### Supplementary material

**Table 1. List of codes used to identify death of death and patients with dementia in primary care and hospital records.**

|                                      | Read Codes v2                                                                 | ICD10 codes |
|--------------------------------------|-----------------------------------------------------------------------------|-------------|
| Date of death                        | 22J., 9491., 9495., 94G., 8HG., 9493., 94E., 946., 94Z., ZV680, 94., 949A., 949., 9431., 9442., 9451., 9452., 9453., 946., 9492., 9494., 9496., 9497., 9498., 9499., 948., 949C., 949D., 949E., 949F., 949G., 949H., 949J., 949Z., 94D., 94G. |             |
| Diagnosis of dementia                | F110 to F112, E02y1, E041., Eu041, F116., F118., F21y2, A410., Eu107, F11x7, Eu02%, E00%, Eu01%, E012%, Eu00%, A411% | F000 to F03x G30 to G30.9 G31 to G31.8 G91.2 |
| Multiple admission in last 90 days   | >2 hospital admissions with a Epistart date >= (date of death – 90) + >1 hospital admissions with a Epistart date >= (date of death – 90) & primary diagnosis of: Urinary tract infection (ICD-10 code N39.0), Respiratory tract infection (ICD-10 codes J00-J22.9, J69.0), Sepsis (ICD-10 codes A40.0-A40.9, A41.0-A41.9, A02.1, A26.7, A22.7, A32.7, A42.7), and dehydration (ICD-10 code E86) |             |
Table 2. List of codes used to derive community and primary care contacts

| Community and Primary Care Contacts | Details |
|-------------------------------------|---------|
| **District nurse contacts**         | Service Reference Cost Description = 'District Nurse' or 'District Nurse, Adult, Face to face' or 'District Nursing services: Adult' OR Service Reporting Line = 'District Nursing' or 'District Nursing (H&F, K&C, W)' or 'District Nursing – AWC' |
| **Palliative care community team contacts** | Service Reporting line = 'Palliative Care' or 'Palliative Care Service' OR Service Reference Cost Description = 'Palliative / Respite Care: Adult' or 'Specialist Nursing, Palliative/Respite care, Adult, Face to face' |
| **All nurses**                      | DISTRICT NURSE CONTACTS + ServiceReferenceCostDescription = 'Cardiac Nursing / Liaison: Adult' or 'Other Specialist Nursing' or 'Other Specialist Nursing, Adult, Face to face' or 'Specialist Nursing – Asthma and Respiratory Nursing/Liaison' or 'Specialist Nursing – Active Case Management (Community Matrons)' or 'Specialist Nursing – Cardiac Nursing/Liaison, Adult, Face to face' or 'Specialist Nursing – Continence Services' or 'Specialist Nursing – Continence Services, Adult, Face to face' or 'Specialist Nursing – Diabetic Nursing/Liaison' or 'Specialist Nursing – Diabetic Nursing/Liaison, Adult, Face to face' or 'Specialist Nursing – Parkinson's and Alzheimers Nursing/Liaison' or 'Specialist Nursing – Tissue Viability Nursing/Liaison' or 'Specialist Nursing – Tissue Viability Nursing/Liaison, Adult, Face to face' or 'Specialist Nursing – Tuberculosis Specialist Nursing' OR Service Reporting Line = '24 hour nursing' or 'Community Nursing' or 'Adult Nursing' or Night Nursing (K&C)' or Twilight/Night Nursing Service' or 'Heart Failure Nursing' or 'Tissue Viability Nursing' or 'TB Nursing' or 'Community Matron' or 'DICE – Community Diabetes Service' or 'Diabetes Service' or 'Continence' |
| **Occupational therapist contacts** | ServiceReferenceCostDescription = 'Occupational Therapist, Adult, One to one' OR Service Reporting Line = 'Occupational Therapy' |
