**Supplementary Figures and Tables**

**e-Figure 1a. Veterans Health Administration eligibility criteria**

Non-Tdap vaccine group remains free of Tdap vaccine in follow-up

(No vaccine – n=104,293)

(Tdap vaccine – n=2,772)

Index Date=10/1/2010 (FY2011)

≥3 well visits FY09-FY19, age ≥50 at first well visit (n=458,460)

Tdap vaccine status at 10/1/2010:

(No vaccine – n=445,442)

(Tdap vaccine – n=13,018)

≥65 years old at index

(No vaccine – n=269,368)

(Tdap vaccine – n=3,221)

Active 2 years prior to index

(No vaccine – n=221,450)

(Tdap vaccine – n=3,149)

Free of dementia and medications for 2 years prior to index

(No vaccine – n=191,368)

(Tdap vaccine – n=2,845)

> 90 days follow-up

(No vaccine – n=182,404)

(Tdap vaccine – n=2,772)

Non-Tdap vaccine group remains free of Tdap vaccine in follow-up

(No vaccine – n=11,729)

(Tdap vaccine – n=6,860)

Index Date=10/1/2011 (FY2012)

Sample that is not eligible 10/1/2010 (n=351,395)

Tdap vaccine status at 10/1/2011:

(No vaccine – n=325,999)

(Tdap vaccine – n=25,396)

≥65 years old at index

(No vaccine – n=176,190)

(Tdap vaccine – n=8,069)

Active 2 years prior to index

(No vaccine – n=124,036)

(Tdap vaccine – n=7,948)

Free of dementia and medications for 2 years prior to index

(No vaccine – n=98,330)

(Tdap vaccine – n=6,997)

> 90 days follow-up

(No vaccine – n=92,653)

(Tdap vaccine – n=6,860)

Total (n=125,654)

Remove missing demographics

(n=122,946)

**e-Figure 1b. MarketScan eligibility criteria**

Non-Tdap vaccine group remains free of Tdap vaccine in follow-up

(No vaccine – n=108,909)

(Tdap vaccine – n=6,017)

Index Date=1/1/2011 (CY2011)

≥3 well visits CY09-FY19, age ≥50 at first well visit (n=4,989,703)

Tdap vaccine status at 1/1/2011:

(No vaccine – n=4,696,732)

(Tdap vaccine – n=292,971)

≥65 years old at index

(No vaccine – n=188,035)

(Tdap vaccine – n=6,548)

Active 2 years prior to index

(No vaccine – n=145,825)

(Tdap vaccine – n=6,546)

Free of dementia and medications for 2 years prior to index

(No vaccine – n=140,863)

(Tdap vaccine – n=6,355)

> 90 days follow-up

(No vaccine – n=137,274)

(Tdap vaccine – n=6,017)

Non-Tdap vaccine group remains free of Tdap vaccine in follow-up

(No vaccine – n=42,272)

(Tdap vaccine – n=11,855)

Index Date=1/1/2012 (CY2012)

Sample that is not eligible 1/1/2011 (n=4,874,777)

Tdap vaccine status at 1/1/2012:

(No vaccine – n=4,363,593)

(Tdap vaccine – n=511,184)

≥65 years old at index

(No vaccine – n=129,427)

(Tdap vaccine – n=16,538)

Active 2 years prior to index

(No vaccine – n=108,153)

(Tdap vaccine – n=16,526)

Free of dementia and medications for 2 years prior to index

(No vaccine – n=102,404)

(Tdap vaccine – n=15,985)

> 90 days follow-up

(No vaccine – n=81,575)

(Tdap vaccine – n=11,855)

Total (n=174,053)

