Supplemental Materials for “External validation of the eRADAR risk score for detecting undiagnosed dementia in two real-world healthcare systems”

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**Table S1:** Diagnosis codes, medications, and utilization for study inclusion and exclusion criteria

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| --- | --- | --- | --- |
| **Exclusion** | **Definition** | **KPWA notes** | **UCSF notes** |
| Adequate engagement with health system (to ensure data availability) | Site-specific | Members were required to have at least one year of prior enrollment AND be paneled to a KPWA provider OR receive care at a KPWA clinic within the last year | Patients were required to have two or more visits to a participating primary care practice in the prior 36 months |
| Dementia diagnosis | ICD-9 codes: 046.11, 046.19, 46.3, 46.79, 290.0, 290.2, 290.3, 290.1, 290.4, 290.8, 290.9, 291.2, 292.82, 294, 294.1, 294.2, 331, 331.11, 331.19, 331.2, 331.7, 331.82, 331.89, 331.9, 333.4  ICD-10: A81.01, A81.09, A81.00, A81.2, F01.50, F01.51, F02.80, F02.81, F03.90, F03.91, F10.27, F10.97, F13.27, F13.97, F18.17, F18.27, F18.97, F19.17, F19.27, F19.97, G10, G30.0, G30.1, G30.8, G30.9, G31.01, G31.09, G31.1, G31.83 | Codes from any visit (inpatient, outpatient, emergency department, or other in-person visits). Virtual encounters, including phone and video visits, were excluded. | Codes from any visit, including virtual visits;  Also includes any referral to Memory & Aging Clinic, e-consult to neurology re: memory and aging in prior 2 years |
| Dementia medication | Donepezil (Aricept), Memantine, Rivastigmine (Exelon), Galantamine, combination of donepezil/memantine | Based on medication fills | Based on medication orders |
| Amnestic/memory loss diagnosis | ICD-9: 780.93  ICD-10: R41.3, R41.89 |  |  |
| Late effects of cerebrovascular disease, cognitive deficits diagnosis | ICD-9: 438.0  ICD-10: I69.311, I69.11, I69.21, I69.31, I69.81, I69.91 |  |  |
| Mild cognitive impairment diagnosis | ICD-9: 331.83  ICD-10: G31.84 |  |  |
| Degenerative disease of nervous system, unspecified | ICD-10: G31.9 |  |  |
| Hospice | Codes are not portable across health systems | Defined as not on hospice care at time of index date | Defined as referral to hospice care or diagnosis for being on hospice care in past 1 year |