| **Physiotherapist contacts**        | ServiceReferenceCostDescription = 'Physiotherapist' or 'Physiotherapist, Adult, One to one' or 'Physiotherapy services: Adult' or 'Community Rehabilitation Teams' or 'Rehabilitation for Other Disorders' or 'Rehabilitation for Other Musculoskeletal Disorders' or 'Rehabilitation for Respiratory Disorders' or 'Rehabilitation for Other Neurological Disorders' OR Service Reporting Line = 'Banded Rehab – Therapists (H&F, K&C, W)' or 'Brent Rehabilitation Service' or 'Community MSK Physiotherapy service' or 'Community Rehabilitation' or 'Community Rehabilitation (H&F, K&C, W)' or 'Short Term Rehabilitation' or 'Community IFC MSK Physiotherapy Service' or 'Community Rehab ICE' or 'EDTC – Community Physio' or 'Pulmonary Rehab' or 'Therapies MS Physio' or 'Community Neuro-Rehabilitation (H&F, K&C, W)' or 'Cardiac Rehabilitation' or 'MSK Physiotherapy' or 'Physio (MSK)' or 'Cardiac Rehab' or 'Community Recovery Service – Neuro Rehab' |
| **Speech and Language therapist contacts** | ServiceReferenceCostDescription = 'Speech and Language Therapist, Adult, One to One' or 'SLT – Adult' OR Service Reporting Line = 'Adult SLT' |
| **Rehabilitation teams contacts**   | OCCUPATIONAL THERAPIST + PHYSIOTHERAPISTS + SPEECH AND LANGUAGE THERAPIST |
| **Primary care practice face to face contacts** | Read code v2 = 9N1C., 9N1w., 9NF7., 9NF8., 9k27., 9N1G., 9NFB., 9NFW., 9N1t., 9N1x., 9NF5., 9NF4., 9NF6., 9BF9., 9B2C., 9N11., 9N12., 9N1c., 9N1y0, 9N1z., 9c0H., 9N01., 9N7B., 9NF.., 9NY.., 9NY0., 9NY1. |
| **Primary care practice telephone contacts** | Read code V2 = 9N31., 9b0m., 9b0n., 9b0o, 9N310, 9N311, 9N301, 9N3A, 8CAN., 8CAR0 |
| **Primary care practice failed contact** | Read code v2 = 9N4., 9N4 1%, 9Ni. |
| **Lived in care home**              | Read code v2=13F6., 13F61, 13FK, 13FX, |
| Condition                        | Codes                                                                 |
|---------------------------------|----------------------------------------------------------------------|
| Asthma                          | H33%, H3120, H3B..,173A., NOT (H333., 21262, 212G.)                  |
| Atrial Fibrillation             | G573% NOT (212R.)                                                   |
| Hypertension                    | G2..%, G20%, Gyu2, Gyu20, G24..-G2z., NOT (G24z1, G2400, G2410, G27..) |
| Diabetes                        | C10., C109l, C109K, C10C., C10D., PKyP., C10Q., C10E%, C10F%, C10H%, C10M%, C10N%, C10P% NOT(C10F8) |
| Congestive heart disease        | G3..-G309., G30B.-G330z, G33z..G3401, G342..G35X., G38..G3z., Gyu3%, NOT(Gyu31, G310.) |
| COPD                            | H5832, H4640, H4641, Hyu30, Hyu31, H3..%, H31%, H32%, H36..-H3z., NOT(H3101, H31y0, H3122, H3y0., H3y1. |
| Depression                      | E0013, E0021, E118., E11y2, E11z2, E130, E135., E2003, E291., E2B., E2B1., Eu204, Eu251, Eu341, Eu412, E112%, E113%, Eu32%, Eu33%, NOT(Eu32a, Eu32B, Eu329, 212S.) |
| Epilepsy                        | F1321, SC200, F25%, NOT(F2501, F2504, F2511, F2516, F25y4, F25G., F25H., 21260, 2121, F256%, F258.-F25A.) |
| Heart Failure                   | G58%, G1yz1, 662f.-662i.                                           |
| Peripheral Arterial Disease     | G73.., Gyu74, G734., G73y., G73z%, NOT(G73z1)                        |
| Rheumatoid Arthritis            | N041., N047., N04X., N04y0, N04y2, N1y11, N1y12, N1y1G, N1y10, G5yA., G5y8., N040%, N042%, NOT(N0420) |
| Stroke                          | G65..G654., G656.-G65z, G63y0.-G63y1,Gyu62-Gyu66, ZV12D, Fyu55, G6760, G6W.., G6X.., Gyu6F, Gyu6G, G61%, G64%, G66%, NOT(G617., G669.) |