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| **e-table 1. Variable definitions** | |
| **Variable** | **Definition** |
| **Outcome and Exclusions** | |
| Dementia Exclusion Codes (used in washout) | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **ICD-9 – Codes** | | | | | | | | | 046.1x | 046.3 | | | 290.x | | 291.1 | 291.2 | | 294.0 | 294.1x | | | 294.2x | | 331.x | 332.x | | 333.0 | 333.4 | | | 438.0 | | 780.93 | 797 | | **ICD-10 – Codes** | | | | | | | | | A81.0x | | A81.2 | F01.x | | F02.x | | F03.x | | F04 | | F05 | F10.26 | | F10.27 | | F10.96 | | F10.97 | | G10 | G20 | | G21.1x | | G21.2 | | G21.3 | | G21.4 | G21.8 | | G21.9 | | G23.x | | G30.x | | G31.0x | G31.1 | | G31.2 | | G31.83 | | G31.84 | | G31.85 | G31.89 | | G31.9 | | G91.x | | G93.7 | | G94 | I69.91 | | R41.2 | | R41.3 | | R41.81 | |  |  | |  | |  | |
| Dementia Main Outcome Codes | |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **ICD-9 – Codes** | | | | | | | | | | | | | 290.0 | | 290.1x | | 290.2x | | 290.3 | | 290.4x | | | 294.1x | | 294.2x | | 331.0 | | 331.1x | | 331.2 | |  | | |  | | **ICD-10 – Codes** | | | | | | | | | | | F01.x | F02.x | | F03.x | | G30.x | | G31.0x | | G31.1 |   - 2 code occurrences (on different days) within the same 12- month period  - Date of dementia onset is the first date of diagnosis when criteria met |
| Dementia medications | Donepezil, Rivastigmine, Galantamine, Memantine |
| Alzheimer’s Disease – sensitivity analysis | ICD-9 code: 331.0;  ICD-10 code: G30.x  - 2 code occurrences (on different days) within the same 12- month period  - Date of Alzheimer’s onset is the first date of diagnosis when criteria met |
| **Covariates – measured on or before index date. These variables are used in PS models.** | |
| Type II Diabetes | ICD-9 code: 250.x0, 250.x2, 357.2, 362.0x, 366.41;  ICD-10 code: E11.x, E08.42, E09.42, E13.42, E08.36, E09.36, E13.36  - 2 code occurrences in any 24-month period on/prior to index |
| Smoking/nicotine dependence | ICD-9 code: V15.82, 305.1;  ICD-10 code: Z87.891, Z72.0, F17.20x, F17.21x;  CPT code: 99406, 99407;  HCPCS code: G0436, G0437;  Present in health factor data as current smoker (VHA only)  - Single occurrence on/prior to index date |
| Obesity | ICD-9 code: 278.00, 278.01;  ICD-10 code: E66.9, E66.01;  CPT code: 99401, 99402;  HCPCS code: G0446, G0447, G0473;  Last BMI on/before index is ≥ 30 (VHA only)  - Single occurrence on/prior to index date or last BMI before index is ≥ 30 |
| Hypertension | ICD-9 code: 401.x;  ICD-10 code: I10  - Single occurrence on/prior to index date |
| Hyperlipidemia | ICD-9 code: 272.0, 272.1, 272.2, 272.4;  ICD-10 code: E78.0-E78.2, E78.4-E78.5  - Single occurrence on/prior to index date |
| Stroke or cerebrovascular accident | ICD-9 code: 431.x, 434.x, 438.x;  ICD-10 code: I61.x, I63.3x, I63.4x, I63.5x, I63.6, I63.8, I63.9, I66.x, I69.1x, I69.2x, I69.3x, I69.8x, I69.9x  - Single occurrence on/prior to index |
| Ischemic heart disease | ICD-9 code: 410.x – 414.x;  ICD-10 code: I20.x – I25.x  - Single occurrence on/prior to index |
| Congestive heart failure | ICD-9 code: 398.91, 402.11, 402.91, 404.11, 404.13, 404.91, 404.93, 428.x;  ICD-10 code: I09.81, I11.0, I13.0, I13.2, I50.x  -Single occurrence on/prior to index |
| Atrial fibrillation of flutter | ICD-9 code: 427.3x;  ICD-10 code: I48.x  - Single occurrence on/prior to index |
| Asthma | ICD-9 code: 493.x;  ICD-10 code: J45.x  - Single occurrence on/prior to index |
| COPD | ICD-9 code: 491.2x, 496;  ICD-10 code: J44.x  - Single occurrence on/prior to index |
| Traumatic brain injury | ICD-9 code: 800.x-804.x, 850.x-854.x, 905.0, , 907.0, 959.01, V15.52;  ICD-10 code: S01.90x, S02.x, S04.x, S06.x, S07.x, S09.8x, S09.9x, Z87.820  - Single occurrence on/prior to index date |
| Vitamin B12 deficiency | ICD-9 code: 266.2, 281.1;  ICD-10 code: E53.8, D51.x  - Single occurrence on/prior to index date |