**Table S2:** eRADAR predictors, definitions, and diagnosis codes

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| --- | --- | --- | --- | --- |
| **Predictor** | **Definition** | | **KPWA notes** | **UCSF notes** |
| **Demographics** |  | |  |  |
| Age (per year) |  | |  |  |
| Female |  | |  |  |
| **Diagnoses, past 2 years** | **ICD-9** | **ICD-10** |  |  |
| Congestive heart failure | 398.91, 402.11, 402.91, 404.11, 404.13, 404.91, 404.93,428.0-428.9 | I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5–I42.9, I43.x, I50.x, P29.0 |  |  |
| Cerebrovascular disease | 430.x-438.x | G45.x, G46.x, H34.0, I60.x–I69.x |  |  |
| Diabetes, any | 250.x | E10.x, E11.x, E12.x, E13.x, E14.x |  |  |
| Diabetes, complex | 250.40-250.73, 250.90-250.93 | E10.2–E10.8, E11.2–E11.8, E12.2– E12.8, E13.2–E13.8, E14.2–E14.8 |  |  |
| Chronic pulmonary disease | 490-492.8, 493.00-493.91, 494.x-505.x, 506.4 | I27.8, I27.9, J40.x–J47.x, J60.x–J67.x, J68.4, J70.1, J70.3 |  |  |
| Hypothyroidism | 243-244.2, 244.8, 244.9 | E00.x–E03.x, E89.0 |  |  |
| Renal failure | 403.11, 403.91, 404.12, 404.92, 585.x, 586.x, V42.0, V45.1, V56.0, V56.8 | I12.0, I13.1, N18.x, N19.x, N25.0, Z49.0-Z49.2, Z94.0, Z99.2 |  |  |
| Lymphoma | 200.00-202.38, 202.50-203.01,203.8-203.81, 238.6, 273.3,V10.71,V10.72,V10.79 | C81.x-C85.x, C88.x, C96.x, C90.0, C90.2 |  |  |
| Solid tumor w/o metastases | 140.0-172.9,174.0-175.9,179-195.8, V10.00-V10.9 | C00.x-C26.x, C30.x-C34.x, C37.x-C41.x, C43.x, C45.x-C58.x, C60.x-C76.x, C97.x |  |  |
| Rheumatoid arthritis | 701.0, 710.0-710.9, 714.0-714.9, 720.0-720.9, 725.x | L94.0, L94.1, L94.3, M05.x, M06.x, M08.x, M12.0, M12.3, M30.x, M31.0–M31.3, M32.x–M35.x, M45.x, M46.1, M46.8, M46.9 |  |  |
| Weight loss | 260-263.9 | E40.x-E46.x, R63.4, R64 |  |  |
| Fluid and electrolyte disorders | 276.0-276.9 | E22.2, E86.x, E87.x |  |  |
| Blood loss anemia | 280 | D50.0 |  |  |
| Bipolar disorder and psychoses | 295x, 296.0x, 296.1x, 296.4x, 296.5x, 296.6x, 296.7x, 296.8x, 297x, 298x | F20.x, F22.x-F25.x, F28.x, F29.x, F30.2, F31.2, F31.5 |  |  |
| Depression | 296.2, 296.3, 300.4, 301.12, 309.0, 309.1, 311 | F20.4, F31.3-F31.5, F32.x, F33.x, F34.1, F41.2, F43.2 |  |  |
| Traumatic brain injury | 800-804, 850-854, 905.0, 907.0, 959.01, V15.52 | F07.81, S02.x, S06.x, S07.1, S09.8x, S09.90x, Z87.820 |  |  |
| Tobacco use (past or current) | 305.1, V15.82 | F17.2, F17.2x (anything after the 2), Z87.891, Z72.0 |  |  |
| Atrial fibrillation | 427.3X | I48, I48.x (all codes included under I48) |  |  |
| Gait abnormality | 781.2 | R26 and all within it |  |  |
| **Vital signs** |  | |  |  |
| BMI < 18.5 kg/m2 | Based on most recent measurements of weight and height. Patients without BMI measured in the prior 3 years were assumed to not have BMI < 18.5. | |  |  |
| BMI ≥30 kg/m2 | Based on most recent measurements of weight and height. Patients without BMI measured in the prior 3 years were assumed to not have BMI ≥30. | |  |  |
| High blood pressure (>= 140 mm Hg systolic or >= 90 mm Hg diastolic) | Based on most recent systolic and diastolic blood pressure measurements. Patients without blood pressure measurements in prior 3 years were assumed to not have high blood pressure. | |  |  |
| **Health care utilization, past 2 years** |  | |  |  |
| ≥ 1 outpatient primary care visit | Not portable across health systems | | Limited to office visit in family practice, primary care, internal medicine, or gerontology |  |
| ≥ 1 emergency department visit | Not portable across health systems | | based on encounter data | based on referral data |
| Home health services | Not portable across health systems | | based on encounter data | based on referral data |
| ≥ 1 physical therapy visit | Not portable across health systems | | based on encounter data | based on referral data |
| ≥ 1 cognitive evaluation visit | Not portable across health systems | | encounter with Speech, Language, and Learning department | Referral to Neuropsychology department |
| **Medications, past 2 years** |  | |  |  |
| Antidepressants | amitriptyline, amoxapine, bupropion, citalopram, clomipramine, desipramine, desvenlafaxine, doxepin, duloxetine, escitalopram, fluoxetine, fluvoxamine, imipramine, isocarboxazid, maprotiline, milnacipran, nortriptyline, paroxetine, phenelzine, protriptyline, rasagiline, selegiline, sertraline, tranylcypromine, trimipramine, venlafaxine, vilazodone, vortioxetine | | based on fill data | based on order data |
| Sleep aids | alprazolam, chlordiazepoxide, clonazepam, clorazepate, diazepam, diphenhydramine, eszopiclone, flurazepam, hydroxyzine, lorazepam, meprobamate, midazolam, oxazepam, ramelteon, suvorexant, temazepam, triazolam, zaleplon, zolpidem | | based on fill data | based on order data |

**Table S3:** Dementia outcome diagnosis codes

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| --- | --- | --- | --- |
| **Outcome** | **Definition** | **KPWA notes** | **UCSF notes** |
| Dementia diagnosis | ICD-9 codes: 290.0, 290.2, 290.3, 290.1, 290.4, 291.2, 292.82, 294.1, 294.2, 331, 331.11, 331.19, 331.2, 331.82,  ICD-10: F01.50, F01.51, F02.80, F02.81, F03.90, F03.91, F10.27, F10.97, F13.27, F13.97, F18.17, F18.27, F18.97, F19.17, F19.27, F19.97, G30.0, G30.1, G30.8, G30.9, G31.01, G31.09, G31.1, G31.83 | Codes from any visit (inpatient, outpatient, emergency department, or other in-person visits). Virtual encounters, including phone and video visits, were excluded. | Codes from any visit, including virtual visits |
| Late effects of cerebrovascular disease, cognitive deficits diagnosis | ICD-9: 438.0 | Codes from any in-person visit; virtual encounters excluded. | Codes from any visit, including virtual. |
| Mild cognitive impairment diagnosis | ICD-9: 331.83 | Codes from any in-person visit; virtual encounters excluded. | Codes from any visit, including virtual. |