------------------------------------------|
| Another stroke      | 7                  | 0.5                                           | 2                                                         |
| Pneumonia           | 67                 | 5                                             | 22                                                        |
| UTI                 | 96                 | 7                                             | 31                                                        |
| Seizures            | 21                 | 2                                             | 7                                                         |
| New MI              | 7                  | 0.5                                           | 2                                                         |
| Acute coronary      | 7                  | 0.5                                           | 2                                                         |
| Other (unspecified) | 102                | 8                                             | 33                                                        |
**Supplementary Table S4**  Variables used to inform multiple imputation of missing data

| Variable                                      | Measure                                      | Missing (%) |
|-----------------------------------------------|----------------------------------------------|-------------|
| I. Independent Variable                       |                                              |             |
| Trust                                         | 0=Trust 1 1=Trust 2 2=Trust 3 3=Trust 4 4=Trust 5 5=Trust 6 6=Trust 7 7=Trust 8 | -           |
| II. Dependent Variable                         |                                              |             |
| New Nursing Home Placement                     | 0=No 1=Yes                                  | -           |
| III. Patient Risk Factors (Confounders)        |                                              |             |
| Pre-morbid mRS                                 | 0=scores 0 to 2 1= scores 3 to 5             | 219 (16)    |
| Discharge mRS                                  | 0=scores 0 to 2 1= scores 3 to 5             | 206 (15)    |
| TACS                                          | 0=No 1=Yes                                  | 105 (8)     |
| Brain Lateralization                          | 0=No 1=Yes                                  | 60 (4)      |
| MI/IHD                                        | 0=No 1=Yes                                  | -           |
| Complication                                  | 0=No 1=Yes                                  | -           |
| AHLOS                                         | Continuous, days                            | 3 (0.2)     |
| IV. Auxiliary Variables                        |                                              |             |
| Sex                                           | 0=Male 1=Female                             | 2 (<1)      |
| Age                                           | Continuous, years                           | 1 (<1)      |
| Previous Stroke                               | 0=No 1=Yes                                  | 0 (0)       |
| Diabetes Mellitus                             | 0=No 1=Yes                                  | 0 (0)       |
| Season of Admission                           | 0=Summer 1=Winter                           | 2 (<1)      |
| Day of Admission                              | 0=Weekday 1=Weekend                         | 2 (<1)      |
| ICU Admission                                 | 0=No 1=Yes                                  | 68 (5)      |
| Dementia                                      | 0=No 1=Yes                                  | 0 (0)       |
| Hypercholesterolemia                          | 0=No 1=Yes                                  | 0 (0)       |
| Myocardial Infarction or Ischemic Heart Disease| 0=No 1=Yes                                  | 0 (0)       |
| Hypertensive                                  | 0=No 1=Yes                                  | 0 (0)       |
| Chronic Obstructive Pulmonary Disease          | 0=No 1=Yes                                  | 0 (0)       |
| Stroke Type                                   | 0=Ischemic 1=Hemorrhagic                    | 39 (2)      |
| Atrial Fibrillation                           | 0=No 1=Yes                                  | 172 (13)    |
| Heart Rate                                    | Continuous, beats per minute                | 143 (11)    |
| Temperature                                   | Continuous, °C                              | 185 (14)    |
| Use of anti-coagulants and/                    |                                              |             |
| antiplatelets prior to stroke                 | 0=No 1=Yes                                  | 91 (7)      |

mRS, modified Rankin Scale; TACS, total anterior circulation stroke; myocardial infarction/ischemic heart disease; AHLOS, acute hospital length of stay; ICU, intensive care unit.
**Supplementary Table S5**  
Comparison of patient characteristics between complete cases and those with at least one missing variable

| Patient Characteristic | Complete Cases (n=972) | Cases with at least one missing variable (n=363) | \( P \) |
|------------------------|------------------------|-----------------------------------------------|-------|
| **Median (IQR) or No. (%)** |                        |                                               |       |
| Age, y*                | 77 (67 to 84)          | 75 (65 to 83)                                | 0.04  |
| Sex, female†           | 473 (49)               | 161 (44)                                     | 0.19  |
| Comorbidities†          |                        |                                               |       |
| Atrial Fibrillation    | 238 (28)               | 91 (28)                                      | 0.99  |
| Previous Stroke        | 193 (20)               | 58 (16)                                      | 0.12  |
| Diabetes Mellitus      | 164 (17)               | 57 (16)                                      | 0.67  |
| Dementia               | 55 (6)                 | 18 (5)                                       | 0.72  |
| Hypercholesterolemia   | 192 (20)               | 58 (16)                                      | 0.14  |
| Hypertensive           | 697 (72)               | 231 (64)                                     | 0.005 |
| Myocardial Infarction or Ischemic Heart Disease | 225 (23) | 73 (20) | 0.27 |
| COPD                   | 56 (6)                 | 24 (7)                                       | 0.65  |
| Pre-stroke mRS > 3     | 103 (11)               | 12 (8)                                       | 0.49  |
| ICU admission          | 21 (2)                 | 11 (3)                                       | 0.38  |
| Hemorrhagic Stroke†    | 61 (6)                 | 51 (15)                                      | <0.001|
| TACS                   | 92 (9)                 | 17 (7)                                       | 0.19  |
| No Brain Lateralization† | 119 (12)               | 37 (12)                                      | 1     |
| Complications          | 202 (21)               | 105 (29)                                     | 0.002 |
| Discharge mRS Score > 3 ‡ | 316 (33)               | 48 (31)                                      | 0.70  |
| Winter Admission†      | 512 (53)               | 197 (54)                                     | 0.61  |
| Weekend Admission†     | 247 (25)               | 96 (27)                                      | 0.73  |
| AHLOS, days            | 7 (4 to 17)            | 8 (4 to 20.25)                               | 0.26  |
| New Nursing Home Placement at discharge | 105 (11) | 30 (8) | 0.21 |
| Use of anticoagulants or antiplatelets before | 464 (50) | 157 (48) | 0.63 |