| Mental Health                   | E1124, E1134, E11z., E11z0, E11z2, E2122, Eu323, Eu328, Eu333, Eu32A, Eu329, E114.-E117z, E10%, E110%, E111%, E11y%, E12%, E13%, Eu2%, Eu30%, Eu31%, NOT(E11y2, E135.) |
| Cancer                          | B0%, B1%, B2%, B3%, B4%, B5%, B6%, Byu%, K1323, K01w1, 68W24, C184., NOT(B677.) |
| Palliative care                 | 1Z01., 1JE.., 1Jf.., 38VY., 38Vb., 38Vd., 38Ve., 38Vf., 38Vg., 38Vh., 38Vi., 8BA2., 8BAP., 8BAS., 8BAT., 8BAs., 8Bh1., 8CM1.% (NOT 8CM15), 8CM4., 8CM6., 8CM7., 8CMk., 8H6A., 8H7L., 8H7G., 8HH6., 8H8., 9NEB., 9Ng7., ZV57C., 8CMQ., 9NgD., 9G8.., 9c0P., 9c0N., 8CMW3., 9K9.., 9c0L0., 9c0N., 9NNd., 8CMb., 8B2a., 9NNf0, 38QH., 38QK., 8CMg., 2Jg., 9NNq., 9NNr., 9NNs. |
Table 4. Sensitivity analysis. Multivariate associations between identification of palliative care needs before the last 90 days of life and multiple hospital admissions in the last 90 days of life adjusted by covariables with and without ethnicity

|                                | Original model n=5,804 | Model with ethnicity n=4717 |
|--------------------------------|------------------------|----------------------------|
|                                | RR  | 95%CI  | p-value | RR  | 95%CI  | p-value |
| Identification of palliative care needs before last 90 days |                   |                                |                                |
| No                             | Ref |        |         | Ref |        |         |
| Yes                            | 0.70 | 0.58  | 0.85   | <0.001 | 0.76  | 0.61  | 0.95   | 0.014 |
| Age                            |      |        |         |      |        |         |
| <=75                           | Ref |        |         | Ref |        |         |
| 76 to 85                       | 0.98 | 0.76  | 1.25   | 0.853 | 0.96  | 0.73  | 1.27   | 0.784 |
| 76 to 85                       | 0.96 | 0.75  | 1.22   | 0.733 | 0.92  | 0.70  | 1.21   | 0.557 |
| >=95                           | 0.66 | 0.47  | 0.94   | 0.022 | 0.63  | 0.44  | 0.91   | 0.014 |
| Gender                         |      |        |         |      |        |         |
| Female                         | Ref |        |         | Ref |        |         |
| Male                           | 1.55 | 1.34  | 1.78   | <0.001 | 1.58  | 1.36  | 1.84   | <0.001 |
| Lived in care home             |      |        |         |      |        |         |
| No                             | Ref |        |         | Ref |        |         |
| Yes                            | 0.57 | 0.45  | 0.73   | <0.001 | 0.54  | 0.40  | 0.72   | <0.001 |
| Number of QoF comorbidities    |      |        |         |      |        |         |
| 0                              | Ref |        |         | Ref |        |         |
| 1                              | 0.69 | 0.53  | 0.90   | 0.007 | 0.68  | 0.50  | 0.92   | 0.011 |
| 2                              | 0.91 | 0.73  | 1.12   | 0.371 | 0.89  | 0.71  | 1.12   | 0.324 |
| >=3                            | 0.98 | 0.81  | 1.18   | 0.817 | 0.93  | 0.77  | 1.14   | 0.505 |
| Ethnicity                      |      |        |         |      |        |         |
| White                          | Ref |        |         |      |        |         |
| Black                          | 1.15 | 0.90  | 1.46   | 0.252 | 1.24  | 1.02  | 1.51   | 0.029 |
| Asian                          |      |        |         |      |        |         |
| Mixed or other                 | 0.99 | 0.81  | 1.21   | 0.924 | 0.99  | 0.81  | 1.21   | 0.924 |