| Depression | ICD-9 code: 296.2x, 296.3x, 311;  ICD-10 code: F32.0-F32.5, F32.9, F33.0-F33.3, F33.4x, F33.9  - 2 outpatient occurrences (on different days) in same 12- month period or 1 inpatient occurrence on/prior to index date. |
| Any anxiety disorder | ICD-9 code: 309.81, 300.00, 300.01, 300.02, 300.23, 300.3;  ICD-10 code: F40.1x, F41.0, F41.1, F41.9, F42, F43.1x  - Composite of PTSD, panic disorder, anxiety disorder not otherwise specified, obsessive compulsive disorder, social phobia, and generalized anxiety disorder  - 2 outpatient occurrences (on different days) in same 12- month period or 1 inpatient occurrence on/prior to index date. |
| Alcohol abuse/dependence | ICD-9 code: 303.9x, 305.0x;  ICD-10 code: F10.x  - Single occurrence on/prior to index date |
| Any drug abuse/dependence | ICD-9 code: 304.0x, 304.1x, 304.2x, 304.3x, 304.4x, 304.5x, 304.6x, 304.7x, 304.8x, 304.9x, 305.2x, 305.3x, 305.4x, 305.5x, 305.6x, 305.7x, 305.9x;  ICD-10 code: F11.x, F12.x, F13.x, F14.x, F15.x, F16.x, F18.x, F19.x  - Composite of sedative, cocaine, cannabis, amphetamine, hallucinogens, ‘other’, opioid, opioid with other SUD, other SUD excluding opioid, unspecified drug abuse/dependence.  - Single occurrence on/prior to index date |
| High health services utilization | - Controls for detection bias related to more healthcare encounters.  - Average number of outpatient clinic visits per month, calculated as total visits divided by number of months. Total visits is total number of visits in time period of interest. Number of months followed is months from first visit to last visit in time period of interest. Time period of interest is first visit in respective data time frames to index date. - The distribution of the mean is then dichotomized into high utilizer, >75th percentile vs low utilizer, ≤75th percentile. |
| Number of well visits | CPT codes: 99386, 99387, 99396 or 99397  - Number of well visits from start of data to index date. Categorized as none, 1-2, ≥3 |
| Other medications (multiple variables),  yes vs no | Anticholinergics, NSAIDs, antihypertensives, statins, glucocorticoids, antivirals, metformin, sulfonylureas– defined by any sustained use. Sustained use is at least 2 fills in any 6- month period prior to index. |
| Age | Age in years calculated as age on index date. Categorized as 65-69, 70-74, ≥75 |
| Race (VHA only) | White, African American, “other” (most frequently occurring in record). |
| Gender | Male, female |
| Marital status (VHA only) | Married vs. other (on/closest to index date). |
| VA only health insurance vs. VA+private/Other (VHA only) | - Insurance status variable indicating any access to non-VA health insurance. Coverage defined by most frequently occurring coverage prior to index date. MarketScan does not provide insurance coverage information. |
| Region | Home state geographic region at index. VHA provides home state, which was further categorized based on MarketScan regional categories.  Northeast (CT, ME, MA, NH, RI, VT, NJ, NY, PA)  Northcentral (IL, IN, MI, OH, WI, IA, KS, MN, MO, NE, ND, SD)  South (DC, DE, FL, GA, MD, NC, SC, VA, WV, AL, KY, MS, TN, AR, LA, OK, TX)  West (AZ, CO, ID, MT, NV, NM, UT, WY, AK, CA, HI, OR, WA)  Unknown |
| Year of cohort entry (retrospective cohort) | VHA: FY2011 (10/1/2010), FY2012 (10/1/2011)  MarketScan: CY2011 (1/1/2011), CY2012 (1/1/2012) |
| **Tdap Vaccination** | |
| Tdap vaccination | Occurrence of CPT code or drug fill for vaccine product by index date.  CPT codes: 90701, 90715  Drug product names: Adacel, Boostrix |
| **Post-index diseases used in secondary analyses of possible mechanisms of vaccine effect on dementia outcome (these variables are not used in PS models)** | |
| Tdap disease | ICD-9 code: 037 (tetanus), 032.x (diphtheria), 033.x (pertussis);  ICD-10 code: A35 (tetanus), A36.x (diphtheria), A37.x (pertussis)  - Single occurrence between index and end of follow-up |