IQR, interquartile range; COPD, chronic obstructive pulmonary disease; mRS, modified Rankin Scale; ICU, intensive care unit; TACS, total anterior circulation stroke.
### Supplementary Table S6  Multiple logistic regression complete case analysis for new nursing home placement after hospitalization for stroke (n=972)

| Independent Variable                  | OR   | 95% CI        | P    |
|---------------------------------------|------|---------------|------|
| Pre-stroke mRS (reference < 3)        |      |               |      |
| More than or equal to 3               | 0.77 | 0.35 to 1.69  | 0.51 |
| Discharge mRS (reference < 3)         |      |               |      |
| More than or equal to 3               | 10.05| 3.85 to 26.19 | <0.001|
| TACS                                  | 0.94 | 0.41 to 2.14  | 0.87 |
| MI/IHD                                | 0.50 | 0.23 to 1.09  | 0.08 |
| Had a complication                    | 2.29 | 1.10 to 4.76  | 0.03 |
| No brain lateralization               | 1.59 | 0.51 to 5.02  | 0.43 |
| AHLOS, days                           | 1.08 | 1.06 to 1.10  | <0.001|
| Hospital (reference 1)                |      |               |      |
| 2                                     | 0.42 | 0.03 to 5.78  | 0.52 |
| 3                                     | 5.54 | 1.16 to 26.51 | 0.03 |
| 5                                     | 1.75 | 0.36 to 8.53  | 0.49 |
| 6                                     | 0.31 | 0.05 to 2.01  | 0.22 |
| 7                                     | 1.08 | 0.22 to 5.34  | 0.92 |
| 8                                     | 0.56 | 0.11 to 2.82  | 0.48 |

OR, odds ratio; CI, confidence intervals; mRS, modified Rankin Scale; TACS, total anterior circulation stroke; MI/IHD, myocardial infarction or ischemic heart disease; AHLOS, acute hospital lengths of stay.
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Supplementary Figure S4  Model estimates of new nursing home placement odds ratio for each hospital against size of hospital (represented as number of total hospital beds). Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the size of hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S5  Model estimates of new nursing home placement odds ratio for each hospital against hospital stroke volume (mean number of stroke patients admitted and treated in each hospital per month). Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the stroke volume of hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S6  Model estimates of new nursing home placement odds ratio for each hospital against distance to neurosurgical facilities (in miles). Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line illustrates that neurosurgery was available onsite at hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S7  Model estimates of new nursing home placement odds ratio for each hospital against presence of vascular surgery onsite. Horizontal line represents an odds ratio of 1 for reference hospital 1; its blue colour represents that it does not have a vascular surgery onsite. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S8  Model estimates of new nursing home placement odds ratio for each hospital against number of senior doctors per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the senior doctor staffing level for the hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S9  Model estimates of new nursing home placement odds ratio for each hospital against number of junior doctors per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the junior doctor staffing level for hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S10  Model estimates of new nursing home placement odds ratio for each hospital against number of nurses per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the nurse staffing levels for hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S11  Model estimates of new nursing home placement odds ratio for each hospital against number of occupational therapists per five bed days. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the staffing levels of occupational therapists in hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S12  Model estimates of new nursing home placement odds ratio for each hospital against the number of physiotherapists per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the staffing levels of physiotherapists in hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S13  Model estimates of new nursing home placement odds ratio for each hospital against the number of speech and language therapists per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the staffing levels of speech and language therapists in hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S14  Model estimates of new nursing home placement odds ratio for each hospital against the number of dieticians per five stroke unit beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the staffing levels of dieticians in hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S15  Model estimates of new nursing home placement odds ratio for each hospital against number of hospital beds per CT scanner. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the number of hospital beds per CT scanner in hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S16  Model estimates of new nursing home placement odds ratio for each hospital against number of stroke unit beds per 100 admissions. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the number of stroke unit beds for hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
**Supplementary Figure S17**  Model estimates of new nursing home placement odds ratio for each hospital against number of non-stroke patients treated daily on the stroke unit per five beds. Horizontal line represents an odds ratio of 1 for hospital 1. Vertical line represents the number of non-stroke patients treated daily on the stroke unit of hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S18  Model estimates of new nursing home placement odds ratio for each hospital against number of patients with stroke treated daily outside the stroke unit per five beds. Horizontal line represents an odds ratio of 1 for reference hospital 1. Vertical line represents the number of patients with stroke treated outside the stroke unit per five beds for hospital 1. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S19  Model estimates of new nursing home placement odds ratio for each hospital against presence of early supported discharge (ESD) policy. Horizontal line represents an odds ratio of 1 for reference hospital 1; its blue colour represents that it does not have an ESD policy. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.
Supplementary Figure S20  Model estimates of new nursing home placement odds ratio for each hospital against mean Index of Multiple Deprivation (IMD) score of the counties in which the hospital services, with 95% confidence intervals. Horizontal line represents an odds ratio of 1 for reference hospital 1; its blue colour represents that hospital 1 is located in a county with an IMD mean score of 13.89. Multivariable regression model was adjusted for pre-stroke mRS score, discharge mRS score, TACS, myocardial infarction or ischemic heart disease, complication, brain lateralization, and acute hospital length of stay, after multiple imputation for missing covariate data.