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| **e-Table 2.** **Standardized mean difference percent (SMD%)1 comparing covariates by vaccine status after entropy balancing, overall and by age in the Veterans Health Affairs cohort.** | | | | |
| **Covariates** | **Overall**  **(n=122,946)** | **Age 65-69**  **(n=34,629)** | **Age 70-74**  **(n=21,442)** | **Age≥ 75**  **(n=66,875)** |
| Index fiscal year |  |  |  |  |
| 2011 | -0.42 | -0.01 | -0.45 | -0.97 |
| 2012 | 0.42 | 0.01 | 0.45 | 0.97 |
| Age category |  |  |  |  |
| 65-69 | 0.31 | - | - | - |
| 70-74 | -0.01 | - | - | - |
| ≥ 75 | -0.31 | - | - | - |
| Female gender | 0.03 | 0.00 | 0.01 | 0.03 |
| Race |  |  |  |  |
| White | -0.02 | -0.01 | 0.01 | 0.03 |
| Black | 0.02 | 0.00 | 0.00 | -0.01 |
| Other | 0.00 | 0.03 | -0.03 | -0.04 |
| Married | -0.03 | -0.01 | -0.01 | -0.01 |
| VHA only insurance | 0.09 | -0.01 | 0.02 | -0.12 |
| Region |  |  |  |  |
| Northeast | 0.02 | 0.00 | 0.05 | 0.05 |
| Northcentral | 0.03 | -0.01 | 0.00 | 0.13 |
| South | -0.07 | -0.01 | -0.04 | -0.21 |
| West | 0.04 | 0.00 | 0.05 | 0.09 |
| Unknown | -0.14 | 0.11 | -0.23 | -0.32 |
| High healthcare utilization | 0.07 | -0.01 | 0.07 | 0.06 |
| # well visits, category |  |  |  |  |
| 0 | -0.01 | 0.01 | -0.02 | -0.05 |
| 1-2 | -0.01 | -0.01 | -0.01 | -0.01 |
| ≥ 3 | 0.03 | 0.00 | 0.04 | 0.08 |
| Type II Diabetes | -0.01 | -0.01 | 0.00 | -0.02 |
| Obesity | 0.08 | -0.01 | 0.03 | 0.05 |
| Hypertension | -0.04 | -0.01 | 0.01 | 0.05 |
| Stroke | 0.00 | 0.00 | 0.01 | 0.04 |
| Ischemic heart disease | -0.08 | -0.01 | 0.00 | 0.00 |
| Congestive heart failure | -0.06 | 0.00 | 0.00 | -0.02 |
| Atrial fibrillation | -0.08 | 0.00 | -0.01 | -0.04 |
| Asthma | 0.00 | 0.00 | 0.02 | 0.02 |
| COPD | -0.01 | 0.00 | 0.03 | 0.04 |
| Traumatic brain injury | 0.00 | 0.00 | 0.02 | 0.04 |
| Vitamin B12 deficiency | -0.02 | 0.00 | 0.02 | 0.02 |
| Depression | 0.05 | 0.00 | 0.03 | 0.02 |
| Anxiety disorder | 0.06 | 0.00 | 0.03 | 0.00 |
| Nicotine dependence | 0.07 | -0.01 | 0.01 | 0.08 |
| Alcohol abuse/dependence | 0.05 | 0.00 | 0.01 | 0.03 |
| Drug abuse/dependence | 0.03 | 0.00 | 0.01 | 0.01 |
| Anticholinergics | 0.02 | 0.00 | 0.01 | 0.00 |
| NSAIDS | 0.03 | -0.01 | -0.01 | 0.02 |
| Antihypertensives | -0.02 | -0.01 | 0.02 | 0.07 |
| Statins | 0.00 | -0.01 | 0.01 | 0.07 |
| Steroids | 0.00 | 0.00 | -0.01 | 0.03 |
| Antivirals | 0.02 | 0.00 | 0.01 | 0.01 |
| Metformin | 0.03 | 0.00 | 0.03 | 0.01 |
| Sulfonylurea | 0.00 | 0.00 | 0.00 | 0.00 |
| 1) SMD% <10% indicates balance | | | | |

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| **e-Table 3.** **Standardized mean difference percent (SMD%)1 comparing covariates by Tdap vaccine status after entropy balancing, overall and by age in the MarketScan cohort** | | | | |
| **Covariates** | **Overall**  **(n=174,053)** | **Age 65-69**  **(n=107,498)** | **Age 70-74**  **(n=33,585)** | **Age≥ 75**  **(n=32,970)** |
| Index year |  |  |  |  |
| 2011 | -0.32 | -0.02 | 0.99 | -3.73 |
| 2012 | 0.32 | 0.02 | -0.99 | 3.73 |
| Age category |  |  |  |  |
| 65-69 | 0.56 | -- | -- | -- |
| 70-74 | -0.27 | -- | -- | -- |
| ≥ 75 | -0.48 | -- | -- |  |
| Female gender | 0.02 | 0.00 | 0.02 | -0.02 |
| Region |  |  |  |  |
| Northeast | -0.14 | -0.01 | -0.16 | -0.67 |
| Northcentral | 0.04 | 0.00 | 0.07 | 0.21 |
| South | 0.02 | 0.00 | -0.16 | -0.21 |
| West | 0.06 | 0.00 | 0.20 | 0.66 |
| Unknown | 0.05 | 0.04 | 0.02 | -0.65 |
| High healthcare utilization | -0.07 | 0.00 | 0.02 | -0.15 |
| # well visits, category |  |  |  |  |
| 0 | -0.23 | -0.03 | -0.37 | -0.92 |
| 1-2 | -0.03 | 0.01 | 0.03 | 0.02 |
| ≥ 3 | 0.15 | 0.01 | 0.20 | 0.54 |
| Type II Diabetes | -0.05 | 0.00 | -0.05 | -0.09 |
| Obesity | 0.03 | 0.00 | 0.02 | 0.14 |
| Hypertension | -0.08 | 0.00 | 0.01 | 0.05 |
| Stroke | -0.04 | 0.00 | 0.03 | -0.06 |
| Ischemic heart disease | -0.10 | 0.00 | -0.07 | -0.10 |
| Congestive heart failure | -0.09 | 0.00 | -0.02 | -0.21 |
| Atrial fibrillation | -0.06 | 0.00 | 0.00 | -0.02 |
| Asthma | 0.02 | 0.00 | 0.05 | 0.16 |
| COPD | -0.05 |  | 0.01 | -0.06 |
| Traumatic brain injury | -0.02 | 0.00 | 0.04 | 0.02 |
| Vitamin B12 deficiency | -0.05 | 0.00 | -0.09 | -0.11 |
| Depression | 0.01 | 0.00 | -0.02 | 0.05 |
| Anxiety disorder | 0.01 | 0.00 | -0.01 | 0.05 |
| Nicotine dependence | -0.02 | 0.00 | -0.12 | 0.02 |
| Alcohol abuse/dependence | 0.01 | 0.00 | 0.03 | 0.06 |
| Drug abuse/dependence | 0.00 | 0.00 | -0.01 | -0.01 |
| Anticholinergics | 0.01 | 0.00 | 0.00 | 0.02 |
| NSAIDS | 0.02 | 0.00 | -0.02 | 0.13 |
| Antihypertensives | -0.05 | 0.00 | 0.04 | 0.21 |
| Statins | -0.01 | 0.00 | 0.02 | 0.22 |
| Steroids | 0.00 | 0.00 | 0.01 | -0.08 |
| Antivirals | 0.03 | 0.00 | 0.04 | 0.10 |
| Metformin | -0.01 | 0.00 | 0.00 | 0.01 |
| Sulfonylurea | -0.05 | 0.00 | -0.07 | -0.13 |
| 1) SMD% <10% indicates balance | | | | |